ASSAM STATE
DISASTER MANAGEMENT PLAN

ASSAM STATE DISASTER MANAGEMENT AUTHORITY

GOVERNMENT OF ASSAM

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Glossary of Key Terms

Capacity	The combination of all the strengths, attributes and resources available within a community, society or organization that can be used to achieve agreed goals.
Climate Change	The Inter-governmental Panel on Climate Change (IPCC) defines climate change as: "a change in the state of the climate that can be identified (e.g., by using statistical tests) by changes in the mean and/or the variability of its properties, and that persists for an extended period, typically decades or longer. Climate change may be due to natural internal processes or external forcings, or to persistent anthropogenic changes in the composition of the atmosphere or in land use". The United Nations Framework Convention on Climate Change (UNFCCC) defines climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods".
Critical facilities / infrastructure	The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency.
Disaster	'Disaster' means a catastrophe, mishap, calamity or grave occurrence in an area, arising from natural or man made causes, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area
Disaster management	'Disaster management' means a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for – Prevention of danger or threat of any disaster, Mitigation or reduction of risk of any disaster or its severity or consequences; Capacity building; Preparedness to deal with any disaster; Prompt response to any threatening disaster situation or disaster; Assessing the severity or magnitude of effects of any disaster; Evacuation, rescue an relief; Rehabilitation and reconstruction

Disaster risk reduction	DRR is the concept and practice of reducing disaster risks through systematic efforts to analyze and manage the causal factors of disasters, including through reduced exposure to hazards, lessened vulnerability of people and property, wise management of land and the environment, and improved preparedness for adverse events.
Early warning system	The set of capacities needed to generate and disseminate timely and meaningful warning information to enable individuals, communities and organizations threatened by a hazard to prepare and to act appropriately and in sufficient time to reduce the possibility of harm or loss.
Exposure	People, property, systems, or other elements present in hazard zones that are thereby subject to potential losses.
Hazard	A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
Mitigation	The lessening or limitation of the adverse impacts of hazards and related disasters.
Preparedness	The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
Prevention	The outright avoidance of adverse impacts of hazards and related disasters.
Recovery	The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
Response	The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet the basic subsistence needs of the people affected.
Risk	The combination of the probability of an event and its negative consequences.
Risk assessment	A methodology to determine the nature and extent of risk by analysing potential hazards and evaluating existing conditions of vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend.
Structural and non-structural measures	Structural measures: Any physical construction to reduce or avoid possible impacts of hazards, or application of engineering techniques to achieve hazard-resistance and resilience in structures or systems; Non-structural measures: Any measure not involving physical construction that uses knowledge, practice or agreement to reduce risks and impacts, in particular through policies and laws, public awareness raising, training and education.
Vulnerability	The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.

Abbreviations

ADB	Asian Development Bank
ASDMA	Assam State Disaster Management Authority
ASDMP	Assam State Disaster Management Plan
ASTEC	Assam Science Technology and Environmental Council
CBRNE	Chemical Biological Radiological Nuclear and High-Yield Explosive
CSO	Civil Society Organizations
CWC	Central Water Commission
DDRIC	District Disaster Response & Information Centre
DM	Disaster Management
DPR	Detailed Project Report
DRIC	Disaster Response & Information Centre
EOC	Emergency Operations Centre
ESF	Emergency Support Functions
EWS	Early Warning Systems
FLEWS	Flood Early Warning Systems
FRERM	Flood and Riverbank Erosion Risk Management
GLOF	Glacial Lake Outburst Floods
GSI	Geological Survey of India
GSHAP	Global Seismic Hazard Assessment Programme
HRD	Human Resource Development
IMD	Indian Meteorological Department
IPCC	International Panel on Climate Change
ISRO	Indian Space Research Organization
LDOF	Landslide Dam Outburst Floods
NESAC	North Eastern Space Applications Centre
NEIST	North-East Institute of Science and Technology
NGOs	Non-Governmental Organizations
PDNA	Post Disaster Damage and Needs Assessment
PGA	Peak ground acceleration
PRIs	Panchayati Raj Institutions
NDMG	National Disaster Management Guidelines
NDRF	National Disaster Response Force
SAARC	South Asian Association for Regional Cooperation
SEC	State Executive Committee
SDRIC	State Disaster Response & Information Centre
SDMG	State Disaster Management Guidelines
SDRF	State Disaster Response Force
SOP	Standard Operating Procedures
SWAN	State Wide Area Network
UNDP	United Nations Development Programme
UNISDR	United Nations International Strategy for Disaster Reduction

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PART – I DISASTER MANAGEMENT IN ASSAM

SECTION 1: THE ASSAM STATE DISASTER MANAGEMENT PLAN

1.1.1 Authority to Plan

Section 23 of the Disaster Management Act 2005 provides that there shall be a Disaster Management Plan for every state. The State Plan shall be prepared by the State Executive Committee and shall be approved by the State Authority.

This plan is prepared under the provisions outlined in the Disaster Management Act 2005 and Section 5 (State Plan) of Assam State Disaster Management Rules 2010

1.1.2 Aim and Purpose of the Plan

The aim of State DM Plan is to ensure that all components of Disaster Managament are addressed to facilitate planning, preparedness, operational, coordination and community participation.

The purpose of ASDMP is to set out Government of Assam's approach to DM in accordance with the operational and legislative responsibilities of the DM Act 2005 and Assam Disaster Management Rules 2010.

ASDMP will stand as a high level document outlining the approach to DM by ASDMA, Department of Revenue and Disaster Management and allied State Departments. The plan is in alignment of the framework overseeing the following sections: operational, administrative, financial, legal aspects and process. All hazard events, whether natural or man-made the state is vulnerable to, will be managed in accordance with the ASDMP. This Plan will be further supported by hazard specific plans; department wise preparedness, mitigation and emergency response plan; state disaster management guidelines (SDMG).

1.1.3 Scope of the State Disaster Management Plan

In accordance with the Disaster Management Act 2005 and Assam Disaster Management Rules 2010, the plan must include the following:

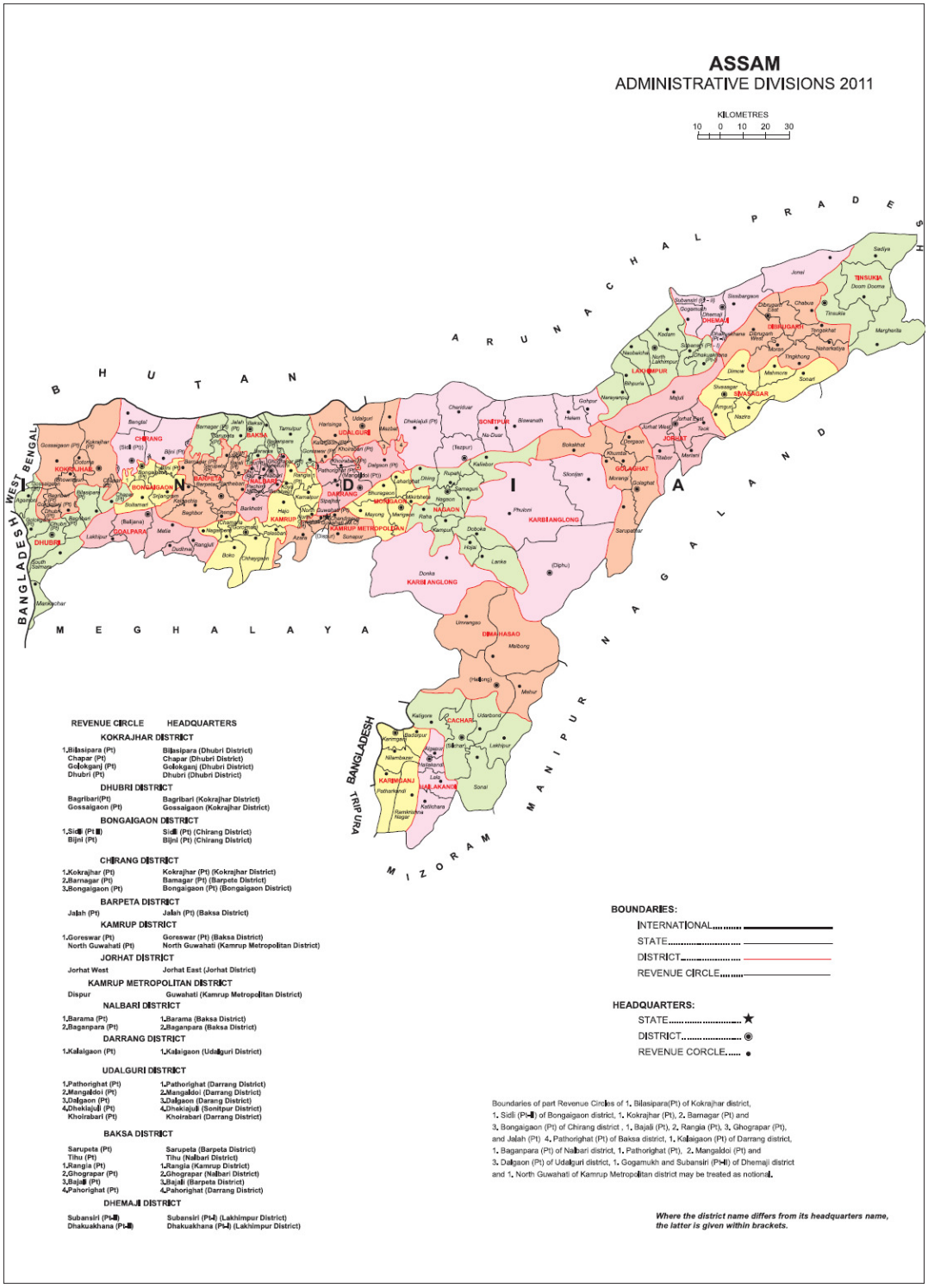
- Identify the vulnerability of different parts of the State to different forms of disasters;
- The measures to be adopted for prevention and mitigation of disasters;
- The manner in which the mitigation measures shall be integrated with the development plan and projects;
- The capacity-building and preparedness measures to be taken;
- The roles and responsibility of each department of the Government of the State on relation to prevention, mitigation, preparedness, capacity building, response and rehabilitation;
- The roles and responsibilities of different departments of the Government of the State in responding to any threatening disaster situation or disaster;
- The roles and responsibilities of community based organizations, international and national non-governmental organizations in activities of capacity building, response and relief.

SECTION 2: PROFILE OF THE STATE

1.2.1 Administrative Divisions

The State is divided into 27 administrative districts. For the present districts of Assam and their location, refer to Fig 1.

Figure 1: Administrative Divisions (2011)

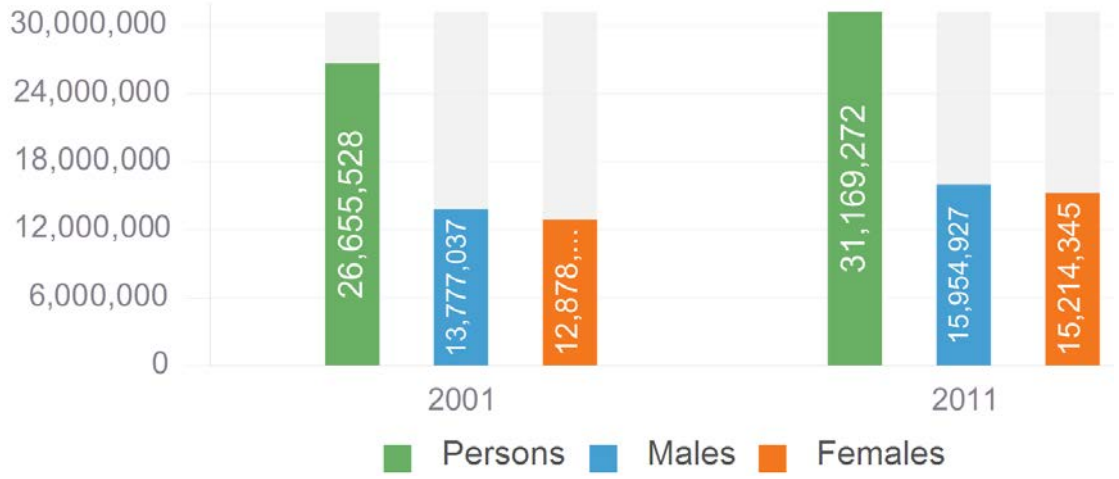


Source: Census of India 2011

1.2.2 Demography

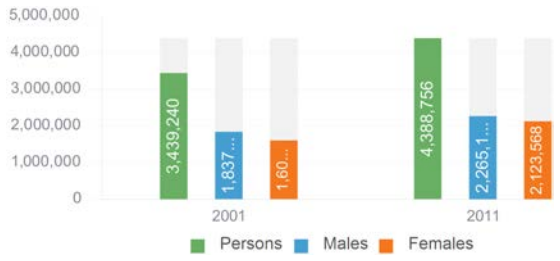
Total population of Assam is 31.17 million (2011 Census). Population grew steadily from 3.29 million in 1901 to 6.70 million in 1941, while it has increased unprecedentedly to 14.63 million in 1971, 22.41 million in 1991, 26.66 million in 2001 to reach the present level. Population Density stands as 396.8/km^2. Literacy rate as per the 2011 census is 73.18%.

Figure 2: Population Size (Total)



Population Size (Rural)

Population Size (Urban)



Source: Census of India (http://censusindia.gov.in/2011census/censusinfodashboard/index.html)

Note: The data used in the Censusinfo India Dashboard being of provisional nature, only important notes have been mentioned above. More detailed notes would be given when the final population tables are released (Last accessed on 17Nov2011)

1.2.3 Key departments in the State

The lists of key departments in the State of Assam are mentioned below:

- Agriculture Department
- Assam Accord Department
- Animal Husbandry and Veterinary Department
- Border Areas Department
- Cooperation Department
- Cultural Affairs Department
- Directorate of Technical Education, Assam
- Directorate of Financial Inspections, Assam
- Education Department
- Election Department
- Environment and Forests Department
- Excise Department
- Electricity Department
- Finance Department
- Information Technology Department
- Irrigation Department
- Judicial Department
- Panchayat & Rural Development Department
- Passport Department
- Personnel Department
- Planning & Development Department
- Public Enterprises Department
- Public Health Engineering Department
- Public Works Department
- Registration Department
- Revenue & Disaster Management Department
- Science and Technology Department
- Social Welfare Department

▪ Fishery Department ▪ Food & Civil Supplies Department ▪ General Administration Department ▪ Guwahati Development Department ▪ Handloom Textiles & Sericulture Department ▪ Health and Family Welfare Department ▪ Hill Areas Department ▪ Home Department ▪ Industries & Commerce Department ▪ Information & Public Relations Department	▪ Soil Conservation Department ▪ Sports and Youth Welfare Department ▪ Tourism Department ▪ Tribes Welfare Department ▪ Transportation Department ▪ Urban Development Department ▪ Water Resources Department ▪ Welfare of Minorities & Development ▪ Welfare of Plain Tribes & Backward Classes Department

Source: http://assamgovt.nic.in/departments/index.asp; *(Note: this is not a complete list)*

1.2.4 Economy

Agriculture

The economy of Assam continues to be predominantly agrarian. The contribution of Agriculture sector to the State Domestic Product was more than 25 per cent during 2009-10. The chief agricultural products of the state are varieties of rice, tea, jute, mustard, pulses, sugarcane, potatoes, oranges, pineapples, coconut, arecanut, black pepper, citrus fruits, banana, papaya, turmeric, spices, flowers, medicinal & aromatic plants, besides many types of vegetables thus contributing significantly towards food and nutritional security of the State

Fishery

There are about 3.91 lakh hectare of water area in the State in the form of rivers, beel, derelict water bodies and ponds and tanks. There is a positive trend in fish productivity during recent past. During the year 2009-10, the fish production has reached the tune of 2.18 lakh metric tons against 2.06 lakh metric tons fish produced in 2008-09.

Livestock and Veterinary

As per estimation, the number of Indigenous Cattle is 77,62,572 and Crossbreed Cattle numbered 4,46,185 in the State during 2009-10 as reported by State Animal Husbandry and Veterinary (AH&V)Department. The AH & V Department has also published the estimated figure of Fowl and Duck as 7942817 and 3106136 respectively during the same year. The milk production in the State during 2009-10 was estimated at 830 million liters. The egg and meat product on were estimated at 4680 lakh numbers and 32000 M.T. respectively during the same period.

Industry

The Industrial scenario of the State is mainly confined within the growth of employment oriented Small Scale Sector, which comprises of manufacturing and processing industries. The contribution of manufacturing sector to Gross State Domestic Product is estimated at around 8% during 2010-11. At present there are 16 Industrial Estates, 4 Industrial growth centre, 11 Integrated Infrastructure Development (IID) Projects, 17 Industrial Areas, 11 Growth Centers, 6 Mini Industrial Estate, one Export Promotional Park, one Food Processing Industrial Park spread over different parts of the State, and these are the major infrastructural support and facilities to the entrepreneurs of the State. The total SSI units in the State numbered 32,984 are providing employment to 1,67,216 persons till the year 2009-10. In 2009-10, the value of produced goods of 1,667 number SSI units was worth Rs.584.00Cr *(Source: Directorate of Economics and Statistics, Government of Assam).*

The Tea Industry of Assam, which is about 170 years old, playing a vital role in the State as well as in the national economy. The Assam's Tea industry also possesses a significant reputation in the global economy. The total area under tea cultivation is accounting for more than half of the country's total area under tea and the Tea Industry of Assam provides average daily employment to more than six lakh persons in the State which is around 50 percent of the total average daily number of labour employed in the country. The number of Tea Gardens in the State was 49102 covering land of 301000 Hectares out of 140712 Tea Gardens covering 556000 Hectares of land in the country as a whole. The estimated tea production of the State was 4875 lakh kg. as against 9808 lakh kg. total tea produced in the country during the year 2008 as per report of Tea Board of India. The tea production in Assam constitutes more than 50 percent of the total production of the country.

Among the plantation crops, rubber cultivation is also gaining its popularity in the State due to congenial agro climate as well as its eco-friendly activity.

Assam has ample scope for bamboo based industry like paper manufacturing industry, since this region has highest concentration of bamboo i,e, around 60% of the total Bamboo of the country. Under the National Bamboo Mission it is proposed for plantation of selected species of Bamboo in the State, in an area of 176000 Hectare, as a raw material for bamboo based industry.

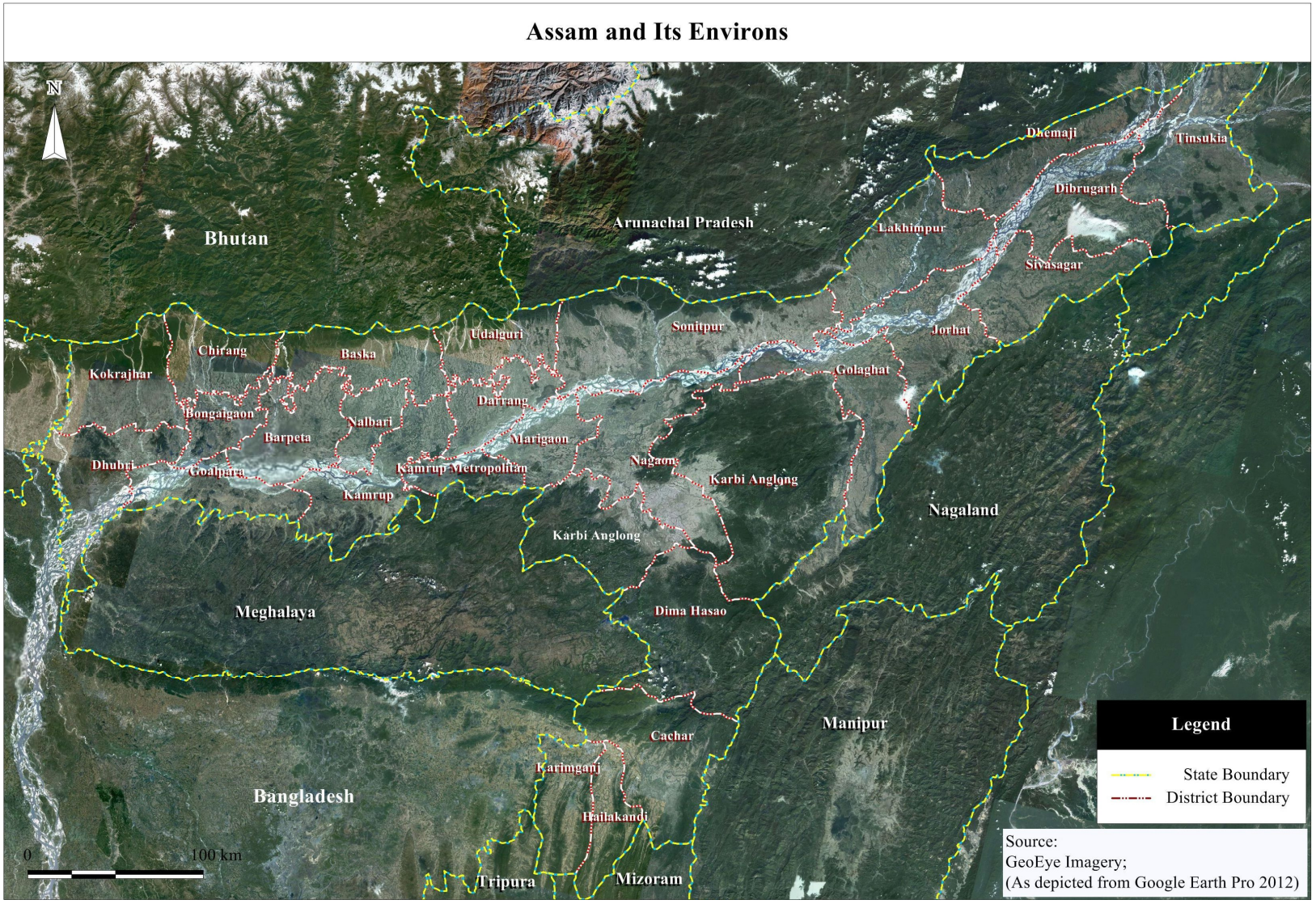
Sericulture, a major cottage industry of the State, is practiced in more than 10500 villages and provided employment to 2.6 lakh of family. Assam has the monopoly in production of Muga, the Golden Silk in the world and 99% of Muga Silk produced in Assam. Assam has also achieved the right of "Geographical Indication" in Muga Silk.

1.2.5 Geography

As per the plate tectonics, Assam is in the eastern-most projection of the Indian Plate, where the plate is thrusting underneath the Eurasian Plate creating a subduction zone and the Himalayas. Assam possesses a unique geomorphic environment, with plains, dissected hills of the South Indian Plateau system and with the Himalayas all around its north, north-east and east. Geomorphic studies conclude that the Brahmaputra, the life-line of Assam is an antecedent river, older than the Himalayas. The river with steep gorges and rapids in Arunachal Pradesh entering Assam, becomes a braided river (at times 16 km wide) and with tributaries, creates a flood plain (Brahmaputra Valley: 80–100 km wide, 1000 km long). The hills of Karbi Anglong, North Cachar and those in and close to Guwahati (also Khasi-Garo Hills) now eroded and dissected are originally parts of the South Indian Plateau system. In the south, the Barak originating in the Barail Range (Assam-Nagaland border) flows through the Cachar district with a 40–50 km wide valley and enters Bangladesh with the name Surma.

The State is one of the richest biodiversity zones in the world. Total Forest cover stands as 35.48% and consists of tropical rainforests, deciduous forests, riverine grasslands, bamboo, orchards and numerous wetland ecosystems. The state has 5 national parks, 13 wildlife sanctuaries and 2 bird sanctuaries (Official website, Government of Assam, *Last assessed on 20Mar2012*).

Figure 3: Assam and its environs



1.2.6 Physiographic Divisions

The evolution of the modern day topographic and physiographic architecture of Assam, leading to development of the mighty Brahmaputra Valley, the Central Assam range comprising of the Mikir and North Cachar (Barail) hills and the Barak Valley extending south-westward into alluvial plains of Bangladesh are due to the effect of several complicated cycles of geological events of the North East India. The state can be broadly divided into the following physiographic domains:

a. Brahmaputra valley - The vast alluvial plains of Brahmaputra valley occupy most of the North Assam covering Goalpara, Kokrajhar, Dhubri, Kamrup, Nalbari, Barpeta, Nagaon, Darrang, Sonitpur, Sibsagar, Jorhat, Golaghat, Lakhimpur and Dibrugarh districts. The Brahmaputra valley is bounded by Arunachal Himalaya in the north and northeast, Patkai – Naga - Lushai range of Nagaland and the Shillong Plateau in the south and southeast. The Brahmaputra valley with an average elevation from 50 to 120 m above m.s.l. represents an unique landscape comprising of a 800 km long and 130 km wide valley delimited by the low-lying valley to its south and the Karbi Anglong hills and Barail range comprising the North Cachar hills in the central part.

b. Central Assam Hills -The Central Assam which essentially is a hilly terrain comprised of Mikir Hill in Karbi Anglong and North Cachar Hill districts.

c. Barak valley - The hilly and alluvial terrain in the south covering the Cachar and Karimganj districts in the Barak valley.

1.2.7 Major River Systems

All the rivers in Assam are liable to floods, mainly because they receive heavy rainfall within a short time. These rivers are in their early stage of maturity and are very active agents of erosion. The river waters collect a tremendous amount of silt and other debris and raise the level of the river beds. Therefore, it becomes impossible for the main channel to cope with the vast volume of water received during the rains[1].

The Brahmaputra and the Barak are the two major river systems of the State. The Brahmaputra River originates at an elevation of about 5,000 m above mean sea level (AMSL) in Tibet. The Bhramaputra River, known as Tsang Po in Tibet, after a long eastward course of 1,600 km abruptly veers towards south around Namcha Barwa peak (7,710 m) in Eastern Himalaya. This southward course of the river flowing through Arunachal Pradesh is known as Siang River. It passes through tortuous course across the mountains of Arunachal Pradesh and then emerges on to the plains of Assam, where downstream it is met by the Dihang, which is known as the largest tributary of the Brahmaputra, further fed by tributaries like Dibong, Sessiri, Lohit and Noa-Dihing around Saikhowaghat. The river known as Brahmaputra in Assam initially flows south-westward and thereafter towards west in the Brahmaputra Valley. Further down streams, the river swings towards south and passes on to the plains of Bangladesh. The Brahmaputra River between Namcha Barwa and the confluence with Dihang descend by about 2,200m and its water power resources have been estimated to be the third biggest in the world coming after Congo and Amazon basins. Along the northern bank, the Brahmaputra River is joined by the tributaries like Subansiri, Ranga Nadi, Dikrong, Gabharu, North Dhansiri, Pagladiya, Manas, Aie, Beki,

[1] *(State and Union Territories – Assam, http://www.webindia123.com/Assam/LAND/Rivers.htm, Last assessed on1Nov2011).*

Champamati, Gangadhar, and Raidak. All these tributaries more or less flow in straight courses up to the junction of the main river. On the south bank tributaries like Burhi-Dihing, Disang, Dikhau, and South Dhansiri originate from Naga-Patkai Hills. The Kopili River originates from North Cachar Hills, while the Digaru, Bharalu, Kulsi, Singra, Dudnai and Krisnai originate from Meghalaya Plateau. Some of the rivers and tributaries originating from the south flow for quite a distance almost parallel to the Brahmaputra River before joining the main river. The often changing meandering course of the Brahmaputra and its tributaries are not only due to lateral erosion because of the low gradient of the rivers but also due to periodic, local and sudden changes in the basement levels due to the netotectonic activity (Geology and Mineral Resources of Assam, GSI, 2009).

1.2.8 Geology

Assam has a diversified geological spectrum. It is located near the hairpin bend of the Himalayas. Hence the extreme geostatic pressures exerted on the landmass during the creation of the Himalayas have resulted in Assam having large areas of sedimentary deposits. This explains the huge amount of oil found in places like Digboi, Bongaigaon etc.

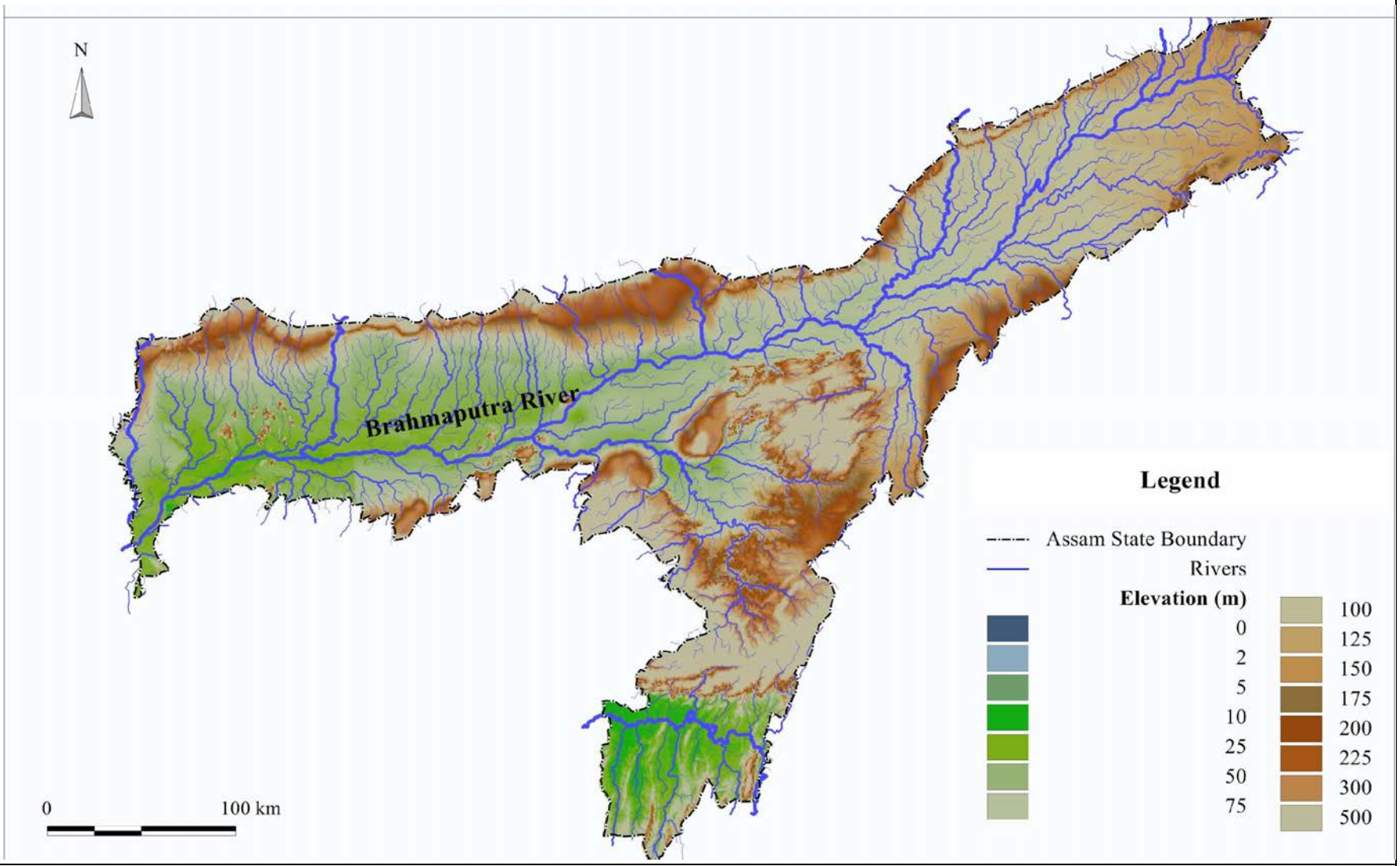
Cachar district of Assam is a huge storehouse of limestone. Limestone, which is basically Calcium Carbonate, is primarily a sedimentary rock which is used in a plethora of purposes namely construction, interior decoration etc. Karbi Anglong District and North Cachar hills have substantial reserves of coal. Of the four types of coal namely Peat, Lignite, Bituminous and Anthracite, the third kind is readily available out here.

Karbi Anglong is also rich in Kaolin (China Clay) deposits. Another district, Morigaon, contains extensive reserves of granite. The famous Dhubri district has an approximate reserve of more than ten million tones of Iron Ore. Of the four kinds of Iron ore, Haematite, Magnetite, Limonite and Siderite, the region is predominant in Haematite deposits. Not to be outdone, Nagaon district has got very high reserves of Glass Sand. Thus it can be unanimously vouchsafed that the geology of Assam depicts a rich repository of minerals with its diversified geographical structure. *(Information collated from Geology of Assam – http://www.mapsofindia.com/assam/geography/geology-of-assam.html, Last assessed on 1Nov2011)*

1.2.9 Climate

Assam experiences the predominant influence of the southwest tropical monsoon which is normally active from April to October with occasional winter showers. The approach of the monsoon is usually marked by strong winds, overcast skies accompanied by occasional thunder showers, hailstorms and at times by cyclones between April and May. Thunderstorms known as Bordoicila are frequent during the afternoons. Heavy downpour starts from June. The annual average rainfall of the state varies between 1600mm and 4300mm from place to place. The average rainfall for the state as a whole is about 2900mm with maximum precipitation during June and July. The average temperature in the state varies from 4°C to 19°C during the winter and 26°C to 37°C during the summer accompanied by high humidity.

Figure 4: Topographic Features & River Network



Source: TARU 2011

1.2.10 Scale and diversity of assets needing Disaster Management arrangements

Given the State's geographical location, population size, natural resources, richest biodiversity zones, and complexity of hazard risks there can be no single approach directed towards protecting the people and elements at risk (physical, social and economic resources). A wide range of government institutions operate to govern the state and manage the assets. The state is among nations largest producer of crude oil, significant share in India's agricultural production (tea and rice), and has built up infrastructure system (lifeline buildings / highways / road / rail / airport / heliport / power / communication) that serves as a critical link within the state and as a vital link to northeastern part of India.

Considering the geographical location, access issues, population exposure, scale and diversity of resources, there exists an urgent need for implementing and expanding State wide comprehensive disaster management strategies encompassing Preparedness. Prevention & Mitigation, Emergency Response & Rehabilitation. Initiatives on these fronts if taken by all departments of the state will result in minimizing the loss if life, reduce disruption time of basic services vital for society to function and protect assets/infrastructure which are vital for the state economy.

SECTION 3: OVERVIEW OF ASSAM STATE DISASTER MANAGEMENT ARRANGEMENTS AND GOVERNANCE

1.3.1 Overall Structure

The DM Act 2005 forms the legal basis for DM activities within all levels of the State Government and it includes:

- Establish disaster management authority(s) at the State, District and Local level
- Assessment of the vulnerability to different forms of disasters and specify measures to be taken for their prevention or mitigation
- Undertake preparedness activities to respond to any threatening disaster situations and give directions where necessary for enhancing such preparedness
- Coordinate emergency response in the event of any threatening disaster situation or disaster
- Promote general education, awareness, community training including drills in regard to the forms of disasters and the measures that may be taken to prevent the disaster, mitigate and respond to such disaster
- Give direction and ensure roles and responsibilities are clearly outlined for Departments of the Government functioning at all levels in responding to any threatening disaster situation or disaster
- Assist and protect the community affected by disaster or providing relief to such community or, preventing or combating disruption or dealing with the effects of any threatening disaster situation
- Develop mechanisms in which the mitigation measures shall be integrated with the development plans and projects
- Monitor the implementation of the plan, annual review and update the plan at all levels

As per the DM Act 2005 and the Assam DM Rules 2010, DM arrangements in the state are based upon partnerships between National, State, District and Local Authority. This partnership recognizes each Level of DM arrangements. Levels of disasters have already been categorized and disseminated as L0, L1, L2 and L3, based on the ability of various authorities to deal with them.

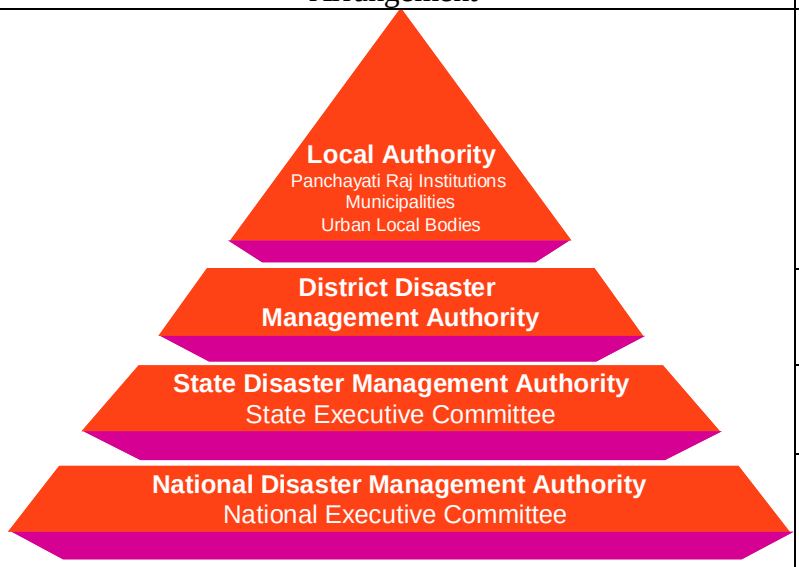
L0	L0 denotes normal times which are expected to be utilized for close monitoring, documentation, prevention, mitigation and preparatory activities. This is the planning stage where plans at all levels from community to the State shall be put in place. Training on search and rescue, rehearsals, evaluation and inventory updation for response activities will be carried out during this time.
L1	L1 specifies disasters that can be managed at the district level, however, the state and centre will remain in readiness to provide assistance if needed.
L2	L2 specifies disaster situations that may require assistance and active participation of the state, and the mobilization of resources at the state level.
L3	L3 disaster situations arise from large scale disasters where districts and the state may not have the capacity to respond adequately and require assistance from the central government for reinstating the state and district machinery.

The partnership across authorities is to work collaboratively and ensure coordination and planning at all times, information sharing and resource mobilization that are necessary for DM. In any response situation, initial efforts would always be taken by the District Administration. However, when District is overwhelmed in any situation, the support necessarily has to come from the State and National Level. Responsible

Officer (RO) within the jurisdiction control will trigger the activation for various level of disaster.

DM arrangement in Assam is based on a four tired structure and recognizes all four levels (L0, L1, L2 and L3), including the support mechanism from the National Level.

Figure 5: Overall Structure

Statutory Authority	Arrangement	Level of Operation[2]
Local		L1
State		L1
		L2
National		L3

DM Structure is to be established across the state of Assam (Local/District/State) along with creation of support structures such as Disaster Response Information Centre, State Disaster Response Force (SDRF) among others, so as to conduct operations for each Level of DM arrangements

1.3.2 Institutional Framework and their roles and responsibilities

1.3.2.1. Roles and Responsibilities of State level arrangements

Assam State Disaster Management Authority

The Assam State Disaster Management Authority is constituted under the chairmanship of the Chief Minister and other members will ensure inter-departmental coordination covering all aspects of DM. The State Authority has the responsibility of laying down policies and plans for DM in the State, recommend the provision of funds for mitigation and preparedness measures, review the development plans of different departments of the State and ensure that prevention and mitigation measures are integrated therein and issue necessary guidelines or directions as may be necessary.

State Executive Committee

The State Executive Committee (SEC) is constituted under the chairmanship of the Chief Secretary to the Government of Assam will assist the State Authority in the performance of its function and coordinate action in accordance with the state guidelines laid down by the State Authority and ensure the compliance of directions issued by the State Government under the Act.

[2] Reference has been made to High Powered Committee (HPC) Report, 2001

1.3.2.2. Roles and Responsibilities of District level arrangements

District Disaster Management Authority

The District Disaster Management Authority constituted for every district in the State is under the chairmanship of the Deputy Commissioner. The District Authority shall act as the district planning, coordinating and implementing body for DM and take all measures for the purposes of DM in the district as per the guidelines laid down by the National and State Authority.

The District Authority will prepare the District Disaster Management Plans, review capabilities and preparedness measures, give directions to the concerned departments at the district level, organize and coordinate specialized training programmes for different level of officers, employees, voluntary rescue workers and take all such measures as may be appropriate for a holistic and pro-active approach to DM.

1.3.2.3. Roles and Responsibilities of Local level arrangements

Local Authorities

The local authorities include the PRIs, Municipalities, Urban Local bodies, Cantonment boards etc. the local authority will ensure that its officers and employees are trained for disaster management, resources relating to DM are so maintained as to be readily available for use in the event of any disaster situation; construction practices under it or within its jurisdiction confirm to the standards and specifications laid down for prevention of disaster and mitigation; and carrying out relief, rehabilitation and reconstruction activities in the affected areas in accordance with the State Plan and the District Plan.

1.3.3 Disaster Management Plan

As per the DM Act 2005, Disaster Management means a continuous and integrated process of planning, organizing, coordinating and implementing measures which are necessary or expedient for-

- Prevention of danger or threat of any disaster
- Mitigation or reduction of risk of any disaster or its severity or consequences;
- Capacity-building;
- Preparedness to deal with any disaster;
- Prompt response to any threatening disaster situation or disaster;
- Assessing the severity or magnitude of effects of any disaster;
- Evacuation, rescue and relief;
- Rehabilitation and reconstruction;

Disaster Management plan at all levels will be drawn upon at the Local, District and State levels as well as by relevant departments with a mandate for DM functions to ensure coordination and holistic response to disaster. The plans will incorporate the inputs of all stakeholders for integration into the planning process.

1.3.4 Supporting Plan

State level Supporting Plan (Department and Sector) for each of the functional area, developed in relation to specific hazards and related intensity of emergency are to be produced as directed by SEC. Supporting Plans are to be reviewed and endorsed by ASDMA.

In preparing the Supporting Plan the sector department (designated as an agency for a particular hazard/emergency or involved in sector development activities) is required to communicate/consult with all other departments/agencies/organizations that have a role in mitigation/prevention, preparedness, emergency response, rehabilitation. The roles and responsibilities of primary and support organizations will be detailed in the Supporting Plan. The Supporting Plan will identify resources available for their own agency for undertaking DM activities taking into consideration of covering the local function requirements, as well as make provisions from external sources (support organizations) if need arise.

This methodical approach of DM plan development process is applied at State, District & Local level and Supporting/Sub-Plan current status compiled as Annex to State DM Plan and District DM Plan, City DM Plan. Their development must be approved by respective institutional arrangement.

1.3.5 State Guidelines for Disaster Management

The DM Act 2005 mandates the NDMA to lay down policies and guidelines (National Disaster Management Guidelines, NDMG) for the statutory authorities to draw their plans. NDMA concentrates on prevention, mitigation, preparedness, rehabilitation and reconstruction and has formulated appropriate policies and guidelines for effective and synergized national disaster response and relief. The State Plan is in conformity to the guidelines laid down by NDMA. Given the unique characteristics of the State, prevalent hazards and associated socio-economic risks State Disaster Management Authority shall initiate steps towards preparation of State Disaster Management Guidelines (SDMG). SDMG shall be prepared by ASDMA in consultation with local/district/state authorities and subject experts. The Guidelines shall be approved by SEC.

1.3.6 Partnership arrangement - Involvement of Civil Society Organizations and Private Sector

With the framework of the involvement, DM activities entail support across variety of institutions including the Civil Society Organizations and Private Sector Organizations.

Business and industry organizations are aware of the hazard risks in the state. Risks posed by geological and hydro-meteorological hazards are high and therefore executive staff of these organizations will require assessing threats and taking adequate prevention and mitigation strategies. Onsite and offsite plans are a mandatory requirement for all hazardous units. The existing emergency plan could expand to include employee injury prevention programmes, community outreach programme (educate people about potential threats), business continuity plan and allocate resources towards hazard specific mitigation. A critical need for coordination and partnership support in DM is being recognized by ASDMA.

Voluntary organizations are involved in providing disaster relief to individuals and families during emergency situation / mass care, in coordination with the State/District administration. Traditional relief and response agencies, community first responders (trained in basic first-aid, search and rescue) and DM Volunteers provide extensive support (knowledge assistance, human resource requirement) to local administration and community during emergency situations.

1.3.7 Disaster research, documentation and scaling-up

Research is a process of steps used to collect and analyze information to increase our understanding of a topic or issue. “Disaster research” deals with conducting field and survey research on group, organizational and community preparation for, response to, and recovery from natural and technological disasters and other community-wide crises. The purpose behind this field of research is to attempt to advance and communicate knowledge on mitigation techniques and procedures and disaster preparedness, response, and recovery. Research allows continuous improvement through enhancement of arrangements, policies and planning with the aim of minimizing the affects of disasters and enhancing community resilience to disasters.

Engineering institutions are traditionally involved in research towards improvising the safety and design of structural elements to withstand severe forces. Post-disaster needs assessments (PDNA) also provide valuable information from the field and can be directly linked towards developing prevention and mitigation instruments/tools. The lessons identified/best practices *(what worked and what did not work effectively)* can be documented and circulated for policy considerations.

DM stakeholders across departments and agencies will have their own independent responsibility to identify, support and resource research priorities within their sector. It is important to establish links with research/policy/academic organizations at the state and national level involved in the realm of disaster research and documentation of best practices.

1.3.8 List of ongoing initiatives

ASDMA has undertaken various activities to build a disaster resilient state. The list highlights select activities and is not exhaustive.

- Flood early warning system (FLEWS)
- Hazard Risk and Vulnerability Assessment
- Revision of Assam Relief Manual (1976), renamed as Disaster Management Manual
- Setting up of Disaster Information and Response Centre at Revenue Circle Level
- Involvement of NGO’s and Ex-Service men in DM
- Integration of Emergency Helpline Numbers
- Revisiting the danger levels of major rivers of Assam
- Equipping the Districts for better response during floods
- Capacity building and awareness generation
- Trainings and workshops for stakeholders (engineers, architects, doctors, PRIs, NGOs, volunteers in first aid & search and rescue)
- State wide school safety programme
- Technical projects undertaken by knowledge institutions in the State
- Establishment of Assam Institute of Disaster Management (AIDM)

SECTION 4: APPROACH AND FRAMEWORK ADOPTED BY ASDMA FOR DISASTER MANAGEMENT

1.4.1 Integrated approach

ASDMA suggests adopting an integrated approach and risk management framework to the development of DM arrangement across the State. The approach takes into the following considerations:

1.4.1.1. The "comprehensive risk management approach"

DM Planning must adopt a comprehensive approach to ensure a balance between the various elements as mentioned in the DM Act 2005. Planning for DM should entail in reduction of risk, enhance resilience of the systems and communities at risk, undertake effective response and recovery, streamline mitigation and prevention instruments in reconstruction and rehabilitation efforts, mainstream disaster risk reduction in development planning. ASDMA focuses on five mission areas of DM:

Mission area 1: Preparedness
Mission area 2 & 3: Prevention and Mitigation
Mission area 4 & 5: Response and Rehabilitation

These mission areas will serve the purpose to look into all components of DM as specified in the national DM Act and State DM Rules (2010). The mission areas are not compartmentalized by any means as they remain highly interdependent and applicable to all hazards that are threat or have the potential to turn into a disaster in the State of Assam. Execution of the five mission areas is a subject focus of all administrative tiers of the Government, institutions/organizations/agencies/departments and communities in the State. Stakeholders in DM will keep the focus directed on the mission and direct activities towards long terms vulnerability reduction, integrate DRR measures in the development planning process and manage residual risk ***(untreated)*** across the State.

Key activities which fall within the mission area are broadly mentioned below:

Preparedness	Prevention & Mitigation	Response	Rehabilitation
▪ Stakeholder consultation ▪ Emergency preparedness and 'All hazards' response plan ▪ Roles and responsibilities ▪ Standard Operating Procedures ▪ Mutual-aid agreement ▪ Testing of the plan ▪ Mock drills / Table-top exercises / Simulation exercises	▪ Structural and non-structural measures ▪ Land use planning regulations / Zoning ▪ National Building Code / Indian Standard Code of Practice (BIS) ▪ General Development Control Regulations (GDCR) / Building byelaws ▪ Risk transfer / Techno-financial	▪ Emergency declaration ▪ Emergency response plan activation ▪ Emergency response centre ▪ Communication plan (technical/scientific institutions, authorities, communities at risk, general public, media) ▪ Issue of advisory, threat level,	▪ Post-disaster needs assessment (PDNA) ▪ Post Disaster Recovery and Reconstruct8ion Plan (PDRRP) ▪ Temporary housing and provision of food/water and sanitation ▪ Restoration / Reconstruction of physical infrastructure and community services ▪ Psychosocial Care and Mental Health Services ▪ Public information ▪ Counseling ▪ Socio-economic impact

Preparedness	Prevention & Mitigation	Response	Rehabilitation
▪ Scenario planning ▪ Early warning / Alert systems ▪ Resource inventory and list of key contacts/specialists ▪ Evacuation plan ▪ Training and Education	regime ▪ Infrastructure strengthening ▪ Critical infrastructure protection ▪ Early warning systems (EWS) ▪ Education and training ▪ Relocation to safe places	warning notification and delisting ▪ Resource augmentation and mobilization to cater response needs ▪ Liaison between agencies and between government authorities ▪ Evacuation to safer grounds ▪ Search & Rescue ▪ Temporary shoring of weak structures ▪ First-aid ▪ Medical assistance to the injured ▪ Rapid damage survey ▪ Provide immediate relief	assessment ▪ Financial package / financial assistance ▪ Community rehabilitation ▪ Review of building byelaws and zoning / revision of development plan ▪ Reconstruction programme – incorporate disaster risk reduction (DRR) concerns

It is to be noted that mission areas exist in continuum and there is a definite interplay between them and the departments with mandated tasks and core capabilities. These missions are to be further built towards meeting certain targets and monitor / summarize the progress. Action Plan has been suggested in Part X of this plan document. The timeline highlighted can be taken into consideration as threshold requirement to see the implementation and benefits of DM actions. The actions suggested are not exclusive to any single Department or Administration level of the Government, but rather encompasses all stakeholders across the State.

1.4.1.2. The "all hazards approach"

Hazards are generally identified as sources of danger or risk. They are usually characterized either as natural events (geological, hydro-meteorological, chemical, biological) or human-caused events. State of Assam is exposed to range of hazard risks. ASDMA has expanded to address DM planning from "all hazards approach". This arrangement calls in for DM arrangements that can cater to range of possible hazard risks and disasters. However, specific hazard risks (depending on intensity of the event) and associated vulnerability will require specific DM actions. The approach is useful to keep a larger canvas for decision making and reducing risk by undertaking systematic interventions.

1.4.1.3. The "all agencies approach"

Inter-agency collaboration is essential for DM planning. A range of risk reduction and emergency response options could emerge through collaborative arrangements. It is not possible for any one agency to prepare/deal with the

consequences of disaster event. This approach involves coordination of activities across all levels of the government departments required to contribute to ASDMA's principle focus areas: a. Preparedness, b. Prevention and Mitigation, c. Response and Rehabilitation. In order to facilitate this approach Departments across all levels will identify primary and support/secondary role functions and incorporate the procedure in the Supporting-Plan (refer Section 1.3.4). Departments will have to build common understanding of Assam State DM Policy (2010) & Assam State DM Rules (2010) and undertake measures that apply within their jurisdiction or areas of responsibility.

1.4.1.4. The "resilience approach"

Resilience is the capacity of systems and communities, potentially exposed to hazards, to adapt by resisting or changing, in order to reach and maintain an acceptable level in functioning and structure. This is determined by the degree to which the social system is capable of organizing itself to increase its capacity for learning from past disasters for better future protection and to improve risk reduction measures (UNISDR). In order to build the state's overall resilience to disasters, it is vital to encompass this approach. ASDMA is of the view to adopt 'resilience-based approach' to address DM. This approach brings in shared responsibility between government and institutions, communities at risk (households), business and service providers, CSO's/NGO's and individuals. Adopting this approach will help towards developing sustained behavioral change at societal level *(build social cohesion)* and demonstrate successful partnerships.

1.4.1.5. Enhancing "local disaster management capability"

Local community and institutions are in the frontline of managing the event. Given the scale of the impact from a disaster, it is noticed that assistance from external sources are often limited. Institutions and communities at the local level are the first one to respond with available resources. Section 41 of the DM Act 2005 mentions that local authority may take measures as may be necessary for DM.

The capability of the institutions and the communities are to be built sufficiently to carry out disaster operations and participate in risk sensitive development planning.

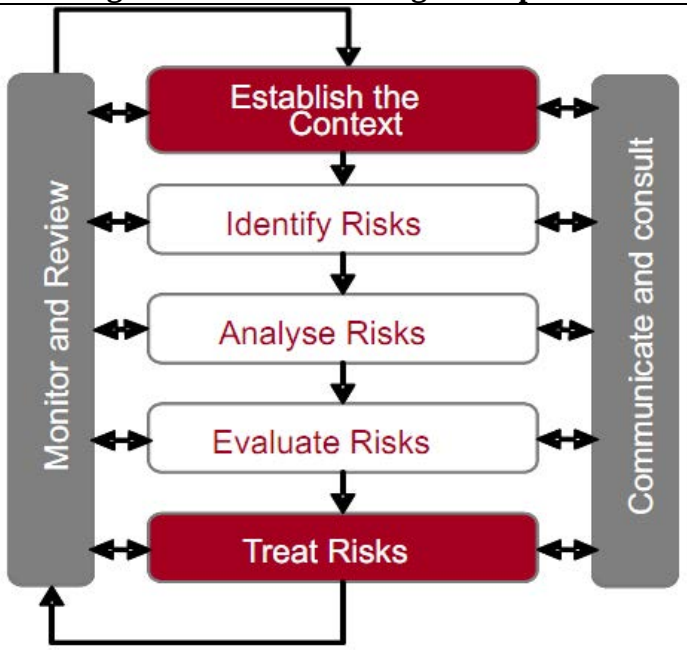
1.4.2 Outlining risk in the context of management framework

Risk is defined as uncertain consequence of an event or activity with respect to something that human's value. These risks are embedded in the larger societal, financial and economic consequences and are at the intersection between natural events, economic, social and technological developments and policy-driven actions (IRGC, 2005). The need for improved governance to manage risk has been debated and hence this section aims to introduce a risk management framework outline along with the linked components. The idea of providing this outline is to see through the lens of a new management system, adopt various components of the framework to specific needs and articulate within the roles and functions of the organization.

ISO 31000 : 20009 (E) – Risk Management, Principles and Guidelines is a well established standard which establishes the relationship between risk management principles, framework and process. This standard is applicable to all forms of risk and

contains: a. One vocabulary, b. A set of performance criteria, c. One, common overarching process for identifying, analyzing, evaluating, and treating risks; d. Guidance on how that process should be integrated into the decision making processes of organization. Refer to Fig 6 for the risk management process diagram.

Figure 6: The risk management process



Source: http://www.irr-neram.ca/pdf_files/ISO%2031000.pdf

The standard describes all key elements required within the framework and goes about describing the process for the organization to create, implement and keep the elements relevant. Institutions/organizations having understood the risk profile and the processes will have to design/revise the management components of the plan. The implementation time frame may vary on a range of parameters as it may require alignment with the complexity of the organization itself, and will require alignment with the culture and processes. Large institutions can adopt a strategy to have a hierarchy of plans operating within an overall plan which determines the contour of operations.

1.4.3 Establishing the context of risk governance

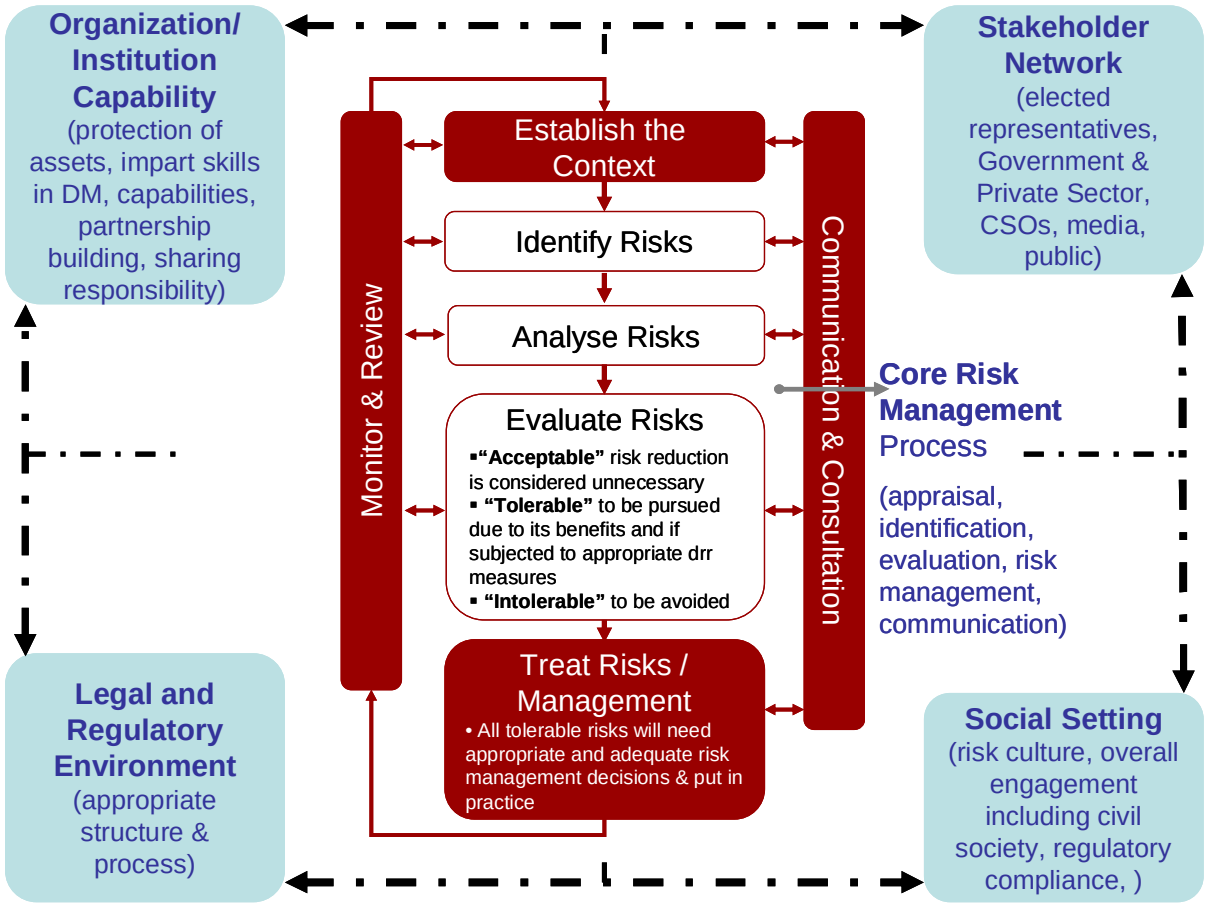
Risk Governance deals with the identification, assessment, management and communication of risks in a broad context. It deals the totality of actors, rules, conventions, processes and mechanisms and is concerned with how relevant risk information is collected, analyzed and communicated, and how management decisions are taken. It applies principles of good governance that include transparency, effectiveness and efficiency, accountability, strategic focus, sustainability, equity and fairness, respect for the rule of law and the need for the chosen solution to be politically and legally feasible as well as ethically and publically acceptable (IRGC, 2005).

The framework is summarized in the diagram (risk governance context) and it highlights on key building bocks *(risk management process, organizational and*

institutional landscape, social setting, legal or regulatory environment & stakeholder engagement) that are essential for risk-related decision-making.

Figure 7 draw a comprehensive risk management framework for the State of Assam, indicates activity streams, and key building blocks. Using this framework across all levels (State, District, Local, or any other unit level of enquiry) enables a mechanism to understand the risk, consult the stakeholders and develop options for dealing with risk.

Figure 7: Risk Governance



Dotted line indicates the two way communication link established to explain the rationale for decision making process, allow stakeholders to understand their role, allow them to make informed choices about the risk environment, responsibilities of institutions including their own responsibilities.

PART – II STATE RISK ASSESSMENT

SECTION 1: INTRODUCTION

2.1.1 General

Risk assessment is a methodology to determine the nature and extent of risk by analyzing potential hazards and evaluating existing conditions of possible vulnerability that together could potentially harm exposed people, property, services, livelihoods and the environment on which they depend. It includes review of the technical characteristics of hazards such as their location, intensity, frequency and probability; the analysis of exposure and vulnerability including the physical social, health, economic and environmental dimensions; and the evaluation of the effectiveness of prevailing and alternative coping capacities in respect to likely risk scenarios. This series of activities is sometimes also known as a risk analysis process (UNISDR, 2011).

Risk in general is characterized by hazard intensity, exposure of elements and the scale of damage that it undergoes under the influence/action of the hazard. Risks faced are not static and there is a continuous need to study, undertake research and update the profile of the risk within the state as well as the surrounding region. A range of institutions (Geological Survey of India, Indian Meteorological Department, Central Water Commission, Indian Space Research Organization among others) with mandate from the Central and the State Government are involved in primary detection and assessment of the hazard. Technical institutions are also involved in undertaking scientific and social assessments for a wide range of risks within the State environment. From the disaster management perspective it is important to understand the hazards and its potential impact, and prepare governance institutions and community/society to respond for particular outlook/scenario.

Nodal agencies/Scientific institutions document/catalogue disaster events and these databases are maintained and updated on regular basis. Every event feeds into better understanding and building of the hazard profile. Information such as population vulnerability due to socio-economic factors, physical vulnerability, accounts of damage and loss are maintained by a range of agencies mandated to deliver sector specific functions. By putting all this information together, the state can develop/undertake risk analysis or risk assessment exercise. The output/information will enable disaster management professionals and communities to undertake prevention/mitigation and preparedness actions.

The broad state wide profile of hazards and impacts is covered in the subsequent description within this chapter. The results of the broad-brush assessment indicate that a wide range of threats and hazards pose a significant risk to the State institutions, infrastructure and community. Earthquakes, landslides, floods *(including flash floods and urban flooding)*, wind and cyclone, droughts, cloud bursts, erosion, forest fire, climate variability and climate change, epidemics, infectious diseases, chemical hazards and hazardous material release / chemical spills, transportation accidents – road / rail / inland waterways including boat capsize, shortages/problems resulted due to loss of infrastructure, structural collapse of infrastructure, act of terror, sabotage of critical infrastructure, dam failures, mine collapse, CBRNE, ground water pollution,

any slow/rapid changes in the environment causing problems related to health / loss of life / damage to assets / impact on livelihood / economic loss / landscape damage or changes etc. present significant risks to the State of Assam.

A detail risk assessment will help in identifying risk reduction measures, prioritize response functions, update preparedness plan and inform strategic and policy decision making at all administration levels (Local/District/State/National). A detailed Multi-Hazard Risk & Vulnerability Assessment (MHRVA) study can direct strategic investment plan for risk reduction.

ASDMA has commissioned several scientific studies to determine hazard risk and vulnerability across the State. The information collated through these assessments is used to guide developing planning efforts and mitigation/response aspects of disaster management.

The state of Assam is prone to natural hazards such as earthquakes, floods, landslides, cyclones and occasional draughts. The population is vulnerable to perennial floods, landslides and environmental degradations. Disasters cause sudden disruption to the normal life of a society and cause enormous damage to property to a great extent. Chronological reviews of the past major disasters show possibilities of similar events in future. Since the detailed HVRA is in the process of development under the guidance of ASDMA, this section attempts to throw light on the critical issues as identified by scientists and published within peer reviewed articles, journals and technical reports.

2.1.2 Earthquake Hazard

Earthquakes are one of the most destructive of natural hazards in the seismically active Assam. The State of Assam has experienced several devastating earthquakes in the past resulting in a large number of deaths and severe property damage. Active seismicity of the North Eastern region has caused extensive landslides, rock falls on the hill slopes, subsidence and fissuring of ground in the valley, and changes in the course and configuration of river tributaries and Brahmaputra mainstream. These changes, especially in river morphology have a significant impact on the hydrologic regime and vulnerability of the communities which are in its proximity and are dependent upon this natural system as their source of livelihood.

According to Mahajan et al. (2010), geo-morphologically, Assam falls within in an earthquake prone zone (BIS Seismic Zone IV and V) of the Indian subcontinent. Much of Assam lies in the Brahmaputra River Valley, except for a few southern districts. The northern and eastern parts of this valley are bounded by the Himalayan Frontal Thrust (HFF). The Himalaya is a result of continent–continent collision between the Indian and the Eurasian plates. In the eastern parts along with the HFF, there is the arc of the Lohit and Naga Thrusts. Among the large earthquakes in this region were the events in 1897 and 1950 (Joshi et al., 2007). According to a hazard map developed by the Global Seismic Hazard Assessment Programme, some of the location within the state can experience peak gravitational acceleration (PGA) ranging from 0.24g to 0.48g. The region where the highest PGA can be expected is along the state's border with Meghalaya, the site of the Great Indian earthquake of 1897 (GSHAP, 1999).

Sliced between two tectonic plate collision boundaries, the Himalayan in the north and the Indo-Burman in the east, the Northeastern region is one of the seismically most active regions of the world. The two great earthquakes of magnitudes 8.7 in 1897 and 1950 are memorable events in the annals of earthquake history of this entire region. According to some of the documented evidence discussed by Joshi et al., (2007), these earthquakes were so intense that the rivers changed their courses, ground elevations immensely affected. Apart from these, there is a recorded history of around twenty destructive earthquakes which has affected this region in the past century. Earthquakes during non-instrumental period in Assam are in the year of 1548, 1596, 1601, 1642, 1663, 1696, 1756, 1772, 1838, & 1841. With complex tectonic and geology set up of the region can produce earthquakes of magnitudes 8 and above every few hundred years (Mahajan et al., 2010). The earthquakes of Magnitude 6 and above measured during instrumental period in Assam is presented in Table 1:

Table 1: Earthquake Hazard History of Assam State (M>6.0)

Date	Epicenter	Lat	Long	Origin Time	Magnitude
10th January 1869	9.4 Km N of Kumbhir (Assam)	25.00 N	93.00 E	11:45 UTC/ 17:15 IST	7.5
12th June 1897	14 Km ESE of Sangsik (Meghalaya)	25.50 N	91.00 E	11:41 UTC/ 17:11 IST	8.7
9th September 1923	South Meghalaya, India	25.25 N	91.00 E	22:03:42 IST	7.1
2nd July 1930	3.9 kms NNW of Dabigiri (Meghalaya)	25.80 N	90.20 E	21:03:34.4 UTC/ 03:23:34.4 IST	7.1
21st January 1941	Near Tezpur, Assam	26.50 N	92.50 E	02:30:16.0 UTC	6.5
23rd October 1943	13.6 kms E of Hojai (Assam)	26.00 N	93.00 E	17:23:17 UTC/ 22:53:17 IST	7.2
29th July 1947	Arunachal Pradesh	28.80 N	93.70 E	13:43:20 IST	7.7
15th August 1950	20.7 kilometers NW of Tajobum (Arunachal Pradesh)	28.50 N	96.50 E	14:09:28.5 UTC/ 19:39:28.5 IST	8.7
31st December 1984	SSE of Silchar (Assam)	24.64 N	92.89 E	23:33:37 UTC	6.0
6th August, 1988	Indo Myanmar Border	24.14 N	95.12 E	05.03 IST	7.3

Source: CNDM, Assam Administrative Collage, Assam

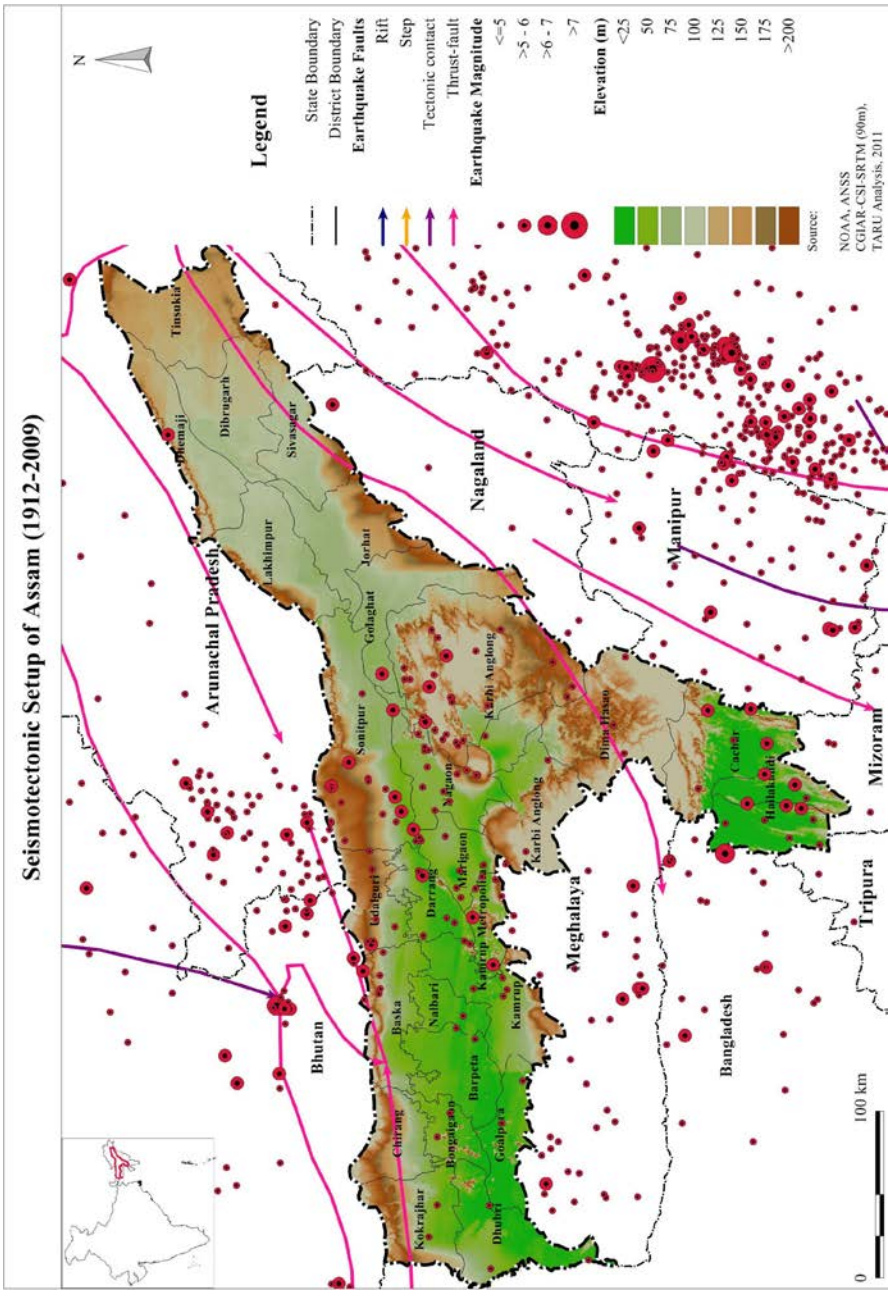
Table 2: Some of the recent earthquakes					
Date	**Epicenter**	**Lat**	**Long**	**Origin Time**	**Magnitude**
9 Dec 2004	Silchar Region, Assam	24.710 N	92.523 E	08:49:00 UTC	Mw 5.4
18 August 2003	Upper Tsangpo, Xizang, Eastern Tibet	29.547 N,	95.562 E	09:03:02 UTC	Mw 5.5
1 June 2005 -	Upper Dibang Valley, Arunachal Pradesh	28.871 N	94.598 E	04:16:48 UTC	Mw 5.7
14 Feb 2006	Mana, North Sikkim,	27.377 N	88.362 E	00:55:23 UTC	Mw 5.3
23 Feb 2006	Bhutan	26.863 N	91.632E	20:07:26 UTC	Mw 5.2
18 May 2007	Nambu, North Sikkim,	27.302 N	88.159 E	12:40:02 UTC	Mb 4.6
20 May 2007	Singyang, North Sikkim	27.303 N	88.191 E	14:18:18 UTC	Mb 5.0
2 Dec 2008	India Nepal Border Region	27.373 N	88.051 E	05:11:42 UTC	Mw 5.2
19 Aug 2009	Assam Region	26.556 N	92.470 E	10:45:13 UTC	Mw 5.0
21 Aug 2009	Bhutan	27.332 N	91.437 E	08:53:05 UTC	Mw 6.1
29 Oct 2009	Bhutan	27.262 N	91.417 E	17:00:38 UTC	Mw 5.1
31 Dec 2009	Bhutan	27.319 N	91.510 E	09:57:29 UTC	Mw 5.5
4 Feb 2011	Myanmar region	24.618 N	94.680 E	13:53:46 UTC	Mw 6.2
18 Sept 2011	India Nepal Border Region	27.723 N	88.064 E	12:40:48 UTC	M6.9
30 December 2011	Central Assam region			15:14:01 UTC	M3.6
18 December 2011	Sikkim-Nepal border			21:35:26 UTC	M4.6
Source: www.asc-india.org (Last assessed on 20Mar2012), USGS & Results of NEIC Catalogue Search					

Figure 8 represents the seismo-tectonic setup of Assam and indicates the location of historical earthquakes within the region. Figure 9 indicates probable earthquake peak ground acceleration (PGA) map as described by Global Seismic Hazard Assessment Program (GSHAP) an initiative undertaken with the support of the International Council of Scientific Unions (ICSU), and endorsed as a demonstration program in the framework of the United Nations International Decade for Natural Disaster Reduction (UN/IDNDR).

According to the Global Seismic Hazard Assessment Programme (GSHAP) data, the state of Assam lies in a region with high to very high seismic hazard. As per the 2002 Bureau of Indian Standards (BIS) map, this state also falls in Zone-V. Based on the

hazard history and its zonation, much of Assam falls within high intensity[3] zone i.e. IX or more based on Modified Mercalli Intensity (MMI) scale (which is a macroseismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence). According to United States Geological Survey (2010), an earthquake which has a ground shaking of MMI scale of IX will cause considerable damage in specially designed structures and the well-designed frame structures will be thrown out of plumb. The damages will be great in substantial buildings, with partial collapse. There are also possibilities of buildings being shifted off its foundations. Any intensity higher than this will destroy well-built wooden structures, most masonry and frame structures.

Figure 8: Seismo-tectonic Setup of Assam



Source: TARU Analysis,, 2011

[3] Magnitude and Intensity measure different characteristics of earthquakes. Magnitude measures the energy released at the source of the earthquake. Magnitude is determined from measurements on seismographs. Intensity measures the strength of shaking produced by the earthquake at a certain location. Intensity is determined from effects on people, human structures, and the natural environment.

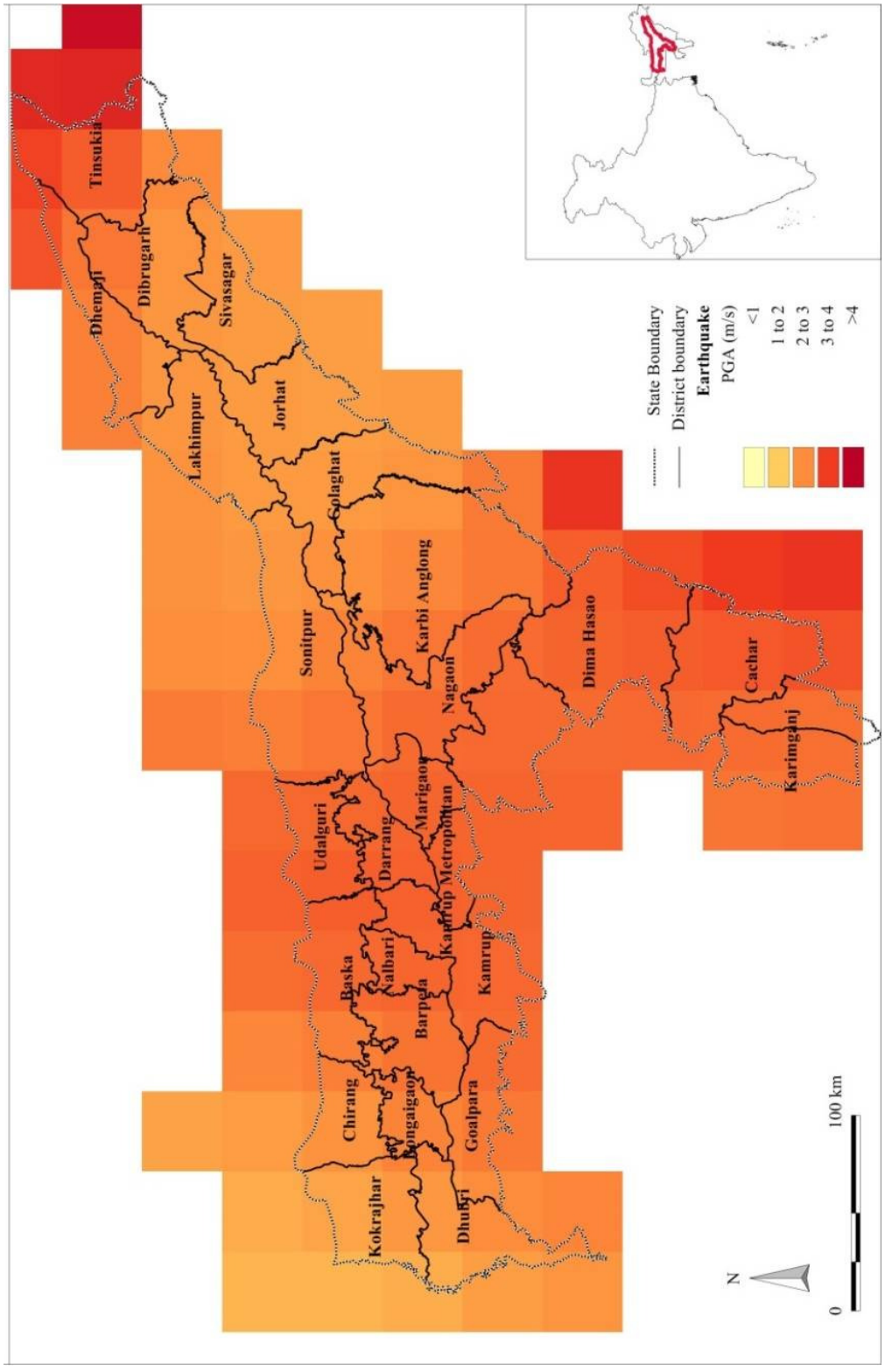


Figure 9: Peak Ground Acceleration

Data Source: GSHAP, 1999

2.1.3 Flood Hazard

Assam lies in the middle of the Brahmaputra and Barak basins. The Brahmaputra basin is one of the largest river basin in the northeast region of India. The river Brahmaputra originates from the semi-arid region of south Tibet. The Brahmaputra basin covers an area of 5,80,000 sq.km., out of which 70,634 sq.km. falls within

Assam. The Assam basin has a length of about 1540 km in east-west direction and a maximum width of 682 km. in north-south direction. Due to this geo-climatic condition, flood hazard risk is of concern in the Brahmaputra and Barak river basins in Assam.

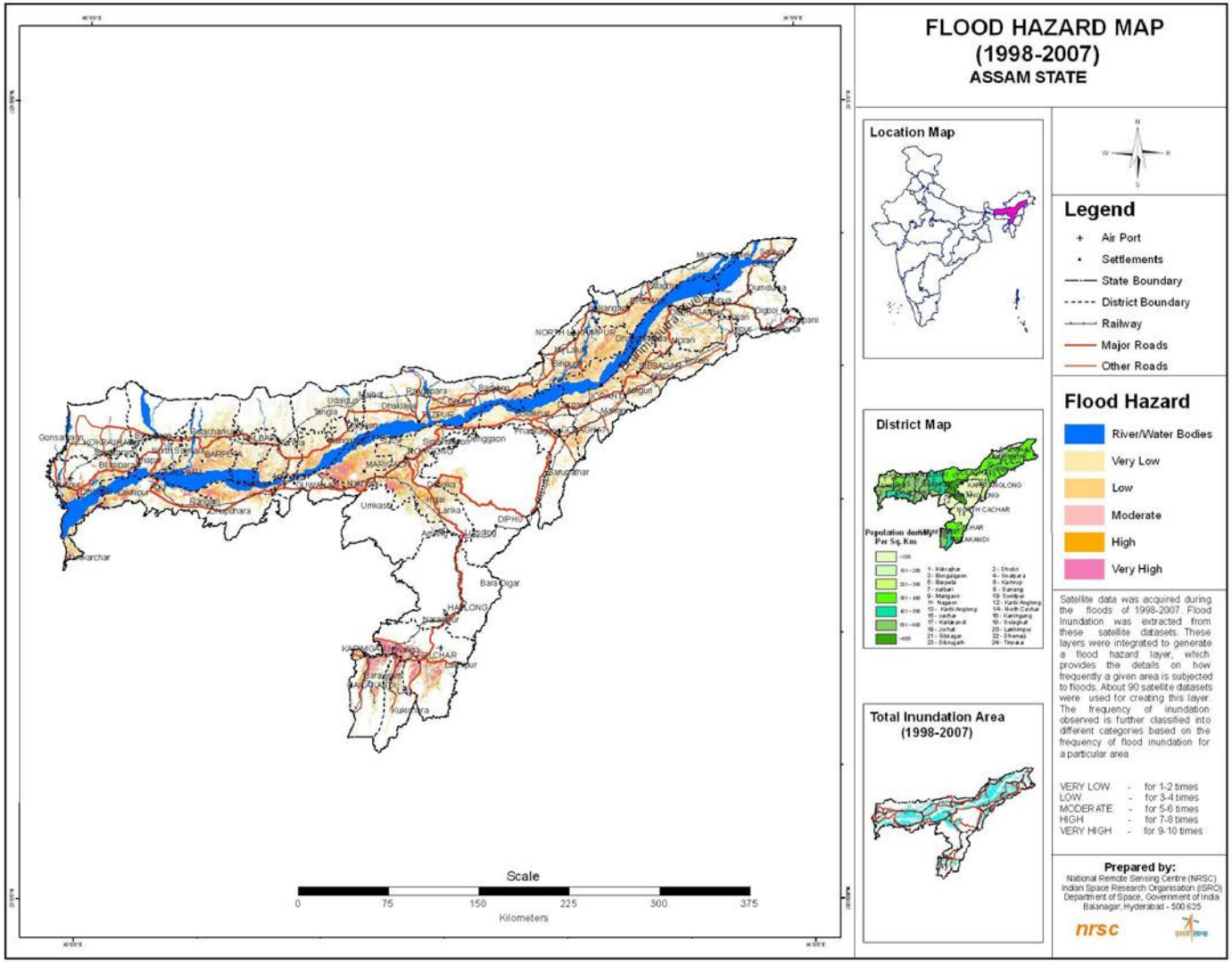
The Brahmaputra Valley in Assam is one of the most hazard-prone regions of the country, with more than 40% of its land (3.2 million hectares) susceptible to flood damage. This is 9.4% of the country's total flood-prone area. About 7% of land in the state's 17 riverine districts has been lost because of river erosion over the past 50 years (Source: Environment Assessment Report, India: Assam Integrated Flood and Riverbank Erosion Risk Management Investment Program, ADB June 2009). Expected average annual population exposed to flood hazard is presented in Figure 11.

Flood hazard risk in the state is due to a blend of numerous natural and anthropogenic factors. The important cause for frequent occurrence of flood in this region is the extremely dynamic monsoon rainfall regime and the unique physiographic setting. The water yield of the Brahmaputra basin is among the highest in the world. This, together with the limited width of the valley and the abruptly flattened gradient, leads to tremendous drainage congestion and resultant flooding. The Brahmaputra valley had experienced major floods in 1954, 1962, 1966, 1972, 1974, 1978, 1983, 1986, 1988, 1996, 1998, 2000 and 2004.

In addition to the geo-climatic regime of the state the morphology of the Brahmaputra River is another significant factor contributing to the floods. Characterized by intense braiding and bar formation, channels exhibit successive bifurcation and rejoining of flow around sand bars and islands. This results in a highly dynamic river bank line and bed configuration. The morphology and behavior of the river undergoes drastic changes in response to variations in the flow regime and pattern of sediment transport and deposition in the river following the seasonal rhythm of the monsoon. Multiple factors, such as excessive sediment load, large and variable flow, easily erodible bank materials, and aggradation of the channel, have been the possible underlying factors. Another striking feature of the river's morphology is the continuous shift of the thalweg (deep channel) from one location to another within the unstable bank lines of the river. Bank materials of the Brahmaputra consist mainly of fine sand and silt with only an occasional presence of clay. They have a relatively fine-grained top stratum and a coarser substratum. Different patterns of erosion and accretion occur at different locations within a few kilometers of the riverbank at the same time, and erosion and accretion follow each other in different magnitude at the same location (EA Report, FRERM, ADB 2009).

The floods are caused by the runoff of extremely heavy rainfall during the monsoon and high sediment loads from upper watersheds that are geologically unstable and degraded because of deforestation and changing land use. The flood combined with river erosion has significant impacts each year. Estimated possible flood hazard risk of Assam in presented in Fig 10.

Figure 10: Flood Hazard Map (1998-2007)



According to Flood Hazard Atlas of Assam (ISRO, 2011), approximately 28.31% (22.21 lakh hectares) of land in state of Assam was affected by flood hazard between the period 1998 to 2007. In the above study, the flood prone areas were divided into categories based on frequency which range from very high to very low. Very high indicates nine to ten times inundation during last 10 years. This amounts to nearly 1.64% of total geographical areas of state (5.79% of total flood affected area). 'High; indicates occurrence of seven to eight floods over the last 10 year. This amounts to approximately 2.86% of total geographical areas of state (10.11% of total flood affected area). The rest of the flood affected zones i.e. moderate, low and very low the percentage area of each flood hazard category accounts to 4.48% (15.83% total flood affected area), 6.27% (22.14% total flood affected area) and 13.06% (46.13% total flood affected area) respectively.

Table 3 Flood Hazard Affected Area in Assam (1998-2007)

Hazard Severity	Flood Hazard Area (ha)	% Flood Hazard (w.r.t. State Geographic Area)	% Flood Hazard (w.r.t. Total Flood Hazard Area)
Very High	1,28,687	1.64	5.79
High	2,24,629	2.86	10.11
Moderate	3,51,667	4.48	15.83
Low	4,91,761	6.27	22.14
Very Low	10,24,584	13.06	46.13
Total	22,21,328	28.31	100

Source: Flood Hazard Atlas of Assam, ISRO 2011

Table 4 Extent of Flood Hazard in Assam (1998-2007)

Affected Area (%)	No. of Districts	Name of Districts
0-10%	4	Baska, Chirang, North Cachar, Karbi Anglong
10-20%	2	Kokrajhar, Tinsukia
20-30%	6	Cachar, Golaghat, Hailakandi, Kamrup (Metro), Karimganj, Udalguri
30-40%	6	Bongaigaon, Dhubri, Dibrugarh, Golpara, Kamrup(Rural), Sonitpur
40-50%	5	Dhemaji, Jorhat, Nalbari, Nagaon, Sibsagar
50-60%	1	Lakhimpur
60-70%	1	Barpeta
70-80%	2	Darrang and Morigaon

Source: Flood Hazard Atlas of Assam, ISRO 2011

Note: Analysis is based on 10 years (between 1998-2007) data used in above mentioned study.

Apart from the geo-climatic setting, high rate of population growth in the form of high birth rate and immigration from border countries has led unplanned settlements. Human activities like deforestation, accelerated rated change in land use, filling up

low lying areas for the construction of buildings, urban development and temporary flood control measures are some changes which do contribute to the overall vulnerability of the state to floods (Dhar and Nandaragi, 2003). The reliability and effectiveness of the embankments from the Brahmaputra flooding are generally insufficient because of structural deterioration and ongoing riverbank erosion.

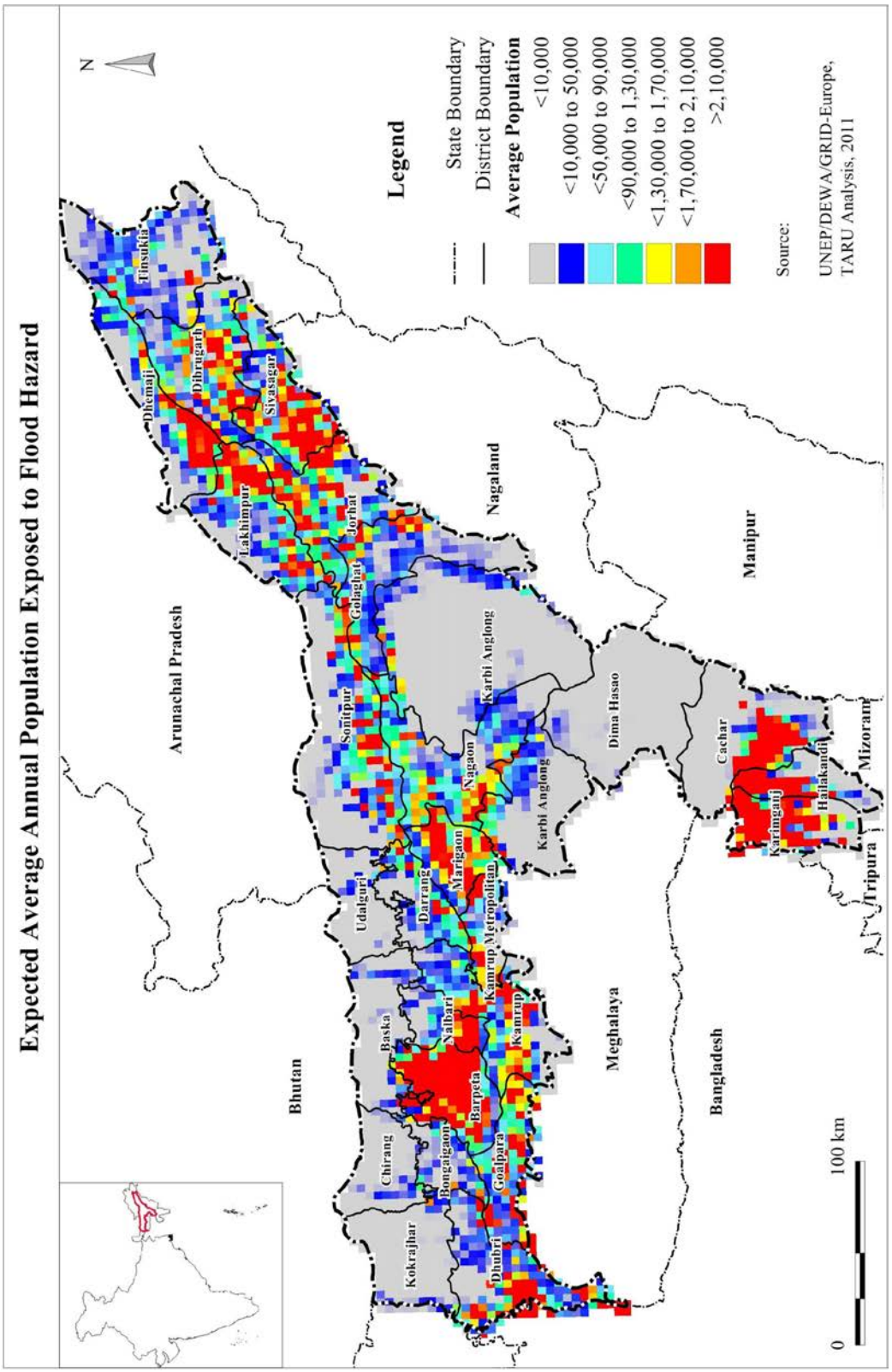


Figure 11: Expected Average Annual Population Exposed to Flood Hazard

An indicative map of expected average annual population exposed to flood hazard risk is presented in Fig 11. As per the FRERM report, the local communities believe that the major cause of their unrelenting flood and drainage problems is the unreliability of the deteriorated infrastructure. Other concerns raised include (i) the inadequate quality of embankment construction; (ii) delayed or nonpayment of land acquisition and resettlement for completed works; and (iii) the need for community participation in planning, implementation, and management. It is increasingly realized to build FRERM infrastructure (structural and non-structural mitigation) to address the concern of flood and river-bank erosion. Systematic monitoring of the river dynamics, need to be strengthened.

2.1.4 Landslide Hazard

Landslides are sudden, short-lived geomorphic event that involves a rapid-to-slow descent of soil or rock in sloping terrains. It can also be caused by excessive precipitation or human activities, such as deforestation or development that disturb natural slope stability. Landslides are caused when the stability of a slope changes from a stable to an unstable condition. A change in the stability of a slope can be caused by a number of factors, acting together or alone.

Assam is located on the Himalayas, which are the recent foundation of mountain history and are geologically unstable; they are seismically very active therefore are still in the upheaval stage (Valdiya, 1975). As mentioned in previous sections the state has a history of earthquakes. These earthquakes are usually accompanied by damaging landslides in the region *(GSI, 2011)*. Even though much of the minor landslides go unnoticed some of the major events which have occurred in the region over the past seven years are presented in the table below:

Table 5 List of key Landslide events

Date	Type	District	Name of the Place	Cause of Landslide
5- 8 Oct 2004	Land-slide	Kamrup	Guwahati Urban	Heavy concentrated rainfall
28 Aug, 2009	Rock-slips and land slide	North Cachar Hills	Mahur and Phaiding	Torrential rains
12-Sep-10	Rock-slips and land-slide	Lakhimpur, Dhemaji, Golaghat, and Bongaigaon	-	-
16-Jun-10	-	North Cachar Hills	Jatinga, Longrangjao, Mahur and Wadringdisa	Heavy rains
3-Jun-10	Mud-slide	Karimganj	Rongpur Village	-
2-Apr-10	-	Cachar	Dholai Block	Torrential downpour

Table 5 List of key Landslide events				
			Name of the	
23-Mar-11	-	Kamrup	Kharguli Area of Guwahati City	-
				Source: GSI

Figure 12 and 13 illustrates the landslide affected areas and estimated population exposed to the event in Assam.

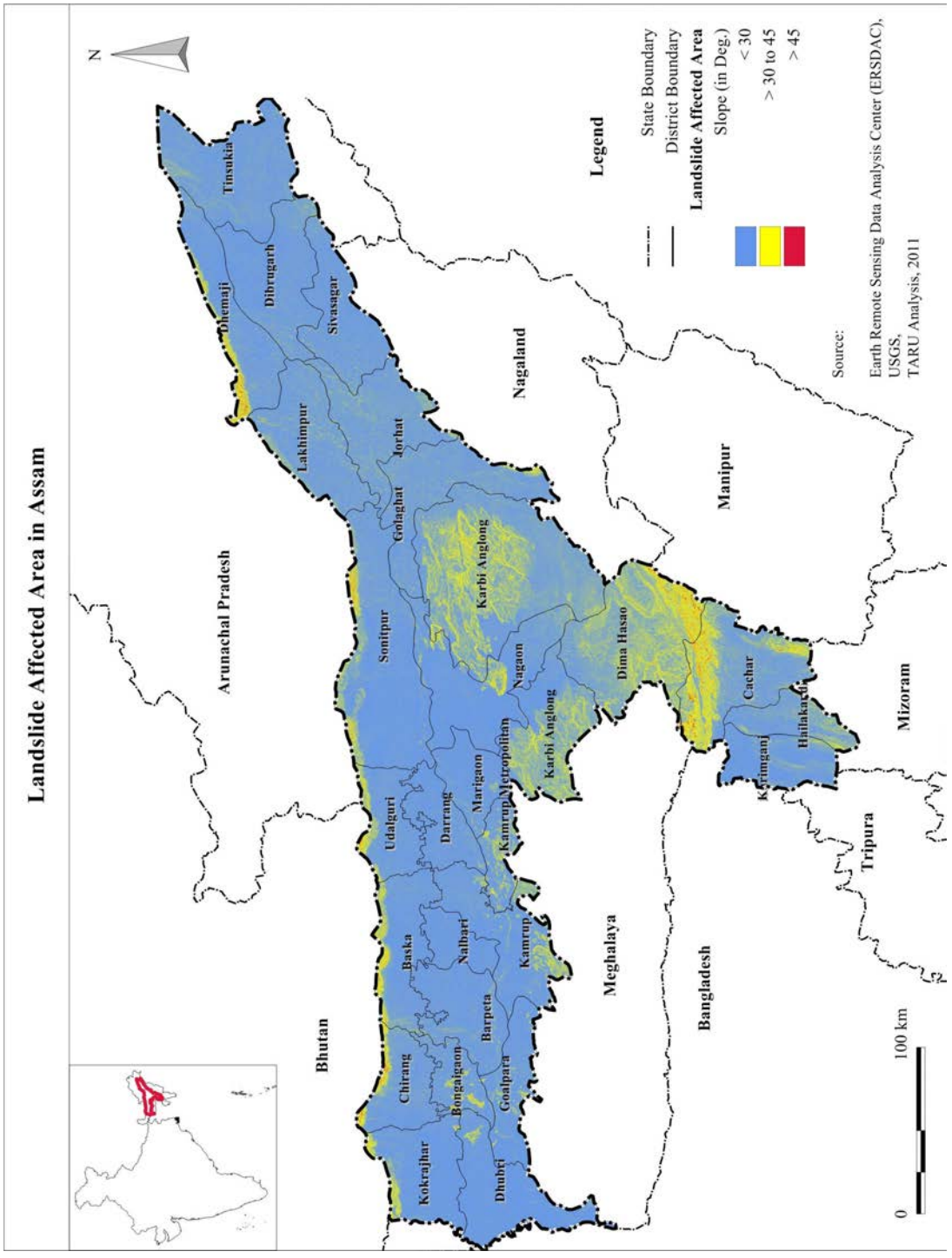
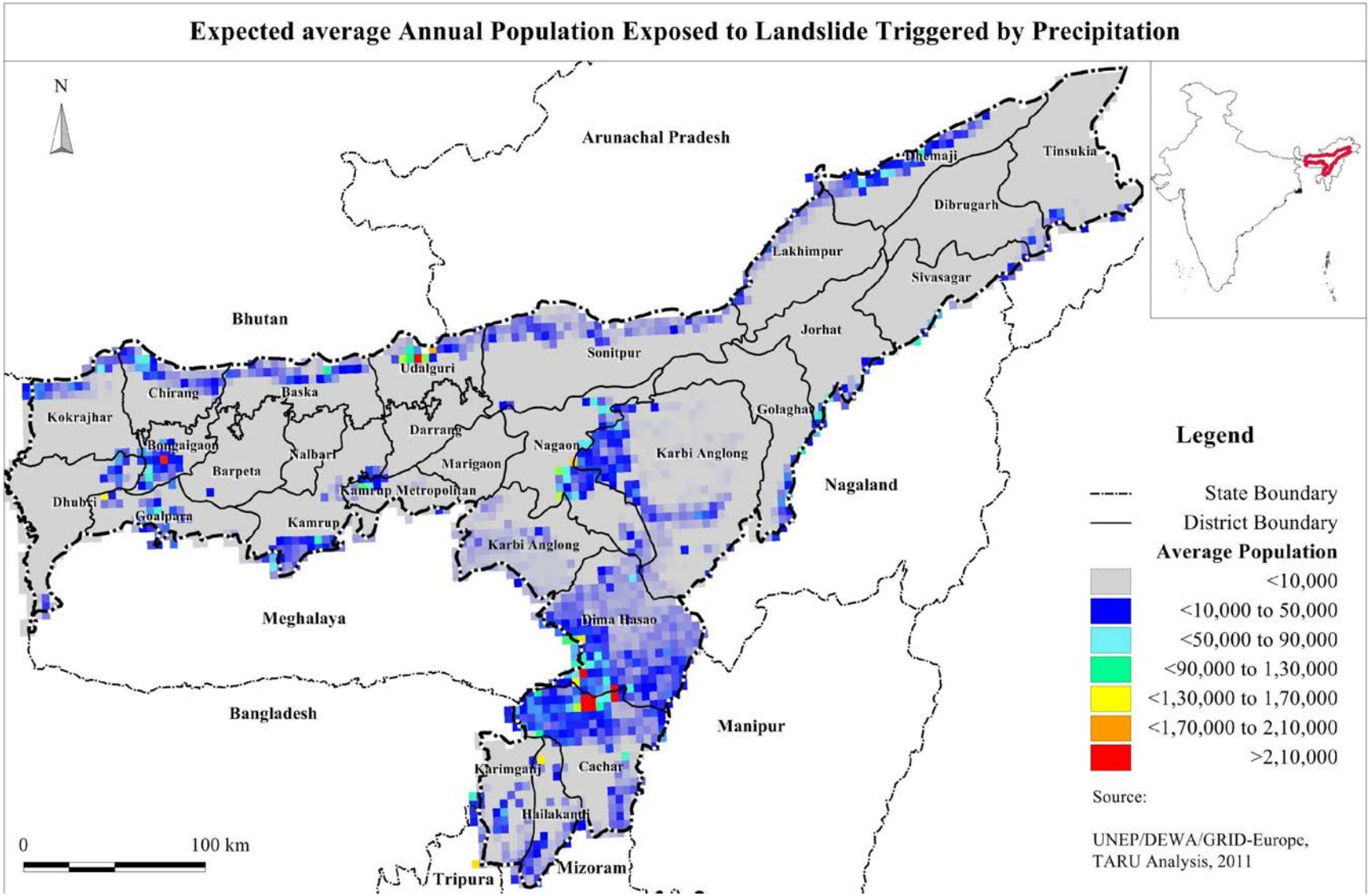


Figure 12: Landslide Affected Area in Assam

Figure 13: Expected Average Annual Population Exposed to Landslide Triggered by Precipitation

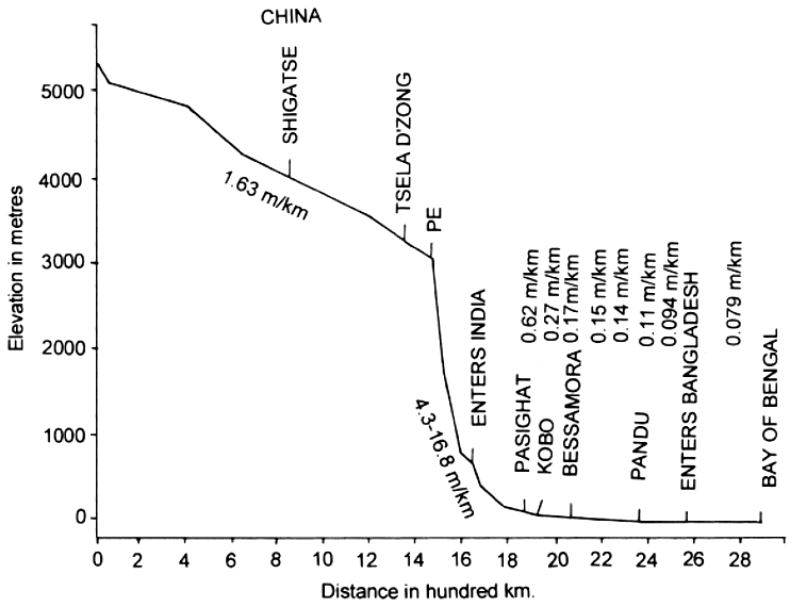


2.1.5 Erosion

The Brahmaputra basin is an example of an extremely heterogeneous watershed with complex topography, high spatial variability in land cover. The elevation profile of the Brahmaputra river is illustrated in Figure 14. Additionally, the climate is complex within the catchment because of the altitudinal range, the geographical location and the influence of the South Asian monsoon systems. Further, the tectono-sedimentary province along the Brahmaputra river valley in the state of Assam is near about 720 km long and 90 km wide with high variation in elevation which is home for nearly 26 million people. It ranges 120 m at Kobo in the extreme east through 50.5 m at Guwahati to 28.45 m at Dhubri in the extreme west (Sarma, 2005). The above factors give rise to riverbank erosion which has been a regular phenomenon in Assam.

Erosion history of Assam indicates that between 1912 and 1996 around 868 sq.km. of land was lost to bank erosion; averaging to about 10.3 sq. km. of area lost per year. Further, the research conducted by Sharma *et al.* (2010) also made evident that significant erosion occurred in Assam due to Brahmaputra river between 1914 to 1975. According to Kotoky *et al.* (2004), the bank line of the Brahmaputra is extremely unstable consisting mostly of fine sands and silts. Large scale slumping of river banks does take place when the level falls after a flood. Further, the braided nature of the Brahmaputra adds unpredictability to erosion problem making it more serious.

Figure 14: Elevation Profile of the Brahmaputra River



Source: Sarma (2005)

The average bank-line shift of the north bank towards the north is estimated to be 227.5 m/year on average, 331.6 m/year from the north bank towards the south, 137.2 m/year from the south bank towards the south and 225 m/year from the south bank towards the north (Sarma, 2005). Over bank flood due to breaches in the embankment render the fertile cultivable land unsuitable for crop production due to deposition of coarse sand on the surface to a variable depth. The erosion statistics of Assam is presented in the Table 6.

Table 6 Soil Erosion Statistics of Assam (2002)	
a) Total cultivable area in Assam	34,60,082 Ha
b) Area affected by Soil Erosion	1,93,000 Ha
c) Area under Wasteland & Degraded Land	2,71,556 Ha
d) Area affected by shifting cultivation	1,70,000 Ha
Average area being eroded due to flood and soil erosion problems	6,500 Ha
f) Average area affected by Flood annually	4,50,000 Ha
g) Average annual rainfall in Assam	2,4000 mm
h) Total Annual Silt Load of Brahmaputra (1990)	
At Bhurbandha	3,59,241 Cu.M
At Pandu	4,94,357 Cu.M
i) Annual Soil Erosion rate (1990)	
Jia Bharali River	4,721 Tonnes per Sq.Km
Puthimari River	2,887 Tonnes per Sq.Km
Source: Assam Science Technology and Environment Council Available Online At: http://www.envisassam.nic.in/soilerosion.asp last accessed on 13th Jan, 2012	

Figure 15: River Bank Erosion

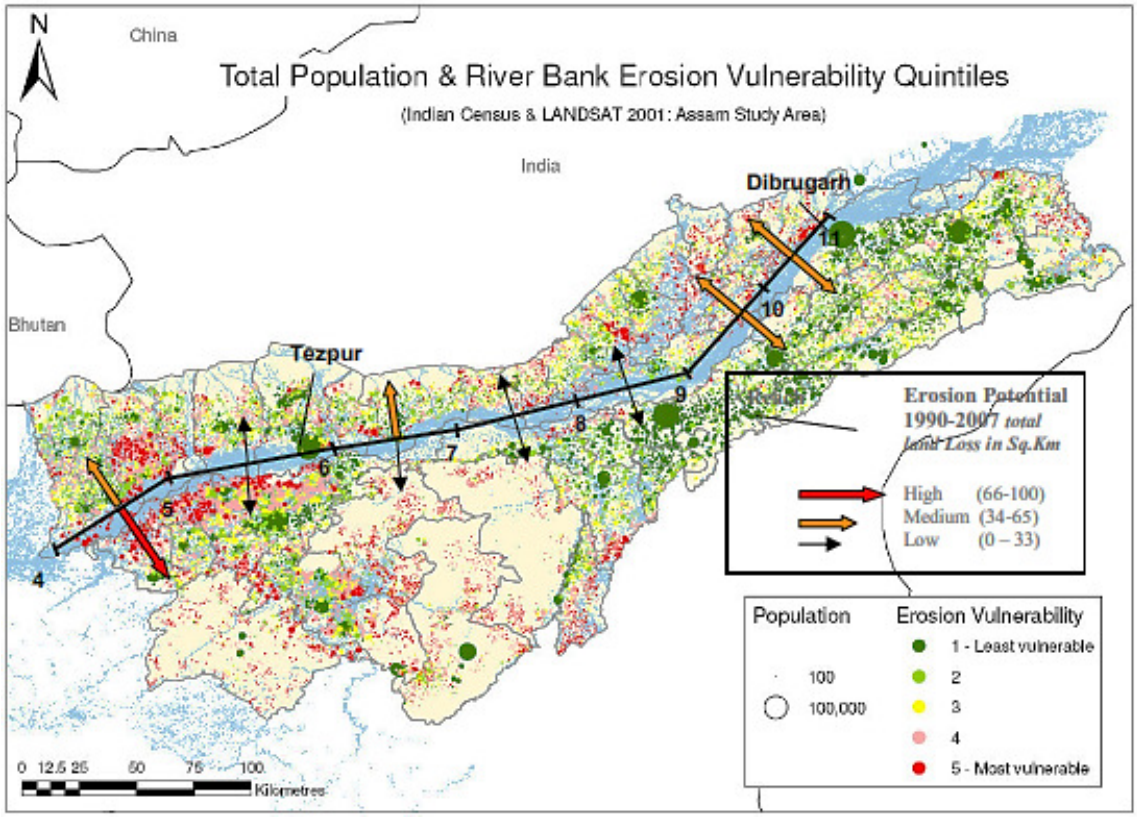
Source: TARU Field Visit, July 2011

The extent of loss to the bank erosion varies from year to year depending on the severity of floods in the state. Majuli, the largest river island in the world is now seriously affected by the erosion and is facing the threat to existence. According to Sarma (2005), in the state of Assam during period 1963–1975 and 1996 the amount of erosion on the north and south banks was 459.51 sq. km. and 368.69 sq. km., respectively (total 846.20 sq. km). Whereas, the amount of erosion was much higher during 1912-1928 periods, the total land eroded in north and south banks accounted to 782.49 sq. km. and 747.61 sq. km. (total 1530.1 sq. km.) respectively, while deposition which is simultaneous process (which formed new area by filling) in the north and south banks amounted to 303.84 sq. km and 246.32 sq. km. (total 550.16 sq.

km.) respectively. Table 7 provides river bank erosion details along Brahmaputra river.

Table 7 River Bank Erosion Along Brahmaputra River (North and South Bank)			
Year	**Erosion (Sq. km.)**		**Total (Sq km)**
	North Bank	South Bank	
1912–1928	782.49	747.61	1530.1
1963–1975	459.51	386.69	846.2
Total			2376.3
Year	**Deposition (Filling) (Sq. km.)**		**Total (Sq km)**
	North Bank	South Bank	
1912–1928	303.84	246.32	550.16
1963–1975	555.08	385.62	940.7
Total			1490.86
Source: Sarma, 2005			

Figure 16: River Bank Erosion Vulnerability



Source: Sharma *et al.*, 2010

According to Assam land-use board study (2003), high rainfall *(more specifically high intensity rainfall)* has been found to be another important factor causing erosion in almost all the districts mainly due to higher gradient/slope. Loss of topsoil through surface run-off under heavy precipitation and humid climatic condition is the most common type of soil erosion (gully) in the entire state. The problem of topsoil erosion

is severe in the plain which further has an impact on the agriculture. The problem of erosion has been observed in districts like Nalbari, Hailakandi and Kokrajhar. These pockets are mostly located in the fringe areas of Indo-Bhutan border (Bhavar Belt) marked by sudden gush of runoff after a rain in the form of flash floods.

Table 8 represents the crop area affected by Gully erosion in Assam with its extent in number of districts.

Table 8 Crop Area Affected by Gully Erosion in Assam

Sr. No.	Crop Area Affected (%)	No. of District
1	0-10%	9
2	10-20%	13
3	30-40%	2
4	40-50%	2
5	> 50%	1

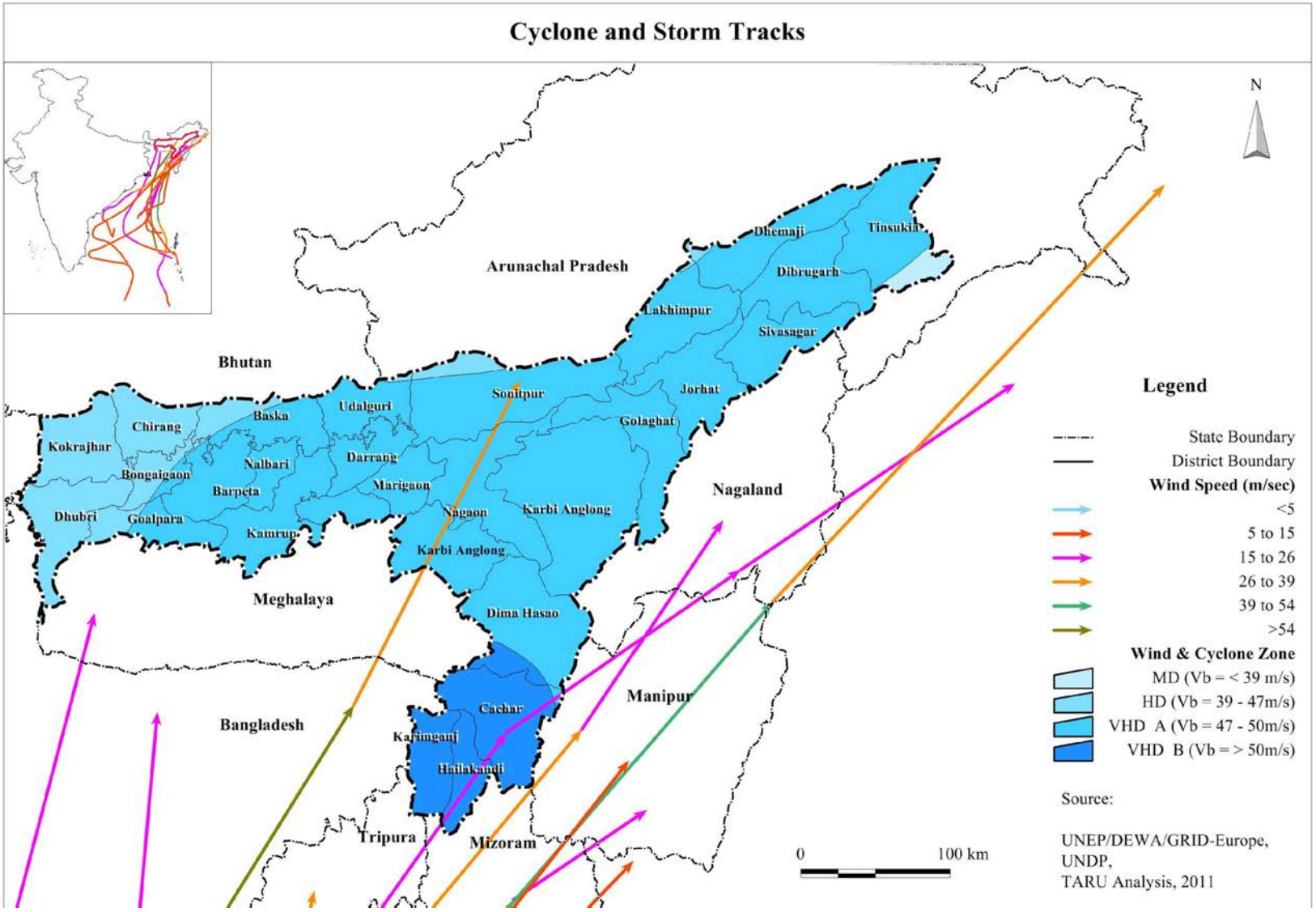
Source: State Land-use Board, 2003

2.1.6 Wind and Cyclone

Assam is situated in the north eastern direction of Bangladesh which is highly prone to cyclone/winds. Every year about 60% of the area affect by cyclone in Bangladesh. Due to the location aspect, districts like Dhubri, Gaolpara, Hailakandi, Chachar and Karbi Anglong are more prone to cyclone/winds. Districts namely Kokrajhar, Bongaigaon, Kamrup, Barpeta, Nalbari, Darrang, Sonitpur, Nagaon, Marigaon, Lakhimpur, Dhemaji, Sibsagar, Jorhat, Golaghat, Dibrugarh, Tinsukia and Karbi Anglong are likely to experience wind speed of 50 m/s whereas districts like Hailakandi, Karimganj and Cachar has wind speed of more than 55m/s and are more vulnerable to cyclonic storms. Occasional cyclones do occur in western Assam their severity is more during monsoon. According to BMTPC cyclone zonation, north-west districts of Assam lying in zone of high damage where wind speed can reach up-to 47 m/s. District very close to Bangladesh are in very high damage zone due to close proximity of Bay of Bengal (which is a cyclone basin). In this zone wind speed can reach up-to 55 m/s, can resultant into large scale damage. Fig 17 indicates the wind speed zonation of Assam along with the tracks of the recent events of cyclones recorded within the state.

According to IMD Cyclone e-Atlas track records for the period 1968-2008 shows two cyclone events passing through the State. According to the Lutheran World Federation/Department for World Service India Program (ACT/LWS India) 2003, a short but devastating storm with torrential rains did occur in areas of Dhubri, Dhemaji, and Sointpur districts of Assam on 22nd April 2003, Mancachar Sub division of Dhubri district situated in the western corner of Assam was affected by this event. Almost 48 people killed and 1,500 persons were injured in this event. There was also an record of similar event on December 23rd, 2010. During this event, Karbi Anglong, Cachar and Hailakandi were affected by severe winds.

Figure 17: Cyclone Affected Area and Zonation of Assam



2.1.7 Fire

Fire hazards risk is complex since predicting or modeling its occurrence at a macro level (state level) difficult. In this report an indicative fire hazard risk of the state is highlighted based on the historical database (1996 to 2008) of fire events as procured from fire service department. Table 9 highlights the occurrence of small, medium and large scale fire calls received by the fire service department within the last decade. The data indicates that that irrespective of the total fires in Assam have been decreasing over the past one decade, there has been a noticeable increase in the number of major fires. This may be due to the density of settlements/development within the cities.

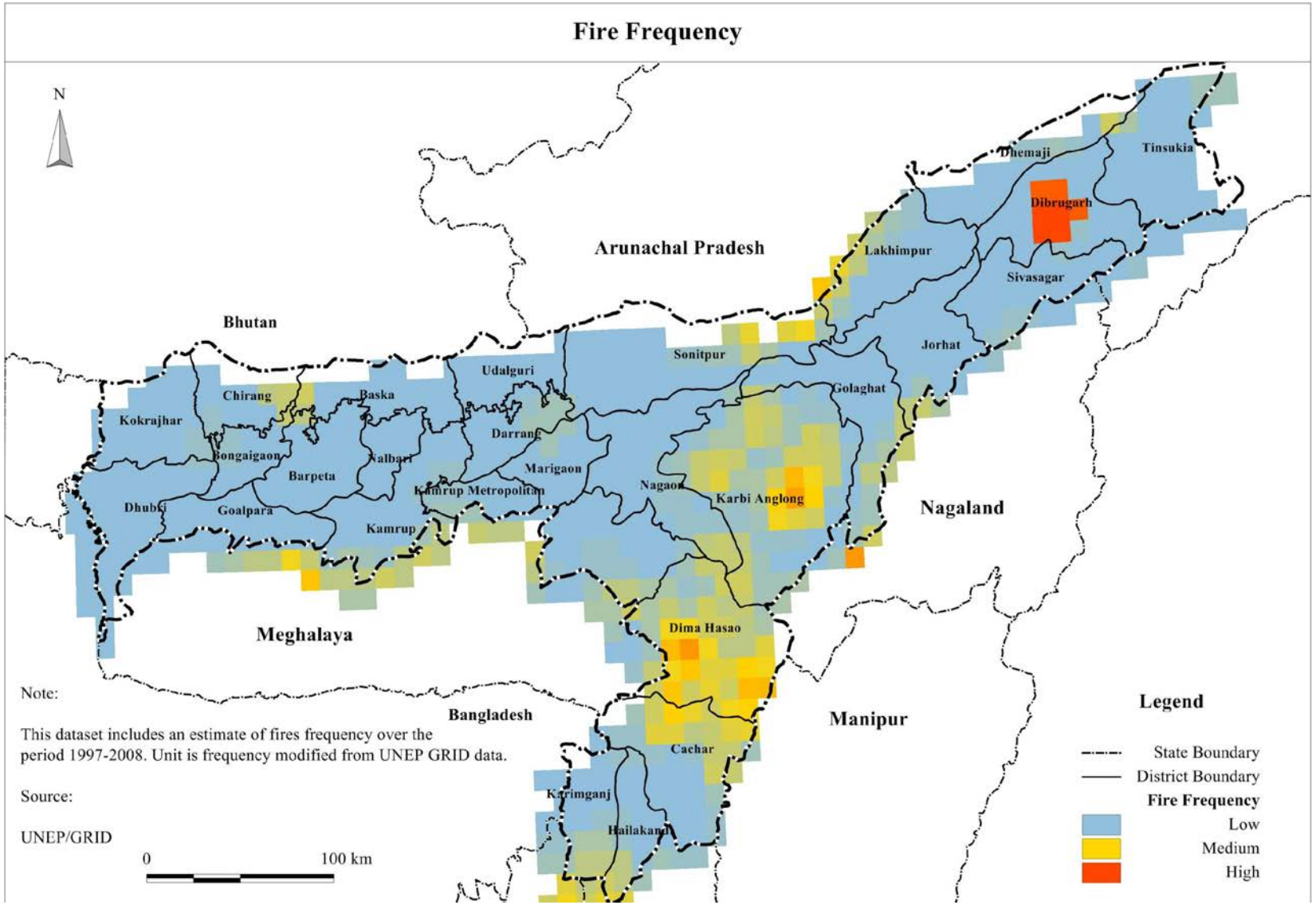
Table 9 Annual Fire Statistics of Assam (Year 1996 to 2008)

Year	Major Fire Call	Serious Fire Call	Medium Fire Call	Small Fire Call	Total No. Of Fire Call
1996	148	13	108	1514	1783
1997	133	12	91	1689	1925
1998	127	6	79	1418	1630
1999	207	14	128	1676	2025
2000	182	17	130	1545	1874
2001	176	15	134	1409	1734
2002	202	12	143	1527	1884
2003	243	5	162	1336	1776
2004	239	15	143	1502	1899
2005	308	9	127	1420	1864
2006	300	8	200	1716	2224
2007	311	7	159	1338	1815
2008	308	11	188	1139	1646

Source: Fire Service Department, Assam

Fig 18 represents frequency of fires (mostly forest fire or other large scale fire incidences) in Assam between 1997 and 2008. It is a modified product of World Fire Atlas (WFA, ESA-ESRIN) dataset which shows low, medium and high frequency. Based on the map it is evident that North Chachar hills, Karbi Alglong and Dibrugarh are more prone to fire incidences.

Figure 18: Fire Frequency



2.1.8 Climate Variability and Climate Change

The main characteristics of climate change include rising temperatures, changes in rainfall pattern, melting of glaciers and sea ice, sea level rise and an increased intensity and/or frequency of extreme events. These changes in physical processes have impacts on biological and socio-economic factors such as: shifts in crop growing seasons; changes in disease vectors; increased rates of extinction of many species; severe water shortages; and heavy deluges and flooding. The north-eastern region of India is expected to be highly prone to the consequences to climate change. The annual mean maximum temperatures in the region are rising at the rate of +0.11°C per decade. The annual mean temperatures are also increasing at a rate of 0.04°C per decade in the region.

The State of Assam is very much a part of the regional warming trend. However, there is no significant trend in rainfall for the region as a whole i.e. rainfall is neither increasing nor decreasing appreciably for the region as a whole. However, for a part of the region comprising Nagaland, Manipur, Mizoram, Tripura and parts of the Barail Hills, making one of the 36 meteorological sub divisions of the country, a significant change in seasonal rainfall has been observed. The summer monsoon rainfall is found to be decreasing over this region significantly during the last century at an approximate rate of 11mm per decade.

Extreme precipitation events (heavy rain storm, cloud burst) may have their own impacts on the fragile geomorphology of the Himalayan part of the Brahmaputra basin causing more widespread landslides and soil erosion. The response of hydrologic systems, erosion processes, and sedimentation in the Himalayan river basins could alter significantly due to climate change. Glacial recession is also linked to increased sediment load in rivers. A number of major flash floods have occurred in this decade due to heavy rainstorms or cloud bursts in the state or in the upper catchments of the rivers in the neighboring states (Meghalaya, Arunachal Pradesh) and highlands in other countries (Bhutan, China).

The southern part of Nagaon district in central Assam valley and adjoining parts of Karbi Anglong form a rain-shadow zone where annual rainfall is as low as 800-1200 mm. Water scarcity is a potential constraint for the people living in these areas. Absence of effective irrigation systems or water harvesting practices adds to the vulnerability of the people. Lumding, located centrally in this zone shows a decline in rainfall at a rate of 2.15 mm per year. As a result water crisis might aggravate in this region in the coming years.

One of the recent studies evaluates the possible impacts of climate change on water resources of the river basins in *India (Climate change impact assessment of water resources of India, A. K. Gosain, Sandhya Rao and Anamika Arora, Current Science, Vol. 101, No. 3, 10 August 2011).* The report mentions majority of the river systems show increase in precipitation at the basin level. Only Brahmaputra, Cauvery and Pennar show marginal decrease in precipitation under Mid Century (MC) scenario. The basins with reduction in precipitation show associated decrease in water yield. It is noticed that majority of the river systems show overall increase in sediment load at the basin level, with some basins such as the Ganga, Brahmaputra, Krishna, Pennar and Cauvery having sub-basins that show reduction in sediment load under the MC scenario. Under the End Century (EC) scenario there is further deterioration. The

magnitude of erosion is much higher; however, the trends are quite similar to the MC scenario. The Ganga system shows significant increase in sediment load in majority of its sub-basins. Some areas of Krishna, Pennar and Brahmaputra show reduction in sediment load under EC scenario. However, the overall situation is bad and needs attention to deliberate on the viable options to cope with such a situation. There are few sub-basins of the Ganga, Brahmaputra, Krishna, Cauvery and Pennar that show some decrease in the peak flow magnitudes. This has a severe implication for the existing infrastructure such as dams, bridges, roads, etc. for the areas and shall require appropriate adaptation measures to be taken up.

More rigorous studies are required at regional scale to ascertain intraregional trends in temperature and rainfall in this part of India. Several districts of Assam were badly affected due to drought like situations consecutively for two years in 2005 and 2006 which had a signature of climate change on them as vindicated by the IPCC report of 2007 (IPCC, 2007a). In the intense drought-like conditions that prevailed in as many as 15 districts of Assam during the summer monsoon months of the year 2006 owing mainly to below normal (nearly 40%) rainfall in the region, more than 75% of the 26 million people associated with livelihoods related to agriculture in these districts were affected and the state suffered a loss of more than 100 Cr due to crop failure and other peripheral effects. The recent spell of drought during October 2008 to July 2009 also has severely affected agriculture and production of hydropower in Assam and its neighboring states.

As a result of global warming, glaciers in the Himalayas are retreating at an average rate of 15m/year, consistent with the rapid warming recorded at Himalayan climate stations since the 1970s. The mainstream of the Brahmaputra River (known as the Yarlung Jhangbo in Tibet, China) and some of its tributaries like the Subansiri and the Jia- Bharali are partly fed by snow-melt run-off in the trans- Himalayan and Himalayan parts of their basins. With glacial contribution decreasing over the years, future lean season flow (low flow) may decrease in the Brahmaputra basin leading to increased water stress and changed hydrological regimes of the rivers as well as altered eco-hydrological characteristics of the riparian ecosystems. As a result agriculture on which large populations depend for livelihoods and diverse ecosystems that sustain a rich biodiversity and food security in the state may be jeopardized. Important forest ecosystems (especially grassland and wetland environs) on river banks such as those in Kaziranga, Manas, Pobitora, Burhachapori, Panidihing and Dibru Saikhowa may see changes in the normal mode of land water interactions which may have significant detrimental effect on the micro-environment characterized by temperature, soil moisture, humidity on which the sustenance of many wild flora and fauna depends. Projected increase in rainfall and accelerated summer flows may give rise to more intense flooding and flood hazards in the Brahmaputra valley as an immediate consequence, but subsequent retreat of glaciers may reduce flows in the long run.

Recession of glaciers caused by climate change have created more glacial lakes in the Nepal, Bhutan and Tibet Himalayas and increasing glacial lake outburst floods (GLOF) have caused more flash flooding in the Greater Himalayan Region in recent times. The catastrophic floods in western Assam in 2004 were a result of a landslide induced flood in the Bhutan hills. Similarly another large LDOF-induced flash flood caused havoc in the bordering areas of Arunachal and China in June 2000.

The Northeast Indian region is going to see massive distortion of its hilly landscape due to the construction of large dams as part of more than 168 hydropower projects envisaged in the next five decades, out of which more than 100 hydropower dams are in Arunachal Pradesh alone. Government of India is also promoting large dam based hydro projects in Bhutan like the Mangdechhu Hydroelectric Project in the Manas river basin (in Bhutan). Given the high probability of increased heavy rainfall events, landslides, formation of GLOFs and LDOFs due to climate change in the Himalayan region, threats of flash floods from the large dams in Arunachal and Bhutan will always loom large over the downstream populations in Assam. *(ASTEC 2011. Recommendations for State of Assam's Strategy and Action Plan on Climate Change. 37p. First Draft. Assam Science Technology and Environment Council, Guwahati, Assam, India).*

SECTION 2: STATEWIDE STRATEGIC HAZARD RISK AND VULNERABILITY ASSESSMENT

2.2.1 Introduction

Assam accounts for about 2.4 percent of the country's geographical area. Its 31.17 million people (2011 Census) are 2.6 percent of the country's population, and its population density of 397 persons per square kilometer is marginally higher than the average density for the country (382 persons per square kilometer). With the increasing population, the need for critical analysis of vulnerability becomes important. With the distribution of land in Assam already being skewed towards large land owners, it is quite likely that the future population (increase) to be pushed towards vulnerable areas i.e. near the rivers or towards the landslide prone/hilly areas. Based on the current population estimates and projecting the same towards the future, it is likely that in spite of limited land availability in some cities (especially cities located near the hills) there will be a substantial increases in the urban population and thereby the vulnerability within those areas.

The percentage of population of the age group 60 and above (5.5% in Assam), who are usually more vulnerable to the natural hazards are found to be less in Assam in comparison to the India (7.4%). But, on the other hand, the proportion of children of age group 6 or below is around 17% in Assam in comparison to the India's average of 16%. Assam ranks among the top 10 states in India with high proportion of children of age six years or below. The proportion of disable persons in Assam is quite less (10 per 1000 people) in comparison to India's average of 20 per 1000 people[4].

While the proportion of children is high in Assam indicating the possibility of demographic dividend, the children of this particular age group are also more vulnerable to the hazard risk of even minimum intensity or magnitude. Further the requirement of medical facility to handle children around this age group will also be quite different from that of adults. The state should address the vulnerability of children to specific disaster by conducting a detailed study which should take stock of the available medical facilities within reach and should also take stock of the presence of medical practitioners/equipments in each and every village. This information upon constant updating will provide the disaster management authorities in directing support during the times of emergency. According to the 2001 census, currently there are around 2 number of health facility (including hospitals, dispensaries, etc) for every 1000 households in the rural areas. Such low number of health facility will be inadequate in providing the required medical and first aid treatment in case of any emergency/disaster situation.

Apart from the urban population and children in general the presence of schedule caste, schedule tribes and other backward castes in the state should be analyzed for critical circles/ districts with respect to specific hazard risk scenario. According to the provisional census (2011) there are about 445 other tribes per 1000 households (in rural areas) and ranks fourth in India. In some hazard incidences, there may be a possibility of not being able to address these vulnerable groups in time. This may be

[4] All information presented within this section are based on 2001 Census, until and unless specified.

due to either lack of accessibility to their location or knowledge of their whereabouts and conditions. While this segment of population may have developed some resilience towards much of the natural hazards, with the changing land use and land cover, demographics and occupation; the vulnerability of this segment of population should be addressed in detail within the district level disaster management plan, taking into consideration their lifestyle and socio economic characteristics.

The critical area of concern is the vulnerability of the housing stock to the varying hazard. Based on the census statistics, the current housing stock in Assam is in a poor condition in comparison to the rest of the country. This state of the housing stock is especially bad in the rural regions of the state in comparison to its urban counterpart. Only 24% of the total rural housing stock is in a good condition compared to the national average of 45%. Over 11% of the housing stock is in a dilapidated condition (around 4.5 lakh houses). This current condition of housing stock is highly vulnerable and may lead to disasters during hazard events with low magnitude or intensity. A district wise analysis of different roof wall type and their respective condition is provided in the sub section below.

In absolute terms, the number of poor people in the State has increased from 7.8 million in 1983 to 9.5 million in 1999-2000. Around 36% of the State's population continues to live below the poverty line, a figure appreciably above the national average of 26%. While the planning commission has identified the general unrest in the state as one of the reasons for the slow growth, much of the lag in growth may also be due to the hazard history and potential hazard risk profile of the state. Further with much of the people are involved in this sector and with the current land holding pattern being skewed (less than 1.5 hectares per person) the people involved in the agricultural sector area are directly affected by the variations in the monsoon and the changes in the river course. The monsoon followed by flooding dominates around one fourth of the productive days adding to the existing (housing, health, etc) vulnerabilities of people working this sector (loss of assets and livelihood).

In comparison to other north eastern states Assam has an advantage in attracting many of the industries (both private and public sector). But in spite of its dominance in that region the percentage contribution of the entire north eastern states is considerably low in comparison with the rest of the Indian states / region. This is mainly due to the lack of connectivity within the state and also of the state with the rest of the country. Further, the location of the state limits also limits the possible road access to the state. Even though the government is spending considerable amount of money in improving the road and water ways within this region this current bottle neck will increase the response time in case of an hazard event.

2.2.2 District Vulnerability Assessment

In this section the vulnerability profiles of the districts of Assam are described. Due to the non-availability of the hazard risk and vulnerability atlas for the development of this management plan, within this study a compilation of information from the following data sources i.e. census statistics, human development index and hazard risk exposure profile were used to develop the individual profile of a district. Even though the detailed figures of the indicators used for this study are presented as tables, representative qualitative indicators such as low medium and high is used for

descriptive purpose. Since this brief profile is expected to direct the policy and decision makers in bringing about prioritized actions for disaster management and disaster reduction within the indicated sectors, the qualitative descriptions are scaled relative to the state's average. Much of the analysis are based on 2001 estimates, therefore the districts which were formed beyond 2001 were not included within this section. The broad level vulnerability indicators and their sub-indicators which were used for the analysis are as follows:

1. *Population exposure:* Total area (ha), district population (2001, 2011), decadal growth rate (1991-2001), population density (2001), urban population (2001), percentage literacy (2001)
2. *Vulnerable population:* Population below the age of six, population above the age of 65
3. *Livelihood indicator:* Worker profile (2001), sector involved, percentage non-workers (2001), percentage female workers (2001), average per capita income (2001), main crop, average land holding per household (2001)
4. *Lifestyle and health indicator:* Percentage household with sanitation, percentage household with access to safe drinking water, number of hospitals and public health centers.
5. *Geo climatic vulnerability:* Elevation, average annual rainfall, predominant soil type, range of slope
6. *Risk Exposure:* Maximum probable wind speed (m/s), probable earthquake intensity, percentage flood hazard area, percentage cropped affected due to floods in the past 10 years, percentage crops affected by gully erosion in the past ten years.
7. *Building vulnerability:* Roof wall index classified as category I, II and III. Within this classification, Category I indicated roof or wall built using one or more of the following materials: grass, thatch, bamboo, wood, mud, plastic or polythene; Category II indicated roof or wall built using one or more of the following materials: Tiles, slate, galvanized iron/metal sheets or asbestos sheets; Category III indicated roof or wall built using one or more of the following materials: brick, stone or concrete.

Situation analysis of the Assam state as a whole indicates that with around 31 million in population the state's population is growing at an average rate of 18.67% with much of the growth rate being concentrated within the rural regions. Due to very low life expectancy, less than 5% of the people in Assam are beyond the age of 65%; whereas, the number of children below 6 years is around 12% placing the combined vulnerable population to be around 17%. Therefore in general one in every five person living in Assam is highly vulnerable to hazard risk events. The percentage literacy is low in the state compared to the national average therefore increasing the complexity of the state administration in communicating hazard risk information to the general public. Over 50% of the population constitutes non-workers. Within the workers, only around 22% of the females are involved in some kind of an employment. This indicates that much of the households are dependent on single bread winners (male). The above aspect combined with skewed land holding (around 1 ha land held by individual farmers) increases the risk exposure of individual households. Sustainability of livelihoods in this existing scenario is highly vulnerable especially during or after any disaster events.

The water supply and sewerage condition of the state needs much improvement. While only 44% of the state's population have access to safe drinking water only around 35% (1 in 3) do not have sanitation facility. This issue combined with the presence of less than adequate hospitals and public health centers places the state vulnerable to health hazards or epidemics which usually follow disasters such as flooding.

The state is frequently affected by the flood hazard i.e. on an average 34% of the land area is affected on decadal basis; followed by erosion, earthquake, landslide, fire and cyclonic storms. The state does receive relatively high average annual rainfall (2,425 mm) in India. The soil types within the states are predominantly of sand, clay or loam. Much of the areas being mountainous and does exhibit slope which ranges from 1 to 8%. Due to soil characteristics, climate and topography; this state is prone to erosion due to rivers in plains and gully erosion in the hilly areas. On an average 10-25% of the agricultural areas are affected by this phenomenon. Since much of the buildings within the state have roof and wall types of category I and II, these buildings are at high risk to floods, erosion and cyclonic wind storms. The state is also situated in highly earthquake risk prone area (IX and above within MMI scale) placing much of the lifeline infrastructure such as dams, bridges, hydro power projects vulnerable to the hazard. With many hydro-power projects taking shape in the state, a detailed assessment of earthquake vulnerability of these infrastructures has to be studied in detail for developing realistic disaster management action plans.

2.2.3 District Profiles

The vulnerability to natural and manmade hazards for the districts in Assam was carried out using secondary sources. This analysis within the current report is predominantly based on census 2001 data. Since the complete census 2011 data set are yet to be made available, this sections highlights the key statistics based on preliminary results as published by the census of India (2011). The analysis also incorporates data from other secondary sources as published by the state and central agencies. These include the human development index (HDI, 2003) conducted by United Nations Development Program (UNDP); Indastat data base (a statistical portal); state development report by planning commission; State land use board, Government of Assam, 2003; Asian Development Bank (ADB) report, 2009 and articles as published within the peer reviewed journals. Since This state level and the district level assessment of vulnerability is expected to provide broad level information about the vulnerable sectors these estimates are likely to vary within the district. A singular hazard may affect the population living in the risk prone area in different manner depending upon that particular population's capacity, resilience and vulnerability. Therefore, we recommend the results from this current analysis should be viewed in tandem with the detailed sectoral analysis carried out within the hazard risk and vulnerability analysis (HRVA) of the circles. The details of the district level information are illustrated in the table presented at the end of this section.

Barpeta: This district is the fifth largest district in terms of population and has relatively high population density (506 people per square kilometer). In spite of having a fairly low share of urban population (7.62%) this district has experienced moderate growth rate (18.53) in the previous decade (1991-2001). Within Assam this district has the high percentage of vulnerable population i.e. population below the age of 6 and above the age of 60 (17% and 5% respectively). Even though this district has relatively high per capita income (Rs 8,089 / annum) it has high number of unemployed workers (both male and female). With relatively high annual rainfall (2,570 mm), this district is highly flood prone with 69% of its area being affected by at least one flood in the last 10 years. The soil in this region is sandy loam and therefore about 6% of area is frequently affected by gully erosion. With moderate

sanitation and safe drinking water facility (around 40%) this district is highly prone to health and water related problems. With very few hospitals (3 per 1,00,000 people) this water and health problems may be aggravated during the periods of flood. With the average landholding being around 1.13 Ha, the livelihood of the farmers are vulnerable to flood and erosion. The majority of the houses (predominantly rural) within this district are made out of thatch, bamboo, wood or mud with some using plastic or polythene. Even though these houses are little affected by earthquakes, the structures are more likely to be affected by floods and wind storms (probable cyclonic winds of 50 m/s).

Bongaigaon: This district has moderate population density (361 persons per square kilometer) and has been experiencing relatively low population growth (12% decadal growth). The presence of sanitation and safe drinking water is very low (less than 30%) increasing the possibilities of health risks during and after disaster. This district has relatively high rainfall (2,889 mm) and around 38% of the areas prone to flood hazard risk. Similar to Barpeta the soil within this district is of sand loamy and there around 12% of the areas are subjected to gully erosion. The maximum probable wind speed within this district is likely to around 50 m/s thereby exposing much of housing stock to cyclonic wind storm vulnerability. Around 70% of the housing stocks within this district are of unstructured nature which includes thatch, mud and bamboo with less than 50% of urban houses having a category II wall types (wood, galvanized iron metal sheet, asbestos).

Cachar: This district is relatively high in population (1.7 million) and moderate decadal growth rate (18.66%). The low population density (381 people per square kilometer) this district has high percentage of sanitation within the state. Only 20% of the households within this district have safe drinking water. The average annual rainfall within this region is around 2,915 mm. Apart from high rainfall; this district lies in the region prone to cyclonic wind storms of 55 m/s. Even though the percentage of area affected by frequent floods (once in 10 years) is relatively low (25%), the crops within this district (44%) are highly vulnerable to either floods or wind damage. The land holding pattern within this district is the highest in the state (2 ha per person). This majority farmer within this district therefore has an option to minimize their annual loss to hazard risk by introducing multiple varieties (breed) of crops. The majority buildings (greater than 50%) within these areas have thatch/bamboo roof within which around 70% have mud/un burnt brink walls. While roof of these houses are less vulnerable to earthquakes, they are highly vulnerable to both cyclonic wind and flood hazard risk. In the past three years this district has been exposed to three major landslides (one in 2009 and two in 2010) caused due to heavy rains leading to life and property loss.

Darrang: The population of this district is around 0.9 million with low urban settlement (4.9%) and high density (432 people per square kilometer). With much of the population living in rural areas their dependency towards agriculture (mostly paddy) for their livelihood is high. In spite of low sanitation (17%) more than 46% of households have access to safe drinking water. The average annual rainfall within this region is around 2016 mm. Even with relatively (within the state of Assam) moderate rainfall, around 75% (highest within the state) of this district and 10% of its agricultural areas are highly vulnerable to floods. With sandy soil and hilly terrain of slope ranging between 1-8%, some parts of this region are also vulnerable to gully

erosion. Majority houses (83%) within this district have Category I wall i.e. bamboo or thatched making them vulnerable to both cyclonic wind storms (maximum probable of 50 m/s) and floods.

Dhemaji: This district has high number of female workers indicating alternate livelihoods within families. This region receives an average annual rainfall of 3,051 mm and much of the district (46%) is prone to floods. Much of the flooding within the district is also due to overflow in some of the rivers and their tributaries caused due to extreme rainfall within the neighboring regions. While highly flood prone, the nature of the floods in these regions are temporary and are of less magnitude (around 1 m) causing relatively little damage to the paddy crops grown in these regions (around 2% area). Around 90% of the households in this region have either bamboo or thatched roof and are vulnerable to cyclonic wind storms. This district is also vulnerable to rock slides usually leading to loss of life.

Dhubri: In Assam, this district has highest population (1.9 million) and population density (584 persons per square kilometer). This district is also having relatively high population growth (23%). In spite high population and its density the district has low literacy rate (less than 50%). The district has moderate health facilities but the percentage population of six year old or younger is relatively high (18%). The 56% of households within this district has access to safe drinking water but only moderate percentage of households have access to adequate sanitation. The annual average rainfall within this region is around 3,516mm leading to around 36% of land area and 38% of agricultural area vulnerable to moderate to high floods. Based on the roof wall index around 12% of the households within this region are vulnerable to earthquakes while 99% are vulnerable to floods and/or heavy rains.

Dibrugarh: The literacy levels within this district is relatively high (71%) leading to strong per capita income (Rs 13,000) within the state. With relatively good health facilities, percentage sanitation and access to drinking water, this district does demonstrate better capacity. In this district around 35% of the total area and 44% of the agricultural areas do experience moderate to high floods. With better roof wall index (category II and III) and better land holding patter (average of 1.9 ha per person), Dibrugarh has better capacity in comparison to the many other districts within Assam.

Golaghat: This district has low population and population density (270 persons per square kilometer) with high literacy rate (70%). The district has high number of hospitals, sanitation facility and access to safe drinking water making it relatively less vulnerable to health related risks. This district receives relatively less rainfall (1,872mm per year) in comparison to other districts within the state, nevertheless, around 30% of the land and agricultural areas are subjected to frequent floods.

Goalpara: The district has a high decadal population growth rate of 23% with low literacy rate of 59%. The average per capita income is low and only one third of the household do have adequate sanitation and access to safe drinking water. In spite of the flooding due to river which affects around 31% of the agriculture area around 6% of the percentage crop areas are affected by gully erosion.

Hailakandi: This district is in the southern part of Assam with relatively high population of around 1 million people. The district has been experiencing population growth of greater than 20% and with moderate urban growth of less than 9% indicating that much of the development has been occurring in the agriculture, industrial or allied sectors. Around 20% of the population fall within the vulnerable group (less than or equal to 6years and over 65 years). Even though this district has relatively high access to safe drinking water, the percentage households with sanitation (61%) and health facilities are one of the lowest in the state. Being close to Bay of Bengal, this district is prone to cyclonic wind storm of speed 55 m/s exposing over 80% of the total building stock which have roof wall types of category I and II. Around 25% of the total area and over 33% of the cropped area are highly exposed to erosion (both due to river and rainfall).

Jorhat: This district has low population 0.6 million with moderate growth in the previous decade. Due to high literacy rate within this district (highest in the state, 77.9%) the percentage households with more than one working member is also fairly high. Being on the eastern part of Assam, this district is highly prone to flooding due to Brahmaputra within around 42% of its land area being frequently affected by flood of varying magnitude. The buildings within this area are constructed mostly out of local materials. In the recent years there is evidence of people using asbestos and G.I roofing materials (around 69%). 28% of the buildings are also constructed using burnt bricks and concrete making them less vulnerable to moderate floods.

Kamrup & Kanrup metro: In the recent years, the district of Kamrup was divided into two districts namely Kamrup (metro) and Kamrup (rural). Since no recent data is available for these districts independently, the following profiling was done considering both the metro and rural regions. According to the recent census, the combined population of both the districts amount to 2.7 million people. The decadal growth of the two districts combined is the highest in the state with 25.7% and a high population density of 579 people per square kilometer. The urban population is the highest in the state (35%). The average per capita income of this district is also quite high at Rs 12,109 per person per annum. With high literacy rate, moderate sanitation, relatively good health facilities this district exhibits relatively high capacity. Within this district the urban areas exhibits relatively stable housing stock where much of the households have category III (brick or concrete) wall type and category II roof type (asbestos and G.I sheets) compared to the rural areas (where the much of the buildings constructed using category I materials). However the seismic vulnerability of existing housing stock and adherence to earthquake resistant design is a matter of immediate concern. Since, this district is prone to landslides and in spite of its relatively better housing stock the exposure to landslide could result in significant damages. The district is also prone to floods. Flood occurs generally in the low lying areas of the Kamrup metro district during May to August every year. Late flood occurs during the later part of September & October. The occurrence of flood in the district is due to the river Brahmaputra and its Tributaries. During rainy days the city of Guwahati also witnesses localized flood due to poor drainage system of the city.

Karbi Anglong: The Karbi Anglong Distrcit is situated in the central part of Assam. This district has dense tropical forest covered hills and flat plains. Karbi Anaglog is predominantly tribal district and the local population's dependency on natural

resources is very high. Except for the valleys, the people in this region practice step cultivation. This district has minimum exposure to flood hazard risk and moderate exposure to wind storms. The building vulnerability is quite high in this region.

Karimganj: Total area of this district is 185,840 ha which comprises varied geographical features including agricultural plains, shallow wetlands, hilly terrains and forests. Total forest cover in the district is more than 54 thousand hectares, which is 30% of total geographical area is covered by forest. In spite of varying topography of this region, this district has a high population density (673 per Sq.Km in 2011, 557 in 2001) - which is 5th highest in the entire Assam. Nearly 75% population has access to good sanitation facilities, which is highest amongst all district; however have low access to safe drinking water facilities.

Kokrajhar: Kokrajhar district receives highest rainfall in Assam, due to this, the district is vulnerable to gully erosion and around 46% of cropped area gets affected due to this frequently. Accessibility to basic facilities/amenities is very less in this district and only 8.93% household have good access to safe drinking water, whereas only 14.41% household have access to sanitation. More than 81.15 % buildings in this district have wall type of category I. Since this district falls within the zone of maximum probable wind speed of 55 m/s the hosing stock is highly vulnerable to cyclonic storms and wind damage.

Lakhimpur: Lakhimpur District is situated on the North East corner of Assam. This district is spread over 289,686 ha. out of which 53% area is affected by frequent floods. Being a zero industrial district, agriculture & allied activities are the prime source of livelihood in this district. Within this districts nearly 5% cropped area are exposed to gully erosion. This has a significant impact on agricultural production. More than 85% buildings in this district have category I roof and wall types thereby increasing the vulnerability of the households to flood risk.

Marigaon: The greater part of this district is an alluvial plain, criss-crossed with numerous rivers and water ways. The mighty Brahmaputra flows along with the northern boundary of the district. Marigaon district is having an area of 149,300 ha, out of which 72.23% area is prone to floods (second highest after Darang district). With very low urban population (only 5% of the total population) the population density of this district is high at 618 person/sq km. This infers that much of the populations resides in the rural areas and are exposed to the frequent floods. However, nearly 62.67% households have good access to safe drinking water thereby minimizing health concerns within this region.

Nalbari: The District of Nalbari is situated at the plans of the Brahmaputra Valley. The tributaries of the Brahmaputra, Nona, Buradia, Pagaldia, Borolia and Tihu do contribute to the agrarian economy of this district. Nevertheless, nearly 50% area of district is affected by flood frequently. Gully erosion is also a major problem in this district and approximately 35% crop area is affected due to gully erosion. This is huge loss of fertile agricultural land in this district.

North Cachar Hills (Dima Hasao): The Dima Hasao district is primarily a hilliest region with highly varying terrain. It has an area of 4,86,293 ha. which is 6.24 percent of the total area of the state. This is a least developed district in Assam. It is

predominantly a forest area and agricultural practices of paddy cultivation are done on Jhuming cultivation system in dry hilly land in the plain terrain areas depending mainly on rainfall. The average rainfall of the district is 3399 mm, but due to the nature of the terrain this district hardly experiences any problem of flooding. Urban population is highest (> 30%) in this district (after Kamrup Metro district) with lowest population density. Only 44 people reside in per sq. km. area. Per capita income is comparatively better in this district and much higher than state average. Number of hospital beds (beds/10,000 persons) is also high amongst all districts. In this district more than 80% buildings have a wall type of Category I. This indicates that the households are highly vulnerable to cyclonic wind storms.

Nagaon: Agriculture is the backbone of the economy within this district providing livelihood to about 78% of the total population. Rice is the staple food of the inhabitants and paddy is the principal crop of the district. Floods, however, are a major impediment in the development of this sector. This is amongst highly dense districts in Assam with 711 people per sq. km. Population increased at the rate of 22.09% within this district. But due to this districts exposure to flood hazard risk and around (48% of district area) the per capita income is relatively low. The low per capita income can also be due to lack of credit flow and resilience mechanisms within the community.

Sibsagar: There are no hill areas in the district of Sibsagar. The southern part extends up to the foot hills of Nagaland and it is well drained and high land and suitable for Tea plantation. Due to this locational advantage agriculture occupies a very important role in the economy of the Sibsagar district and is the major source of income providing livelihood population (Sibsagar District Profile). Total geographical area of this district is 262,656 ha, with a population density of 431 person/sq.km. Per capita income in this district is highest amongst all districts which is an indicator of capacity of population and provide support to improve the overall quality of life after disaster. Literacy rate is quite good in this district (75.33%) and according to Census 2011 literacy ranking; Sibsagar place in 3rd rank amongst all districts. In this district, nearly 72% buildings have Category-1 wall type and more than 60% buildings have Category II roof type. This indicates the high building vulnerability during wind and flood hazards. These are non-engineered buildings which have low stability in wind hazards.

Sonitpur: Sonitpur district is spread over an area of 527,723 ha on north bank of Brahmaputra River. In terms of area Sonitpur is the second largest district of Assam after Karbi Anglong district. The current population of Sonitpur district is 1,925,975. In terms of population it ranks third in Assam after Nagon and Dhubari districts. Total flood hazard affected area in this district is high (30.40%) and nearly 7% of total cropped area are frequently affected by floods. Sonitpur is basically an agrarian economy. Approximately 80 % of its population depends on agriculture allied (primary sector) activities for their livelihood. Rain fed cultivation of single paddy crop still continues in most areas of the district. This district is also affected with moderate gully erosion and nearly 3% of total crop area is affected by this. Very few household have access to safe drinking water and this increase vulnerability during floods. Number of medical facilities is significantly high (more than state average) in this district. The increased number of medical facilities may be due to high vulnerability of the people to health risk especially due to less than sufficient safe

drinking water facility. This aspect has to studies in detail and mechanisms for access to safe drinking water have to be put in place to ensure resilience within this district. Building vulnerability (Roof and Wall Type) is comparatively high in this district and more than 73% and 55% buildings have category-1 wall type and roof type respectively exposing the housing stock to cyclonic wind storm vulnerability.

Tinsukia: This district is having area of 3,838,365 ha. It has a population of 1,316,948 with average density of 303 persons/sq km. The population growth was high (19.5%) during 1991 to 2001 and has decreased to 14.5% in this last decade (2001-2011). It is 3rd highest urbanized district of Assam with 19.49% population resides in urban area. Approximately 54% households have sufficient sanitation facilities and approximately 74% households in this district have a good access to safe drinking water which is highest in the state. With low exposure to cyclonic winds and high exposure to earthquakes the category I (predominant) building stock within this districts are least vulnerable to these hazard risk events. The following tables also indicate the data sources used for the above analysis.

Table 10 Population Exposure							
Vulnerability Index	Highest	High	Low	Lowest			
District	**Population (2011)**	**Decadal growth Rate (1991-2001)**	**Density (2001)**	**Urban Population**	**Population (Age Group 0-6)**	**Population (Aged 65 and above)**	**Literacy (2001) %**
Barpeta	16,93,190	19%	506	8%	17%	5%	57%
Bongaigaon	7,32,639	12%	361	12%	16%	4%	60%
Cachar	17,36,319	19%	381	14%	14%	5%	68%
Darang	9,08,090	16%	432	5%	16%	5%	56%
Dhemaji	6,88,077	19%	176	7%	14%	4%	66%
Dhubri	19,48,632	23%	584	12%	18%	4%	50%
Dibrugarh	13,27,748	12%	347	19%	12%	4%	71%
Golaghat	10,58,674	14%	270	8%	15%	4%	70%
Golpara	10,08,959	23%	451	8%	16%	4%	59%
Hailakandi	6,59,260	21%	409	8%	12%	5%	60%
Jorhat	10,91,295	16%	354	17%	17%	4%	78%
Kamrup, & Kamrup Metro	15,17,202	26%	579	36%	13%	4%	75%
Karbi Anglong	9,65,280	23%	78	11%	10%	4%	59%
Karimganj	12,17,002	21%	555	7%	19%	6%	67%
Kokrajhar	8,86,999	15%	294	7%	17%	4%	53%
Lakhimpur	10,40,644	18%	391	7%	15%	4%	70%
Marigaon	9,57,853	21%	455	5%	14%	5%	59%
Nalbari	7,69,919	12%	504	2%	17%	5%	68%
North cachar	213529	23%	38	31%	16%	3%	69%
Nowgong	28,26,006	22%	604	12%	12%	5%	62%
Sibsagar	11,50,253	16%	395	9%	12%	5%	75%
Sonitpur	19,25,975	18%	315	9%	14%	4%	60%
Tinsukia	13,16,948	20%	303	19%	13%	4%	63%
Source: Census of India (2001 and 2011), Vulnerability index Is based on TARU analysis (2011)							

Table 11 Lifestyle and Health Indicators					
Vulnerability Index	Highest	High	Low	Lowest	
District	**% HH wth Sanitation**	**% HH with Safe Drinking water**	**Hospitals / 10,000 people (2001)**	**PHC (2001) / 10000 people**	**No. of Hospital Beds/10,000 Person (2001)**
Barpeta	39%	40%	0.03	0.24	2
Bongaigaon	28%	20%	0.07	0.31	1
Cachar	63%	20%	0.05	0.13	7
Darang	17%	47%	0.09	0.39	3
Dhemaji	16%	49%	0.04	0.13	4
Dhubri	30%	56%	0.06	0.12	3
Dibrugarh	48%	67%	0.05	0.28	12
Golaghat	32%	60%	0.28	1.50	4
Golpara	38%	32%	0.05	0.17	2
Hailakandi	61%	19%	0.02	0.08	1
Jorhat	30%	47%	0.12	0.36	5
Kamrup, & Kamrup Metro	50%	58%	0.13	0.34	10
Karbi anglong	25%	34%	0.05	0.28	6
Karimganj	73%	18%	0.02	0.17	2
Kokrajhar	14%	9%	0.04	0.30	4
Lakhimpur	25%	29%	0.08	0.26	4
Marigaon	25%	63%	0.03	0.12	2
Nalbari	19%	65%	0.11	0.44	5
North cachar	35%	46%	0.01	0.04	14
Nowgong	42%	65%	0.19	0.49	3
Sibsagar	32%	54%	0.03	0.26	3
Sonitpur	30%	28%	0.05	0.15	10
Tinsukia	54%	74%	0.06	0.11	3
Source: The above information is based on Human development report of Assam, UNDP (2003), Vulnerability Index is based on TARU analysis (2011)					

Table 12 Geo-climatic Vulnerability Indicators						
Vulnerability Index	Highest	High	Low	Lowest		
District	**Wind speed (m/s)**	**Avg Rain Fall (mm)**	**% Flood Hazard Area**	**High Freq.***	**Moderate Freq.***	**Low Freq.***
Barpeta	50	2,570	69%	14%	20%	66%
Bongaigaon	50	2,889	38%	10%	13%	77%
Cachar	55	2,915	25%	42%	14%	44%
Darang	50	2,016	75%	10%	23%	67%
Dhemaji	50	3,051	47%	2%	12%	86%
Dhubri	47	3,516	36%	21%	16%	63%
Dibrugarh	50	2,130	35%	20%	22%	58%
Golaghat	50	1,872	30%	20%	16%	63%
Golpara	50	2,088	38%	11%	20%	69%
Hailakandi	55	2,600	25%	33%	12%	55%
Jorhat	50	2,023	43%	13%	22%	65%
Kamrup, & Kamrup Metro	50	2,133	38%	21%	21%	58%
Karbi anglong	50	1,998	4%	9%	20%	71%
Karimganj	55	3,337	28%	42%	12%	46%
Kokrajhar	50	3,559	13%	1%	4%	95%
Lakhimpur	50	2,311	53%	15%	18%	67%
Marigaon	50	1,875	72%	32%	30%	39%
Nalbari	50	2,182	47%	10%	17%	73%
North Cachar	-	3,399	0%	0%	0%	100%
Nowgong	50	1,560	48%	19%	21%	60%
Sibsagar	50	1,732	47%	18%	24%	58%
Sonitpur	50	2,036	30%	7%	17%	77%
Tinsukia	50	1,986	19%	7%	12%	81%

Note*: High Freq. indicates cropped areas which are affected by flood almost every year, Moderate Freq. indicates cropped areas which are affected by flood once every two years, Low Freq. indicates cropped areas which are affected by floods once every 3 to 4 years

Source: Avg. Rainfall, % flood and flood frequency is from Flood Hazard Atlas, NRSC, 2011; Wind Speed information is from BMPTC (1999)

Table 13 Agricultural Pattern and Risk Indicators						
Vulnerability Index	Highest	High	Low	Lowest		
Districts	**Main Crop**	**Soil Type***	**Slope**	**Total Cropped Area**	**% Crop Area Affected BY Gully Erosion**	**Average Land Holding (Ha) 1991**
Barpeta	Mostly paddy	S-L	1-7%	89,675	6%	1.13
Bongaigaon	Mostly paddy	S-L	3-6%	20,682	12%	0.90
Cachar	Mostly paddy	S-C,C-L,S,S-C-L	1-5%	74,555	6%	2.09
Darang	Mostly paddy	S	1-8%	50,907	15%	1.09
Dhemaji	Mostly paddy	S,S-L	1-2%	69,471	1%	1.32
Dhubri	Mostly paddy	S,S-L	1-7%	63,320	5%	1.12
Dibrugarh	Mostly paddy	-	1-3%	76,544	-	1.86
Golaghat	Mostly paddy	S,C-L,S-C-L	1-3%	58,968	1%	1.30
Golpara	Mostly paddy	S,S-L,C-L	2-7%	57,522	6%	1.09
Hailakandi	Mostly paddy	S-C,C	1-6%	25,244	36%	1.57
Jorhat	Mostly paddy	S-L	1-3%	71,793	-	1.62
Kamrup, & Kamrup Metro	Mostly paddy	S,S-C,S-L	1-5%	87,853	3%	-
Karbi anglong	Mostly paddy	S,C-L,S-L	1-2%	41,817	1%	1.75
Karimganj	Mostly paddy	S,C	1-5%	42,020	5%	1.70
Kokrajhar	Mostly paddy	S-L	2-6%	27,096	46%	1.11
Lakhimpur	Mostly paddy	C-S,S-L,S,C-L	1-3%	1,00,116	5%	1.57
Marigaon	Mostly paddy	C-L,S-L	1-4%	68,210	-	0.96
Nalbari	Mostly paddy	S,S-L,S-C	2-6%	36,615	34%	1.71
North Cachar	Mostly paddy	-	0-2%	8	-	1.56
Nowgong	Mostly paddy	C-L,S-C,S-L	1-5%	1,33,994	1%	1.08
Sibsagar	Mostly paddy	S,S-L	1-3%	75,913	0.41%	1.48
Sonitpur	Mostly paddy	S-L	1-5%	1,24,402	3%	1.04
Tinsukia	Mostly paddy	-	0-2%	30,952	-	1.81

Note:* S = Sandy, C = Clay, L = Loomy, C-L = Clay Loomy, S-L = Sandy Loomy, C-S & S-C = Sandy Clay.

Source: State land use board, Report on erosion in Assam, 2003.

Table 14 Distribution of Houses by Predominant Materials of Roof and Wall and Level of Damage Risk in the State of Assam

Wall/Roof		Census Houses		Level of Risk under								
				EQ Zone				Wind Velocity m/s				Flood Prone Area in %
		No of Houses	%	V	IV	III	II	55&50	47	44&39	33	
				Area in %				Area in %				
STATE - ASSAM				**100**				**83.2**	**16.4**	**0.3**		**16.7**
WALL												
A1 - Mud and Unburnt Brick Wall	Rural	236,005	3.8									
	Urban	31,071	0.5									
	Total	***267,076***	***4.3***	*VH*				*VH*	*H*	*M*		*VH*
A2 - Stone Wall	Rural	7,529	0.1									
	Urban	6,524	0.1									
	Total	***14,053***	***0.2***	*VH*				*H*	*M*	*L*		*VH*
Total - Category - A		**281,129**	**4.6**									
B - Burnt Brick Walls	Rural	660,203	10.7									
	Urban	403,725	6.5									
	Total	***1,063,928***	***17.2***	*H*				*H*	*M*	*L*		*H/M*
Total - Category - B		**1,063,928**	**17.2**									
C1 - Concrete Wall	Rural	71,887	1.2									
	Urban	83,261	1.3									
	Total	***155,148***	***2.5***	*M*				*L*	*VL*	*VL*		*L/VL*
C2 - Wood Wall	Rural	165,602	2.7									
	Urban	40,935	0.7									
	Total	***206,537***	***3.4***	*M*				*VH*	*H*	*M*		*H*
Total - Category - C		**361,685**	**5.9**									
X - Other Materials	Rural	4,053,064	65.7									
	Urban	409,188	6.6									
	Total	***4,462,252***	***72.3***	*M*				*VH*	*H*	*M*		*VH*
Total - Category - X		**4,462,252**	**72.3**									
TOTAL BUILDINGS												
ROOF												
R - 1 Light weight Sloping Roof	Rural	5,036,743	81.6									
	Urban	813,043	13.2									
	Total	***5,849,786***	***94.8***	*M*				*VH*	*VH*	*H*		*VH*
R - 2 Heavy Weight Sloping Roof	Rural	120,065	1.9									
	Urban	21,139	0.3									
	Total	***141,204***	***2.2***	*H*				*H*	*M*	*L*		*H*
R - 3 Flat Roof	Rural	37,482	0.6									
	Urban	140,522	2.3									
	Total	***178,004***	***2.9***	*Damage Risk as per that for the Wall supporting it*								
TOTAL BUILDINGS		**6,168,994**										

Housing Category: Wall Type

Category - A Buildings in field-stone, rural structures, unburnt brick houses, clay houses

Housing Category: Roof Type

Category R 1 - Light weight (Grass, Thatch Bamboo, Wood, Mud, Plastic, Polythene,

Category – B	Ordinary brick building; buildings of the large block & prefab type, half-timbered structures, building in natural hewn stones	GI Metal, Asbestos Sheets, Other Materials)
Category - C	Reinforced building, well built wooden structure	Category R 2 - Heavy Weight (Tiles, Slate) Category R 3 - Flat Roof (Brick, Stone, Concrete)

Notes:

1. Flood prone area includes that protected area which may have more severe damage under failure of protection works. In some other areas the local damage may be severe under heavy rains and choked drainage
2. Damage risk for wall types is indicated assuming heavy flat roof in categories A, B and C (Reinforced Concrete) building
3. Source of Housing Data: Census of Housing, GOI, 2001

Earthquake Zones
EQ Zone V: Very High Damage Risk Zone (MSK >IX)
EQ Zone IV: High Damage Risk Zone (MSK VIII)
EQ Zone III: Moderate Damage Risk Zone (MSK VII)
EQ Zone II: Low Damage Risk Zone (MSK < VI)

Level of Risk: VH = Very High; H = High; M = Moderate; L = Low; VL = Very Low

Building Materials and Technology Promotion Council **Peer Group, MoH&UPA, GOI**

SECTION 3: HAZARD MITIGATION

2.3.1 Priority determination for Hazard Mitigation

A comprehensive approach towards DM is a combination of actions including mitigation activities for specific hazards. This section highlights the need to integrate development programs and reduce disaster related disruption across physical/social/economic/environment assets. The need is to build a mitigation system that can guide the state to prioritize key hazards, geographical areas, and key sectors utmost at risk.

The strategic risk profile indicates the probability and severity of the multiple risks that are faced by the state. Frequent floods in the state accompanied by riverbank erosion, local and regional seismicity, frequent landslides, episodes of drought etc are pushing the State to simultaneously address a range of actions towards reducing vulnerability and risk. Disaster history indicates primary hazards as earthquakes, floods and river bank erosion, landslides and drought. These hazards account for significant losses, however the State has not faced any major earthquake since the last one which occurred in the year 1950. Prioritizing hazard mitigation actions and State wide mitigation plan is part of the strategy adopted by the State Government.

As mandated by the DM Act 2005, disaster mitigation fund shall be created by the State Government for project exclusively for purpose of hazard mitigation. ASDMA Policy 2010 explicitly states that the Government of Assam recognizes the need to have a proactive, comprehensive, and sustained approach to disaster management to reduce the detrimental effects of disasters on overall socio-economic development of the state. It is advised that departments make provisions for disaster management activities in their own departmental budgets. Departments must protect vulnerable critical/lifeline facilities and infrastructure across the State that is prone to severe hazard; undertake efforts to reduce repetitive losses.

The vision of the State is to create a safe and resilient Assam through five mission areas which includes Hazard Mitigation (Structural and Non-Structural measures). Part V of this document outlines the goals and path for hazard mitigation.

2.3.2 Creation of State Hazard Mitigation Plan

Hazards identified in the State of Assam can be placed in two categories based on their probability of occurrence and their potential to result in significant damage and loss of life. Three principle hazards namely earthquake, flood and river bank erosion, and landslide represent major threat and shall be categorized as "**significant**" while those presenting lesser threat are categorized as "**other**". The other category shall include drought, wind and cyclone, severe weather conditions, lightning, forest fire, insect pests, epidemic/pandemic, critical infrastructure failure or collapse (utility malfunction, shortage of energy, dam failure, embankment failure etc), NBRE, act of terrorism and hazardous material release.

Significant hazards are earthquakes, floods and river bank erosion & landslides. The State has not witnessed major earthquake since 1950, however given the vulnerability to this hazard a repeat phenomena of a large earthquake can exact a high cost to the

people, assets (housing, infrastructure) and economy. Flood and river bank erosion occur every year and cause significant damage to people, property, environment and economy. Flood hazard is of major concern as there is a repetitive losses (this loss refers to the significant amount of damage during a disaster that is experienced by settlement and economy that have been impacted in previous events as well) whereas river bank erosion associated losses and damages are undeclared disasters (undeclared disasters are those events that do not qualify for disaster relief assistance by the State or the National Government). River bank erosion event dominate the larger disaster picture and those impacted by the events on a frequent basis suffer more due to repeated phenomenon and with less/marginal or no outside assistance.

Rapid expanding population, extension of urbanizing areas, creation of new assets/infrastructure, rising interdependency among sectors for flow of goods and services, and rising economic development will significantly increase the risk exposure of the State to a range of natural and man-made hazards. This Plan document acknowledges integration of mitigation to both existing development and all new development in the State of Assam. ASDMP recognizes the need for creation of a separate State Hazard Mitigation Plan with appropriate estimations for potential losses and refer this analysis for planning purposes and implementation of the comprehensive mitigation activities. The State Hazard Mitigation Plan shall identify all hazards and associated vulnerabilities and provide a statewide strategy to reduce future disaster losses through implementing mitigation projects.

The State Hazard Mitigation Plan shall:

- Identify and profile all hazards in the State of Assam
- Assess the impact on physical assets from the comprehensive risk assessment study and later prioritize key areas for intervention (immediate and long term)
- Establish a framework for mitigation planning and implementation
- Identify funding sources and mechanism for assistance
- Through funds create opportunities for mitigation planning at State, District, Local and Community Level
- Aim towards vulnerability reduction to all hazard impacts through coordination with development planning efforts, regulatory actions and legal control mechanisms. ensure compliance of design and construction standards, and implement targeted programs that address risk reduction (existing development) and risk integration in all future development actions
- Develop enhanced capability of the stakeholders in mitigation interventions at State, District, Local and Community Level
- Facilitate the process of integrating mitigation into development interventions, community development activities and in the mission area of disaster recovery
- Undertake targeted actions for protection of key lifeline/social infrastructure in the State

2.3.3 Approach towards preparation of State Hazard Mitigation Plan

Mitigation activities are undertaken primarily to prevent loss of life and injury, protect asset value, maintain primary function during adverse circumstances caused due to action of the hazard, and accommodate desired social and economic use. Hazard Mitigation measures fall under the following categories:

- Buffer or separate the hazard from people and assets (e.g., flood protection measures)
- Buffer or separate people and assets from the hazard (e.g., zoning ordinances)

- Reduce the impact of the hazard (e.g., risk transfer through insurance)

Existing literature on mitigation classified actions under the following head: Structural Hazard Mitigation and Non-Structural Hazard Mitigation (e.g., refer to Box 1 indicates the range of measures for flood and riverbank erosion risk management).

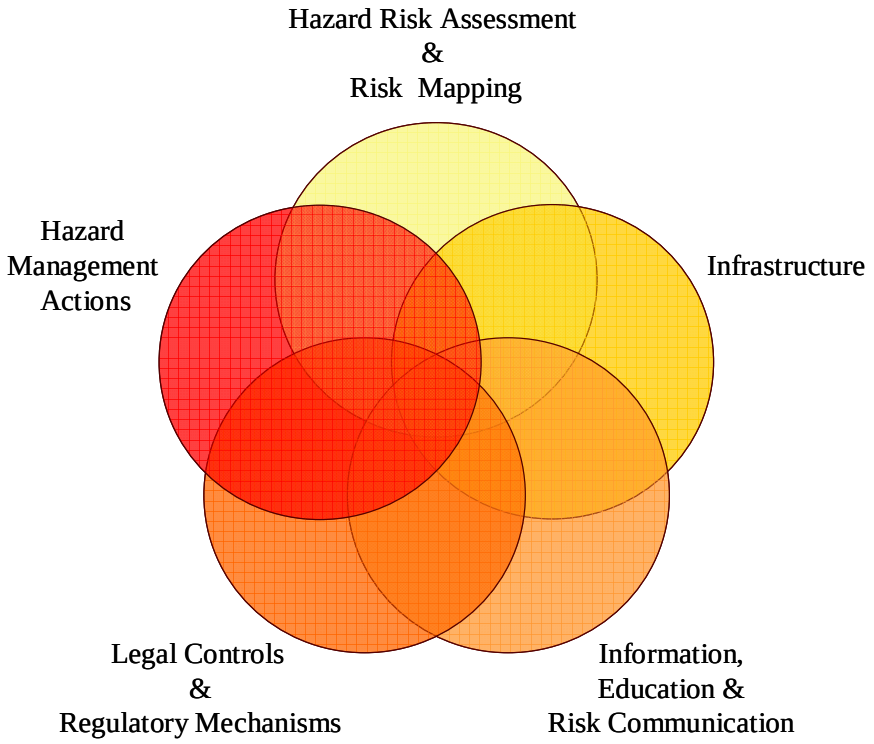
Box 1: Flood and Riverbank Erosion Risk Management

One of the investment program reports (Environment Assessment) in Assam for Flood and Riverbank Erosion Risk Management (ADB 2009) indicates the following programme components.

- *Structural measures* shall include upgraded embankments with assured maintenance (with extended platforms as appropriate); systematic riverbank protection exploring cost-effective, adaptive, and sustainable alternatives; and associated infrastructure (e.g., drainage sluices, canals).
- *FRERM nonstructural measures* shall include flood and erosion risk mapping; improved warning systems; participatory flood emergency response system; and other flood adaptation measures (e.g., adaptive cropping, fish culture).
- *Community-based risk management* shall include participatory systems integrated with local disaster management committees; community FRERM plans; and plan implementation such as community awareness, flood shelters, and associated flood coping and development programs, e.g., adaptive cropping, fisheries, and livelihoods
- *Sustainable FRERM infrastructure maintenance.*

Implementation of mitigation actions for specific hazard is a combination of various measures. These measures can be classified under five functional heads:

Figure 19: Functional Heads of Hazard Mitigation



1. Hazard Risk Assessment and Risk Mapping (HRARM)

Hazard risk assessment and risk mapping exercise will give understanding of the nature of event, location, probability of occurrence, impact and cause-effect

relationship of the hazard. This information can translate better understanding of the hazard risk, identify opportunities for mitigation actions in a long term perspective (keeping in perspective events possible in the near future and potential adverse effects), project scenarios of damage, and quantify projected losses in absence of mitigation investments. HRARM serves as a foundation for proactive risk-related decision making.

2. Hazard Management Actions (HMA)

These actions directly reduce the risk from a natural hazard event by either reducing or eliminating the intensity/degree of the event. Actions mainly include structural actions that alter the physical system of the elements at risk.

3. Infrastructure (INFRA)

These actions directly reduce the risk from a natural hazard event by modifying existing elements of infrastructure, or developing new infrastructure that physically alter the elements at risk. Actions can also include building redundancy within the existing infrastructure or by creating new ones to strengthen or ensure resumption of function under the influence of hazard.

4. Legal Controls and Regulatory Mechanism (LCRM)

The actions under this category will guide risk minimization through effective legal controls and regulatory measures. LCRM measures will empower the administrative systems to conduct regular inspection within the institutions operation mandate. It will encourage/promote actions that will reduce existing risk or bring in control future risk.

5. Information, Education and Risk Communication (IERC)

Information outreach / Risk Communication are of utmost importance in hazard mitigation. Information and education is a considered as a long-term investment in mitigation and this will build consensus about the risk and action steps to be taken to reduce it. It also helps to establish the understanding of acceptable or residual risk (risk that cannot be treated by any action, or risk which is not being attended and that may have the potential to cause damage/loss/harm). Keeping regular communication will boost the level of confidence and trust in decision-making process.

ASDMA has already initiated a range of hazard mitigation actions. Table 15 identifies potential mitigation measures for significant hazard risks and this is built from over ongoing activities undertaken/envisaged by ASDMA. Please note that the table below is indicative and should not be treated as final. The same can be further detailed in the State Hazard Mitigation Plan through appropriate stakeholder consultation meetings with participation of all stakeholders. The stakeholder involvement and their participation will change based on the dominant risk characteristics.

Table 15 Mitigation Action for significant hazard risks

Hazard	Functional Head	Potential mitigation measures
Earthquake	HRARM	▪ Establish a State Level Earthquake Hazard Advisory Committee ▪ Undertake earthquake hazard mapping of select urban centres ▪ Undertake scientific studies to determine earthquake hazard risk for all important and critical lifeline facilities (existing and new ones to be built) ▪ Map location of all key buildings in the state and rate them on the basis of rapid visual screening exercise

Table 15 Mitigation Action for significant hazard risks		
Hazard	**Functional Head**	**Potential mitigation measures**
		▪ Undertake specific vulnerability mapping exercise for critical infrastructure ▪ Establish results of damage/impact on the built environment across the State
	HMA	▪ Prepare state-wide inventory of all buildings at risk to structural collapse/damage under varying degree of hazard (undertake Rapid Visual Screening exercise of buildings) ▪ Promote structural hazard mitigation activities among house owners, business community and across Government departments ▪ Promote non-structural hazard mitigation activities among house owners, business community and across Government departments ▪ Undertake retrofitting of key lifelines and critical/social infrastructure ▪ Implement non-structural mitigation activities for building such as schools, hospitals and critical infrastructure so as to improve the safety ▪ Undertake massive training and certification of professionals and construction workers on safe construction practices and retrofitting ▪ Develop criteria for construction in areas that are at close proximity to the fault or any feature which may result in damage to structure
	INFRA	▪ Screen existing lifelines by undertaking non-destructive testing methods to determine the structural integrity for seismic loading ▪ Undertake structural and non-structural seismic retrofitting of key lifeline/critical infrastructure (including hospitals, schools, emergency services, water supply and other buried facilities or services, power and telecommunication infrastructure, dam/water reservoirs, transportation networks such as bridges/roads/airport runway, utilities, petrochemical facilities, water retaining structures, storage tanks including hazardous materials, industrial installations, law and order facilities such as prisons/jails, buildings of key persons and responsible administration units during emergency situations and facilities of emergency responders) ▪ Provide anchor elements to prevent slip of bridge-deck or span elements
	LCRM	▪ Adopt zoning parameters as identified in the Model Building Byelaws issued by MHA (Sept 2004)

Table 15 Mitigation Action for significant hazard risks		
Hazard	**Functional Head**	**Potential mitigation measures**
		▪ Adopt BIS Codes and NBC in all construction practices across the State ▪ Establish monitoring mechanism for seismic compliance
	IERC	▪ Conduct earthquake drills and emphasize the need for structural and non-structural mitigation ▪ Develop a comprehensive outreach programme for earthquake risk education in schools ▪ Undertake shake-table demonstration projects in rural and urban areas ▪ Float design competition for typical structures (new) in rural and urban areas ▪ Demonstrate urban and rural earthquake mitigation projects (new and retrofit)
Flood	HRARM	▪ Establish a State Level Food Hazard Advisory Committee ▪ Conduct floodplain mapping through partnership of key national and state resource institutions ▪ Conduct detail flood hazard mapping of the State ▪ Create dense network of flood gauges and install gauges in un-gauged flood prone areas that pose significant threat to at risk communities ▪ Map all infrastructure at risk to varying intensity of flood hazard
	HMA	▪ Identify areas prone to sediment built up and implement measures ▪ Undertake flood-proofing of critical and vulnerable infrastructure (elevate important structures vulnerable to flooding) ▪ Undertake embankment strengthening programme ▪ Enhance dam safety measures and integrate end-to-end early warning system ▪ Integrate flood alert and warning system in all functional departments of the State, especially ones located in high flood prone areas ▪ Rehabilitate important facilities prone to regular flooding and create open spaces so as to minimize/reduce future flood impact ▪ Redesign existing storm water and drainage systems in flood prone areas
	INFRA	▪ Protect all critical infrastructure from flood damage ▪ Improve safety of span structures (bridges) ▪ Protect bridge abutments and bridge footings ▪ Provide anchor elements to prevent slip of bridge-deck or span elements ▪ Improve drainage in flood prone areas and across

Table 15 Mitigation Action for significant hazard risks		
Hazard	**Functional Head**	**Potential mitigation measures**
		transportation corridors ▪ Provide storm water drainage systems ▪ Identify and assemble technology to provide drinking water in flood situation ▪ Improve redundancies in water supply network (e.g., grid network) ▪ Protect or flood-proof water treatment/sewerage treatment plants ▪ Clear of waste from existing water channels and if required enhance the flow-rate by undertaking desilting/dredging operations
	LCRM	▪ Control release of water from reservoirs through use of effective forecasting and basin/reservoir modeling methods (may suggest alter in rule-book due to introduction of forecasting and warning regime) ▪ Adopt floodplain management and consider zoning parameters as identified in the Model Building Byelaws issued by MHA (Sept 2004) ▪ Promote flood insurance ▪ Hazard mapping to guide demarcation of flood hazard zoning and complete disclosure of risk to buyers of properties ▪ Revise design standards of buildings and other infrastructure in areas prone to high or moderate flood risk
	IERC	▪ Disseminate alert and warning mechanisms of flood early warning system (FLEWS) project to communities ▪ Encourage use of flood warning in high risk prone areas ▪ Establish communication protocol to relay information on flood to communities at risk ▪ Increase public awareness of flood hazard and mitigation possibilities ▪ Disseminate flood hazard zoning/ mapping information to stakeholders ▪ Establish Monsoon Forum at the State and District Level
Landslide	HRARM	▪ Establish a State Level Landslide Hazard Advisory Committee ▪ Develop a detailed inventory of landslide information database for the State ▪ Promote use of GIS mapping techniques and identify/map hazard prone areas ▪ Undertake statewide landslide hazard assessment study
	HMA	▪ Relocate buildings and infrastructure form

Table 15 Mitigation Action for significant hazard risks		
Hazard	**Functional Head**	**Potential mitigation measures**
		landslide prone areas ▪ Stabilize identified landslide prone areas (terracing, planting of vegetation, geotextile among other methods)
	INFRA	▪ Enhance drainage systems ▪ Relocate facilities/infrastructure in severe landslide prone areas, or undertake structural mitigation works
	LCRM	▪ Adopt zoning parameters as identified in the Model Building Byelaws issued by MHA (Sept 2004) ▪ Adopt BIS Codes and NBC in all construction practices across the State ▪ Prohibit construction in landslide prone areas
	IERC	▪ Develop a comprehensive landslide awareness programme ▪ Disseminate landslide hazard mapping information to stakeholders ▪ At select locations demonstrate mitigation actions through use of local resources / cost effective measures ▪ Initiate community based landslide early warning projects at select risk locations

PART – III ROLES AND RESPONSBILITIES OF STATE GOVERNMENT DEPARTMENT/AGENCIES IN DISASTER MANAGEMENT

SECTION 1: GENERAL

3.1.1 Key Responsibilities

National DM Guidelines Preparation of State Disaster Management Plan (NDMA, 2007) envisages the following responsibilities of departments/agencies of the State Government:

- Planning: development of strategies and requirement analysis for resource utilization. The establishment of structures, development of systems and testing and evaluation by organizations of their capacity to perform as per allotted roles.
- Coordinated Execution of Plans: Increased coordination, convergence and synergy among the departments and institutions should be promoted in order to promote sharing of resources, perspectives, information and expertise through support of training centres, academic and applied research, education & awareness generation programme, etc.
- Mainstreaming DM Concerns into Development Programmes: This deals with integration of measures for prevention of disasters and mitigation into developmental plans and projects including mitigation projects and to facilitate provision of adequate funds for DM. Plans may be shown in three broad categories, viz. short, medium and long term. The structural & non-structural measures to be taken may be brought out in each category.

SECTION 2: ROLES AND RESPONSIBILITIES OF DEPARTMENTS / NODAL AGENCIES

3.2.1 Approach towards allocation of roles and responsibilities

The 'comprehensive risk management approach" and "all hazards approach" recognizes the participation and partnership of all departments and the agencies in the state to carry out DM functions. Given the frequency and intensity of the hazards in the State it is recognized that no single agency can undertake preparedness, prevention, mitigation, response and rehabilitation activities. In order to specifically deal with the disruption to community life and infrastructure that can result from a disaster, it is important to agree upon the coordination role or involvement as primary / secondary support function, as relevant to the event type and magnitude of damage. The responsibilities highlighted in Section 3.1.1 is in addition to the ongoing conduct of core mandate and department activities. One of the scope of this plan is to facilitate the process of DM integration within the development schemes/programmes as well as indicate the role of DM as one of the core department activities facilitate integrate the departments. In order to accomplish the tasks the departments/agencies can draw support from all levels within the Government, Public enterprises, Private sector, CSO's/NGO's and Voluntary agencies.

Through the DM Act 2005 and Assam DM Rules 2010, State government departments/nodal agencies/organizations/enterprises are requested to draw upon specific designated responsibilities in DM which reflect their already mandated tasks and have technical / resource capability and authority to align with the activities of preparedness, prevention, mitigation, response and rehabilitation.

The roles and responsibilities of government agencies with respect to disaster management are outlined in section 3.2.2. This list is not exhaustive and it primarily focuses on the roles and responsibilities of agencies at the State level only. The list is prepared from government's functioning/accountability perspective towards DM.

This list should not be treated ad final and is not complete. Departments/Enterprises which are not figured in this list are not exempted from the DM responsibility; however efforts will be undertaken to reach to all departments and list will be updated. The Plan document has the status of "living document" and subsequent revisions will incorporate the amendments received through feedback from Departments or through consultations. This process will enable to build the much needed partnership arrangement and simultaneously draw clarity.

3.2.2 Roles and Responsibilities

Department / Agency	Disaster Management Roles and Responsibilities
Agriculture Department	▪ Establishing coordination in implementing and providing technological know-how on drought management to the farming community through agricultural extension services ▪ Create assured irrigation facilities and availability of water to the agricultural fields ▪ Continue educating farmers on soil and water conservation technologies through implementation of watershed projects and know-how of drought resistant crops ▪ Drought tracking and communication outreach ▪ Implementing calamity (like flood, drought etc.) relief programmes. ▪ Conduct damage to crops and allied infrastructure in case of disaster
Animal Husbandry and Veterinary Department	▪ Disease control ▪ Undertake fodder assessment and develop contingency plan in case of drought or drought like conditions ▪ Conduct assessment of damage and economic loss due to disasters within the sector
Border Areas Department	▪ Take necessary steps to coordinate with line departments and agencies during response, relief and reconstruction requirements in case of disasters. ▪ Look after the problems and provide minimum basic facilities to the people living in the remote Interstate and International border areas of the state ▪ Improve living standards of the people living in border areas
Education Department	▪ Incorporate disaster management into education curriculum of schools ▪ Maintain and ensure school facilities across the state can stand safe from known hazard risks, and they continue to function in post-disaster environment ▪ Identify/Designate school buildings and infrastructure for providing shelter during emergency situations. Ensure necessary facilities are built in to cater support to the

Department / Agency	Disaster Management Roles and Responsibilities
	evacuated. ▪ Direct and monitor preparation of School DM Plan across the state ▪ Undertake training and capacity building initiatives and develop a resource pool of teachers and students trained and in DM
Environment and Forests Department	▪ Undertake effective forest management practices ▪ Check erosion and management of environment infrastructure of the state ▪ Protection and sustainable use of natural resources ▪ Safeguard the forest and wildlife of the State ▪ Environment Education ▪ Support income generation activities under JFM scheme ▪ Forest fire prevention and assessment of damages
Electricity Department	▪ Coordinate development of the power sector in the state ▪ Provide adequate and quality power to the people and consumers in business as usual environment as well as during the period of disaster situation ▪ Undertake risk assessment of the lifeline infrastructure (generation, transmission and distribution systems) to hazard risks and address through mitigation measures ▪ Carry out disaster management activities pertaining to the sector through Assam State Electricity Board and its successor companies. ▪ Prepare disaster/hazard specific contingency plan
Finance Department	▪ Support towards making provisions for establishing State Disaster/Hazard Mitigation Fund ▪ Arrange necessary funds in case of disaster ▪ Direct development planning activities/schemes to incorporate or build-in safety nets/mitigation measures
Fishery Department	▪ To increase fish and fish seeds production in the state and contribute to the overall food security in the State ▪ Undertake activities to address risk mitigation within the fishery sector, including the processing industries
Food & Civil Supplies Department	▪ Maintain adequate stock of food supplies and provide food security in the State ▪ Allotment and distribution of PDS/TPDS commodities ▪ Identify supply of food needs to be dispatched in case of declaration of disaster ▪ Build reserve stock of supplies in most vulnerable and difficult to access regions of the state ▪ Coordinate / Manage transportation of essential supplies to communities at risk, or in post-disaster situations ▪ Enforcement of law and Rules relating to trading of essential commodities especially in post-disaster situations or drought like scenario
General Administration Department	▪ Handle all protocol matters of VIPs to disaster affected areas ▪ Assess all key Government buildings (residential/non-residential) in the state are hazard resilient

Department / Agency	Disaster Management Roles and Responsibilities
Guwahati Development Department	▪ Oversee the development of Guwahati City through the development works carried out by Guwahati Municipal Corporation (GMC) and Guwahati Metropolitan Development Authority (GMDA) and other Departments of Government of Assam ▪ Monitor the activities of GMC/GMDA and sanction and release fund for the various developmental schemes. ▪ Execute the various developmental schemes (under the Finance Commission and through the funds sanctioned by the GOI) and mainstream risk reduction in all scheme components ▪ Ensure disaster management concerns are streamlined in all development activities (new/repair/strengthening) carried out by GMC/GMDA keeping into consideration of hazard risks namely earthquake, landslide and urban flooding ▪ Undertake detail risk assessment of Guwahati to hazard risks (earthquake/landslide/urban flooding) and prepare scheme for risk reduction through implementation of preparedness, prevention, mitigation programmes ▪ Facilitate capacity building of GMC/GMDA (administration and engineering) staff in disaster management and with specific focus on earthquake risk management ▪ Ensure all buildings sanctioned for design and constructions are compliant with Indian Standard Code of Practice of BIS. ▪ Oversee the preparation of Guwahati City Disaster Management Plan and place it for approval to ASDMA or SEC. ▪ Direct agencies other than GMC/GMDA to observe DM mechanisms in development activities. ▪ Engage with Town and Country Planning or other qualified institute/consultancy firm in undertaking risk sensitive land-use plan and inclusion of the same in the next Development Plan/Master Plan for Guwahati.
Health and Family Welfare Department	▪ Provide health and medical care in normal and disaster situations ▪ Develop adequate health infrastructure in the state and implement programmes towards improvement of health across all sections of the society ▪ Deployment of medical response team in case of health emergency or disaster ▪ Coordinate and transport necessary medical supplies to disaster prone areas ▪ Undertake activities towards preparation of Hospital Contingency Plan for all major hospitals across the state ▪ Conduct vulnerability assessment of all health facilities across the state and undertake preparedness and mitigation measures ▪ Prepare mass casualty plan for the state (earthquake hazard, floods and epidemics)

Department / Agency	Disaster Management Roles and Responsibilities
	▪ Maintain ambulance network and networking among medical practioners/medical institutions to facilitate quick mobility of doctors in rural areas (normal/emergency situation) ▪ Undertake efforts and develop networking of hospitals for special care / mass casualty care ▪ Provide training to hospital administration staff, doctors and paramedics in contingency planning, mass casualty care, networking arrangement ▪ Conduct first-aid training programmes with support of line departments/agencies of the State
Hill Areas Department	▪ Take appropriate action towards implementation of various development works undertaken by different Government Departments. Ensure mitigation components are inbuilt into the schemes and projects sanctioned/implemented ▪ Address specific DM concerns with respect to development and management in hill areas ▪ Undertake capacity building of human resources associated with the department to appreciate and understand environmental issues ad hazard risks, preparedness and mitigation measures
Home Department	▪ Providing security to the state during normal and extraordinary times ▪ Assisting the Civil Administration in times of disaster ▪ Establishment and training of Home Guards and Civil Defence ▪ Help Police Administration in maintaining general law & order as well as control of crime ▪ Fire Safety and Security to individuals and public properties ▪ Training of Fire services Officers ▪ Emergency assistance in disasters ▪ Primary agency to handle NBC events/disasters ▪ Management of the dead ▪ Emergency communication
Industries & Commerce Department	▪ Responsible for safe industrial development in the state ▪ Undertake steps towards management of risks posed by industries (chemical hazard release/technological accidents, human caused failure/transportation of raw or finished products) ▪ Guide the industries towards establishment of On-Site/Off-Site Plans, Hazard specific contingency plans (earthquakes and floods in particular), Business Continuity Plan ▪ Establish mechanism for capacity building and training of industry personnel in disaster management
Irrigation Department	▪ Provide assured irrigation water during all seasons to the cultivators and protection against famine ▪ Development and addition of irrigation potential through irrigation schemes, boosting up agricultural production in the State. ▪ Increase irrigation intensity and practicing multiple cropping,

Department / Agency	Disaster Management Roles and Responsibilities
	thereby uplifting the socioeconomic conditions ▪ Increase in agricultural production of the State by introduction of high yielding variety crops with the help of agriculture extension services, thereby contributing to food security of the State
Information & Public Relations Department	▪ Organize various exercises to generate and mould public opinion ▪ Broadcasting of official announcement needing immediate public attention ▪ Dissemination of official news to print and electronic media ▪ Disseminate early warning to communities at risk (in association with warning protocol institutions) ▪ Bring out publications concerning public welfare ▪ Disaster education and awareness ▪ Collect reliable statistics of damage and needs during post-disaster operations ▪ Publicize schemes meant for beneficiaries (rehabilitation / reconstruction)
Information Technology Department	▪ Development of disaster resilient ICT in the State ▪ Support development of ICT intervention in DM ▪ Undertake activities towards IT disaster recovery for disasters, protection of important data at all levels
Panchayat & Rural Development Department	▪ Responsible for development activities in the rural areas ▪ Identify the area liable to threat/damage form local hazards ▪ Form key committees of the youth/villagers in the village of cluster of villages to address DM (mainstreaming disaster risk reduction in development and emergency response) ▪ Equip the volunteer teams with basic tools and knowledge to address and monitor hazard risks ▪ Encourage drill practices ▪ Facilitate the mechanism of passing resolutions by Sarpanch in Gram Panchayat for disaster preparedness ▪ Ensure/Monitor steps are taken to include the most unprivileged set of people, especially women, adolescent children, pregnant women, old and infirm, physically / mentally challenge.
Planning & Development Department	▪ Responsible for formulation and implementation of the State Plan schemes, incorporation of drr concerns in all scheemes ▪ The department maintains vertical relation with the Planning Commission and horizontal relation with the line departments of the State (in respect of formulation, implementation and review as well as maintenance/ reporting of records on physical progress and financial achievements) ▪ Department prepares draft Annual Plans and Five Year Plans as per the guidelines of the Planning Commission and as per needs and aspirations of the people/State. Department to lay emphasis on mitigation and preparedness within development schemes ▪ Facilitate provisions towards mainstreaming drr in all State

Department / Agency	Disaster Management Roles and Responsibilities
	Plan schemes and funds for implementation in the MLA/LAD Schemes ▪ Ensure utilization of resources take into consideration of DM concerns, enabling to create durable/long lasting assets
Public Enterprises Department	▪ Department undertakes efficient management and control of the State's Public Enterprises ▪ Co-ordinate the functions and operations of the different Public Enterprises in the State ▪ Direct public enterprises to engage in DM activities and develop enterprise wide DM and Response plan
Public Health Engineering Department	▪ Nodal department of the state government entrusted with the responsibilities of providing safe drinking water to the people of Assam ▪ Responsible for ensuring safe hygiene through Total Sanitation Campaign (TSC) ▪ Providing safe drinking water to all the schools located in rural areas ▪ Provide emergency supply of safe drinking water in disaster situations ▪ Assess the impacts of extreme events (natural and man-induced) on facilities of the department and propose / undertake mitigation measures ▪ Undertake risk assessment and management of ground water resources in emergency situations
Public Works Department	▪ Develop infrastructure of transport & communication across the State ▪ Construction and repair of roads, bridges, culverts in the state including construction and repair of public buildings of the state ▪ Keep infrastructure in operational condition, facilitate the movement of goods and services, emergency supplies ▪ Undertake prevention/protection/structural rehabilitation/retrofitting measures of critical infrastructure or connectivity links ▪ Undertake emergency repairs ▪ Provide regular capacity building / training for staff to undertake vulnerability assessment of critical lifelines, develop mitigation options ▪ Ensure design and constriction of buildings are in compliance to Indian Construction Codes of Practice (BIS)
Revenue and Disaster Management	▪ Provide Financial Assistance to the victims ▪ Ensure conduct of all DM activities in the State
Science and Technology Department	▪ Draw upon subordinate organizations technical and scientific knowledge support to address DM concerns in the State
Social Welfare Department	▪ Ensure proper care of the uncared ▪ Protection of the most vulnerable sections of the society and creation of an environment which is conducive to the all round development of children, women and physically challenged persons

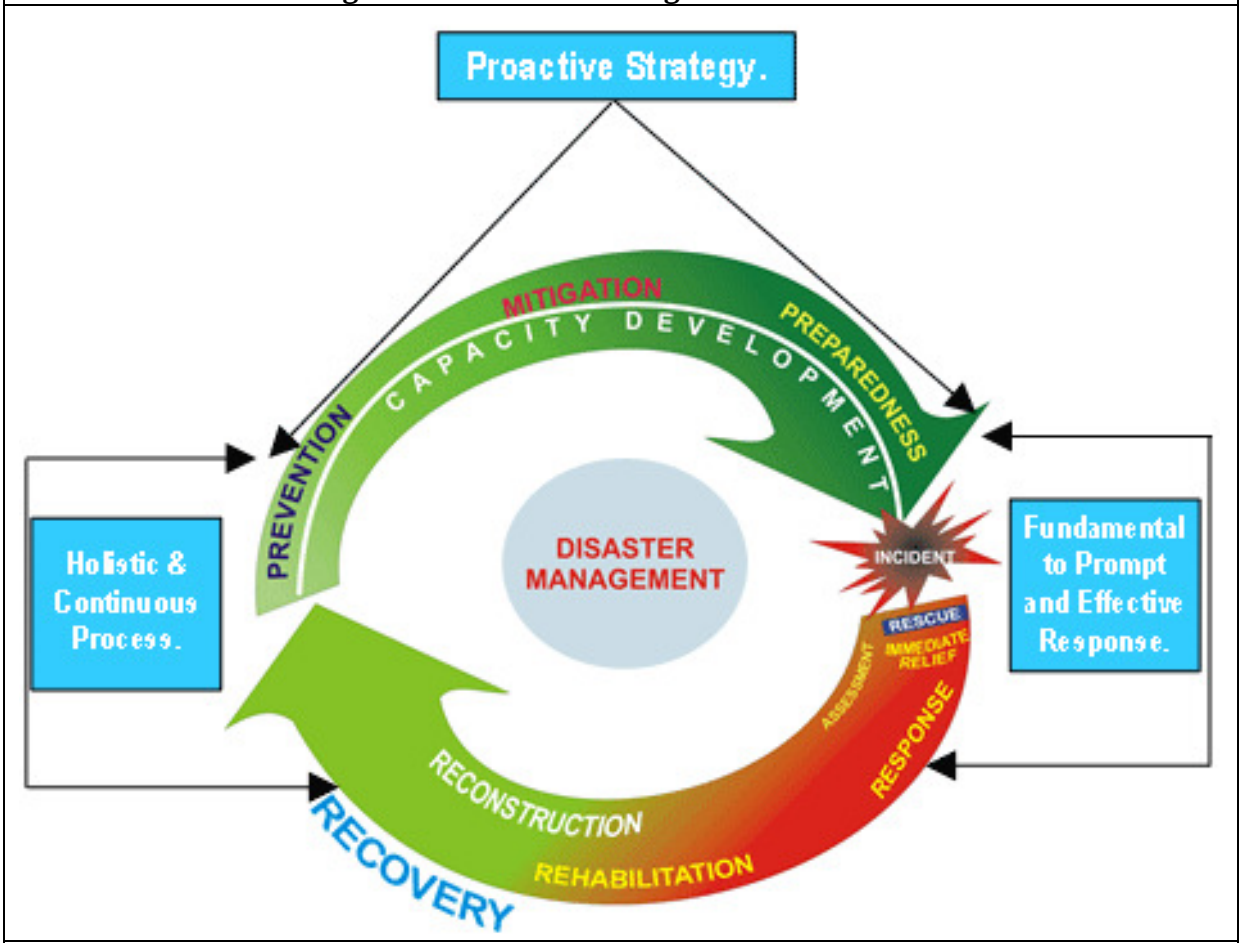
Department / Agency	Disaster Management Roles and Responsibilities
	▪ Integrate DM concerns in the ongoing welfare development schemes in the State ▪ Develop social safety nets taking into consideration of the hazard risks in the region where the welfare schemes are under implementation
Soil Conservation Department	▪ To assess the problems and needs of state in respect of soil erosion, soil conservation, watershed management, nature and environmental conservation and to prepare and undertake necessary schemes and projects in conformity with the objectives. ▪ To protect from soil erosion, agricultural lands in the plains districts from the ravages of gully erosion by either taking up schemes departmentally or through farmers and landowners by demonstration, persuasion and legislative provisions where such exits. ▪ To protect the hill slopes of the Tribal Districts from the harmful effects of jhum cultivation by providing alternate forms of land use and educating cultivators on permanent and productive agriculture through demonstrations and publicity and introducing terracing, contour bunding and such other scientific soil conservation measures ▪ To protect misused non-agricultural land from soil erosion by afforestation, growing plantation crops, fodder crops etc. both in the plains districts and the Hill districts. ▪ Implementation of rubber plantation and bamboo plantation schemes ▪ Implementation of moisture/water conservation activities ▪ Protection of hill slopes ▪ Afforestation in plain and hill districts (misused agricultural land) ▪ Research and field trials on various soil erosion problems of the state and evolve suitable technique for local adaptation ▪ To undertake training programme for Departmental officers of various categories by establishing training schools and centres.
Sports and Youth Welfare Department	▪ Training of NCC, NSS Volunteers and youth in disaster management ▪ Conduct of awareness programme in the State ▪ Integrate DM into the activity forum
State Fire Service Organization / Fire & Emergency Services	▪ Fire Fighting in case of fire accidents. ▪ To save life & property of all citizens in case of fire hazards and in other natural calamities. ▪ Fire prevention & protection of all buildings, industries, commercial & public places etc. ▪ Inspection of all high-rise buildings & other establishments & assess their fire preventiveness & preparedness & effectiveness of fire fighting equipments installed by the owners from time to time. ▪ Law & order duty with local police at ***mela*** or any large-scale

Department / Agency	Disaster Management Roles and Responsibilities
	meetings & functions. ▪ To raise public awareness and conduct periodical training program from time to time and to organize demonstrations showing rescue operation during the fire & other natural calamities etc. to educate the general public.
Tourism Department	▪ Undertake protection and response planning measures at all tourist destinations of the State ▪ Establish mechanism to address distress call of foreign and Indian nationals ▪ Liaison with departments responsible for protection of cultural heritage properties from hazard risks / disasters
Transportation Department	▪ Ensure functioning of Mainland and Inland Water Transport (ferry/cargo/commercial and passenger service) across the State ▪ Road safety (Accident prevention) ▪ Education and awareness ▪ Arrange vehicles for transport of people and relief supplies, navigation aid
Urban Development Department	▪ Implementation of development schemes (services) ▪ Upgradation of services in cities and towns ▪ Construction of buildings ▪ Modernization of Guwahati City ▪ Implementation of techno-legal regime in all development schemes ▪ Monitoring/Enforcement mechanism to ensure earthquake resistant design and construction of buildings, including third party audit for high-rise buildings ▪ Training and capacity building of engineering staff in the department
Water Resources Department	▪ Flood and erosion management ▪ Construction/strengthening/maintenance of embankment

3.2.3 Activities in different mission area of DM

A typical Disaster Management continuum (refer Fig 20), comprises of six elements i.e., Prevention, Mitigation and Preparedness in pre-disaster phase, and Response, Rehabilitation and Reconstruction in post-disaster phase, defines the complete approach to Disaster Management.

Figure 20: Disaster Management Continuum



Source: http://ndma.gov.in/ndma/approachdm.html

Departments in the Government intervene various phases/aspects of the DM continuum. Departments are function-centric and have mandate to undertake business in normal time, and carry the ability to spread scope, internalize provisions made through act and rules. There has been a call for paradigm shift in disaster management, focus from reactive to proactive measures i.e, from relief to prevention and mitigation of disasters. This section outlines functional aspects of the department to undertake DM activities. The items listed provide an initial point of reference and is not to be treated as an exhaustive/final output. It will evolve in respect to changing hazard profile, vulnerability across sectors as well as socio-economic profile of the state, efforts made towards risk reduction by the department/line agencies/community by large. Taking into consideration the primary responsibility, activities of select line departments are listed and further detailed in this section.

PRIMARY RESPONSIBILITY	DEPARTMENT
DM Operations and Plans, Warnings	**Revenue & DM Department**
Medical Care and Health Services	**Health & Family Welfare Department**
Law & Order, Safety & Security	**Home Department**
Emergency Response, Search & Rescue	**Home Department**
Buildings & Lifeline Infrastructure / Communication Infrastructure *(Roads & Bridges)*	**Public Works Department**
Drinking Water Supply & Sanitation	**Public Health Engineering Department**
Transport Systems	**Transport Department**
Emergency supply of food & basic needs	**Food & Civil Supplies Department**
Broadcasting & relay of public information	**Information & Public Relations Department**
Welfare Services	**Social Welfare Department**
Drought management	**Agriculture Department**
Flood protection and river erosion management & Drainage development works	**Water Resources Department**
Power supply	**Power (Electricity) Department**
DM Education & School/Institution Safety	**Education Department**
Vulnerability reduction in rural areas	**Panchayat & Rural Development Department**
Vulnerability reduction in rural areas	**Revenue Department**
Vulnerability reduction in urban areas & built environment	**Urban Development Department**
Finance arrangements	**Finance Department**
Livestock management, animal care services	**Animal Husbandry & Veterinary Department**
Protection of natural resources and environment	**Environment and Forests Department**
Soil erosion and soil conservation	**Soil Conservation Department**
Earthquake & Landslide	**Department of Geology & Mines**
Fire	**Department of Fire & Emergency Services**

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Revenue and Disaster Management Department	
Preparedness	▪ Coordinate with ASDMA on all preparedness activities in the State ▪ Establish infrastructure and human resource support at Department level to undertake DM functions ▪ Periodic check of 'state of readiness' for all hazard risks / Conduct preparedness audit and direct actions ▪ Establish 'monsoon forum' in the state along with support of line departments ▪ Annual reporting to SEC on preparedness level of departments and administration units
Prevention & Mitigation	▪ Establish State Disaster Mitigation / Hazard Mitigation Fund ▪ Annual review of mitigation and prevention measures taken by the department and line agencies ▪ Annual review of hazard risk and vulnerability assessment of the state and direct actions for next year and set targets ▪ Vulnerability reduction in rural areas
Alert & Warning Stage	▪ Establish early warning systems in the state for hazard risks ▪ Establish working relationship with warning agencies in the state and the national level ▪ Establish protocols for dissemination of warning information (if needed, simplified through colour coded information) ▪ Continuously monitor the field situation and determine activation/deactivation of disaster response ▪ Prepare situation reports and update SEC members and all line departments, administration units ▪ Dispatch / preposition teams (quick response team, medical response team, search and rescue team, paramedics) in high risk prone areas which is under the influence of certain intensity of the hazard
Response	▪ Coordinate and manage response actions (incident/disaster) ▪ Address the injured and minimize casualties, take immediate actions to reduce exposure to hazard condition ▪ Deploy rapid damage assessment to gather field information ▪ Take support from agencies equipped with disaster information systems to share satellite data and related analysis indicating the level of hazard or vulnerability or potential threat/risk ▪ Conduct assessment of damage and estimate relief needs ▪ Distribution of relief material and direct restoration of basic services to the affected community/region ▪ Direct agencies to set up temporary elements to the affected population, ensure departments cater to minimum operating standards for distribution of relief ▪ Coordinate with all possible stakeholders including the donors, NGOs, INGOs, Media, Private & Voluntary Sector

Recovery & Rehabilitation	▪ Undertake complete restoration of basic services ▪ Ensure supply of clean water supply, food, sanitation, medical supplies and clothing requirements ▪ Ensure adequate steps are taken to provide enclosed & habitable shelter ▪ In case of a large scale disaster, undertake Technical Assistance studies to determine damage across all sectors to determine priority interventions and scaling of activities ▪ Prepare detailed damage reports and determine the package for rehabilitation and reconstruction programme ▪ Allocation of funds for R&R programme ▪ Coordinate with agencies and institutions extended support (technical/financial/volunteer) ▪ Document lessons learnt and sharing of practices with institutions across the State

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Health and Family Welfare Department	
Preparedness	▪ Review state and district wide health emergency preparedness to hazard risks ▪ Develop state and district wide health preparedness plan and disseminate the plan ▪ Develop a roster of experts and establish networking of key hospitals across the state ▪ Develop additional set of plan documents to address mass casualty care, model hospital contingency plan etc ▪ Ensure all heath care units across the State has a functional DM Plan ▪ Undertake hospital safety assessment and identify shortcomings / gaps to be addressed ▪ Ensure emergency supply stock cater to peak demand ▪ Establish base for field hospitals along with basis / support services ▪ Impart skills and training to medial practioners to function in disaster situations / post-disaster situations ▪ Work towards developing a cadre of volunteers trained in basic first-aid ▪ Impart skill and training for private medical practioners/private sector hospitals/private pharmacy to function during disaster/post-disaster situation
Prevention & Mitigation	▪ Evaluate and undertake action measures towards prevention of water and vector borne diseases after severe rainfall/flood event ▪ Evaluate all facilities to hazard risks, conduct state-wide vulnerability assessment of health infrastructure and define approach for mitigation and preparedness ▪ Budget allocation for hazard mitigation of health facilities *(both, structural and non-structural measures)* ▪ Create state of the art disease surveillance system to prevent outbreak ▪ Create fail safe communication network among select medical facilities across the state ▪ Establish necessary power back-up measures for primary and select secondary and tertiary tier of medical facilities
Alert & Warning Stage	▪ Assess current preparedness level at sector level and initiate actions towards mobilization ▪ Pre-stock supplies, redistribute/concentrate flow supplies to disaster prone areas ▪ In case of disease-outbreaks, undertake vaccination drive or initiate actions as per the advice/established protocol ▪ Protect the facilities in hazard prone areas and activate the building level emergency response plan ▪ Arrange for additional services such as back-up generator for electricity supply ▪ Establish command and control, activation of the entire health system in the State *(as outlined in the State Contingency Plan)* ▪ Activate communicate lines within the sector for coordination

Response	▪ Activation of Health Sector Contingency Plan or District wide contingency plan or a scale lower (depending on the scale of the event). ▪ Set-up relief camp from District to PHC Level, Medical Colleges. Assess the availability on medicine, ambulance services, equipments, instruments, medical experts, medical support staff and paramedics from time to time. ▪ Mobilize pre-determined teams (EMS Team) to address specific health care needs ▪ Provide basic medical assistance to the injured and who are in need of first-aid (pre-hospital care) ▪ Prioritize patient management ▪ Activate triage system as per the established protocol ▪ Transport severely sick and severe injured to main hospitals ▪ Establish field hospitals if need arise ▪ Mobilize psycho-social stabilization team to the affected areas ▪ Management of infectious-diseases emergencies, quarantine ▪ Activate mass casualty plan if need arise ▪ Undertake steps towards networking among practioners and hospital network/health facilities ▪ Ensure emergency communication is functional at all times, network medical services (pharmacy, blood bank, paramedics, ambulance services)
Recovery & Rehabilitation	▪ Provide support in recovery operations ▪ Carry out impact assessment on health infrastructure ▪ Provide support to line departments in recovery and rehabilitation efforts of communities ▪ Provide support of experts for counselling of disaster victims, psychosocial support ▪ Document actions taken by the department and incorporate lessons learnt in the sector plan

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Home Department	
Preparedness	▪ Establishment of State Disaster Response Force and regular conduct of training activities ▪ Conduct scenario exercises / table-top exercises / full scale exercises to determine the state of preparedness of key response institutions and provide feedback for improvement ▪ Ensure operational readiness of the key units functional within the Home Department ▪ Strengthen fire fighting capability of State and initiate backing up the Fire and Emergency Services with Paramedics Unit ▪ Develop fail safe emergency communication plan and initiate measures to reach out to distant communities situated in high altitude or inaccessible areas
Prevention & Mitigation	▪ Ensure that all Response Forces / First Responders are housed in structurally safe buildings and are backed with adequate tools to stage full scale response ▪ Undertake vulnerability assessment of all facilities and initiate mitigation actions
Alert & Warning Stage	▪ Maintain line of communication as per the protocol ▪ Mobilise response teams to hazard prone locations based on the warning information ▪ Coordinate with the State Disaster Information Centre (State EoC) ▪ Facilitate evacuation orders, enforce / monitor process through Police
Response	▪ Dispatch response teams to the affected areas ▪ Provide resource support to conduct Search & Rescue Operations ▪ Maintain law and order at all times ▪ Initiate further actions based on SITREP prepared by State Disaster Information Centre ▪ Relay information through emergency communication lines ▪ Provide support to Fire & Emergency Services to undertake swift actions ▪ Relay information to agencies at State Level in case of external support
Recovery & Rehabilitation	▪ Provide security cover / arrangements for VIP visits ▪ Assist administration in supply and distribution, maintaining law and order in the State ▪ Ensure smooth functioning of recovery and rehabilitation efforts ▪ Assist in management of the dead

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Public Works Department (Buildings)	
Preparedness	▪ Develop Department level preparedness plan ▪ Identify core teams for technical/engineering support/decision making in disaster situations ▪ Develop manuals and guidelines for safe construction practices ▪ Conduct training of staff in latest advancements of engineering, demolition techniques, health monitoring of infrastructure assets, seismic strengthening and retrofitting of buildings, critical infrastructure protection, DM ▪ Maintain inventory list of all key equipments and tools in the state that can be mobilised for response and recovery efforts
Prevention & Mitigation	▪ Integrate risk reduction as a component in design and construction practice of the department ▪ Identify weak lifeline buildings and develop strategy for strengthening / retrofitting so as to minimize damage/disruption ▪ Undertake vulnerability assessment of buildings and determine mitigation options ▪ Establish mitigation fund within the department ▪ Ensure/undertake checks to ensure infrastructure remains in operational condition, should disaster occur ▪ Preposition emergency supplies and equipments/tools in high risk concentration areas ▪ Undertake prevention/protection/structural rehabilitation/retrofitting measures of lifeline buildings ▪ Provide regular capacity building / training for staff to undertake vulnerability assessment of critical lifelines, develop mitigation options ▪ Ensure all design and construction in the department are in compliance to Indian Construction Codes of Practice (BIS) and National Building Code ▪ Work towards Performance Based Seismic Design ▪ Categories structural performance / vulnerability assessment on the basis of the performance based design parameters ▪ Establish 'Building Clinic' with adequate trained staff to advise on strengthening and retrofitting of lifeline buildings/infrastructure
Alert & Warning Stage	▪ Undertake emergency repairs/shoring measures ▪ Secure tools and equipments in safe locations, pre-position if needed ▪ Establish emergency communication network (inter/intra department)
Response	▪ Direct department engineering cadre for emergency response operations ▪ Coordinate temporary repairs to buildings and related infrastructure ▪ Undertake damage assessment of buildings and related infrastructure ▪ Undertake emergency repair and shoring of buildings ▪ Undertake construction of temporary structures and supporting structures to provide basis services to the affected population ▪ Controlled demolition and shoring up of buildings which have turned hazardous due to severe damage/tilting/settlement etc

Recovery & Rehabilitation	▪ Participate in conduct of structural damage assessments ▪ Guide urban authorities and line agencies on structural repair works and package development of repair/reconstruction scheme for housing and related social infrastructure ▪ Undertake detailed damage assessment of buildings ▪ Advise reconstruction/recovery of buildings and community infrastructure ▪ Coordinate, monitor progress and prepare report - repair, reconstruction and strengthening/retrofitting of buildings ▪ Prepare estimates and undertake repair/strengthening works ▪ Provide technical guidance/guidelines for construction of new buildings ▪ Supervise the civil work activities and ensure safe construction practices are streamlined during Recovery/Reconstruction phase

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Public Works Department (Roads and Bridges)	
Preparedness	▪ Develop Department level preparedness plan ▪ Identify core teams for technical/engineering support/decision making in disaster situations ▪ Develop manuals and guidelines for safe construction practices ▪ Conduct training of staff in latest advancements of engineering, demolition techniques, health monitoring of infrastructure assets, seismic strengthening and retrofitting, critical infrastructure protection, DM ▪ Maintain inventory list of all key equipments and tools in the state that can be mobilised for response and recovery efforts
Prevention & Mitigation	▪ Integrate risk reduction as a component in design and construction practice of the department ▪ Identify weak communication/infrastructure links and develop strategy to minimize disruption ▪ Undertake vulnerability assessment of assets and determine mitigation options ▪ Establish mitigation fund within the department ▪ Ensure/undertake checks to ensure infrastructure remains in operational condition, should disaster occur ▪ Preposition emergency supplies and equipments/tools in high risk concentration areas ▪ Undertake prevention/protection/structural rehabilitation/retrofitting measures of critical infrastructure or connectivity links ▪ Provide regular capacity building / training for staff to undertake vulnerability assessment of critical lifelines, develop mitigation options ▪ Ensure all design and construction in the department are in compliance to Indian Construction Codes of Practice (BIS) ▪ Work towards Performance Based Seismic Design ▪ Categories structural performance / vulnerability assessment on the basis of the performance based design parameters
Alert & Warning Stage	▪ Undertake emergency repairs/shoring measures ▪ Determine routes for mobilization of resources ▪ Secure tools and equipments in safe locations, pre-position if needed ▪ Establish emergency communication network (inter/intra department)

Response	▪ Direct department engineering cadre for emergency response operations ▪ Provide equipment support for search and rescue ▪ Coordinate the supply of goods and services ▪ Undertake damage assessment of lifeline infrastructure ▪ Coordinate temporary repairs to damaged infrastructure ▪ Establish missing road-links ▪ Cleaning and removal of debris from communication infrastructure to ease flow of goods and emergency supplies ▪ Undertake emergency repair of roads/communication and shoring of buildings ▪ Create / Provide emergency access in areas which communication links are lost/damaged severely during the event ▪ Undertake construction of temporary structures and supporting structures to provide basis services to the affected population ▪ Removal of debris flow, conduct clearance operations and re-establishment of roads and bridges ▪ Construction of emergency structures (levees among others) to control flood risk
Recovery & Rehabilitation	▪ Participate in conduct of structural damage assessments ▪ Guide urban authorities and line agencies on structural repair works and package development of repair/reconstruction scheme for housing and social infrastructure ▪ Undertake detailed damage assessment of critical infrastructure ▪ Advise reconstruction/recovery of infrastructure ▪ Coordinate, monitor progress and prepare report - repair, reconstruction and strengthening/retrofitting of infrastructure ▪ Prepare estimates and undertake repair/strengthening works ▪ Supervise the civil work activities and ensure safe construction practices are streamlined during Recovery/Reconstruction phase

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Public Health & Engineering Department	
Preparedness	▪ Develop department wide disaster preparedness plan ▪ Identify in advance emergency groundwater resources resistant to natural and man-made disasters that could replace damaged public and domestic drinking water supplies ▪ Develop guideline for consumption/purifying of water in disaster situation ▪ Departmental and public awareness, encourage economic use of water ▪ Training of department engineers in DM ▪ Plan for movement of staff to disaster affected areas, delegation of responsibilities ▪ Restoration plan for damaged facilities ▪ Maintain emergency stock of supplies (pre-contract agreement with suppliers can be a add-on)
Prevention & Mitigation	▪ Undertake conditional assessment of existing infrastructure ▪ Undertake risk assessment of the department facilities and cite recommendations ▪ Protect/strengthen the supply network with alternative/complementary source ▪ Undertake protection measures of distribution infrastructure (pumps, motors etc)
Alert & Warning Stage	▪ On receipt of warning, make provisions for acquiring water supply tankers ▪ Undertake chlorination programme ▪ Protect vital water supply infrastructure from contamination ▪ Arrange for alternate energy source should the electricity grid fail
Response	▪ Provide immediate safe drinking water supply in disaster effected areas ▪ Provide immediate safe drinking water supply for conduct of response activities at hospitals, emergency shelters, schools designated as shelters, relief camps etc
Recovery & Rehabilitation	▪ Assist line departments and agencies in identification sources of potable water ▪ Undertake swift actions to restore damages lines ▪ Undertake regular checks to determine key potable parameters of the water supplied ▪ Restore all services to pre-disaster phase an maintain check on vital quality including bacteriological parameters

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Transport Department	
Preparedness	▪ Carry out conditional survey of all routes and determine risk spots and actions to be taken ▪ Determine possible routes for evacuation for all settlements located in severe hazard prone areas of the state ▪ Check availability of vehicle/resources for evacuation ▪ Develop department wide preparedness plan ▪ Prepare inventory of vehicles that can cater for evacuation, dispatch of response teams, or emergency supplies ▪ Train drivers to operate in extraordinary times and difficult/missing routes, provide training in GPS enabled navigation system
Prevention & Mitigation	▪ Allocate resources for undertaking structural mitigation activities of the department facilities ▪ Direct line departments to take actions on identified risk spots or vulnerable stretches, strengthen if required
Alert & Warning Stage	▪ Make a quick assessment of population that requires evacuation or movement to safe locations/shelters ▪ Control and restrict vehicular traffic to risk prone areas ▪ Keep emergency vehicles on stand-by at pre-identified locations ▪ Ensure sufficient supply of fuel and resources for departmental person to function/undertake activities
Response	▪ Facilitate movement of emergency personnel and equipment to affected site ▪ Facilitate movement of emergency supplies: water, food and fuel ▪ Facilitate movement of emergency medical supplies and first responders to affected site ▪ Move population to safe areas and back on clearance from the administration ▪ Facilitate smooth movement of services in disaster affected areas, without causing disruption along regular routes ▪ Maintain and operate round the clock connectivity to all areas ▪ Control and restrict vehicular traffic movement to disaster affected areas
Recovery & Rehabilitation	▪ Provide recovery support to line agencies ▪ Assess damage to transport infrastructure ▪ Coordinating the reinstatement of transport services and infrastructure

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Food and Civil Supplies Department	
Preparedness	▪ Stock pile resources throughout the year for emergency needs ▪ Monitor the stock and undertake periodic checks of stored items (ensure quality and label fit for consumption) ▪ Prepare department wide preparedness and operational plan for distribution of supplies to people
Prevention & Mitigation	▪ Undertake mitigation and strengthening of all facilities, storage godowns across the State
Alert & Warning Stage	▪ Keep updated on weather bulletins and warning related information ▪ Estimate the population at risk and would be needing support ▪ Identify mechanism for safe transport of food items to the affected population (ensure quality and label fit for human consumption) ▪ Designate locations for pre-stock of supplies, in relief camps
Response	▪ Coordinate with local authorities and transport essential supplies to disaster affected area and pre-determined locations (relief centres) ▪ Provide tailored food packets to people with special needs ▪ Mobilize air/land/inland water transport for supply to far off destinations or regions which are inaccessible
Recovery & Rehabilitation	▪ Provide food supply to relief centres and kitchens till lifted off by the district / local administration ▪ Issue of duplicate ration cards ▪ Maintain price of basic commodities in disaster affected areas ▪ Curb unfair practices

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Information and Public Relations Department	
Preparedness	▪ Undertake education and awareness programmes among masses, build societal awareness ▪ Take steps towards enhancing department level preparedness to hazard risks in the state ▪ Guide media houses on the coverage/reporting on disaster situation, through guidelines or through order ▪ Coordinate with Assam Telecom Circle to ensure communication support during early warning/disaster period
Prevention & Mitigation	▪ Step up departmental level activities focusing on mitigation ▪ Periodically check the communication line to ensure connectivity at all times
Alert & Warning Stage	▪ Disseminate warnings to communities based on established warning protocol ▪ Flash warning message on radio and television network ▪ Gather authentic information about situation on the field ▪ Mobilise personnel to areas prone to disaster ▪ Curb spread of wrong information, rumours, non-scientific/non-verified forecasts
Response	▪ Coordinate a large scale response to disaster ▪ Collect reliable information from the field ▪ Remain as a focal point for release of official and updated information to the media and the public ▪ Regular sharing of information about the disaster and highlight actions undertaken or planned ▪ Broadcast essential information through radio and television ▪ Provide key information and messages through public loud speakers (in field) ▪ Establish media information centre if necessary ▪ Liasion with media agencies – print and electronic media ▪ Coordinate with information centre ▪ Undertake press briefings and provide official version ▪ Provide regular updates to departments, key personnel/decision makers and public
Recovery & Rehabilitation	▪ Provide support to the recovery operation ▪ Document recovery and rehabilitation efforts ▪ Oversee efforts towards restoration activities undertaken by Assam Telecom Circle and service providers ▪ Document cases / lessons from the field and dissemination of findings

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Social Welfare Department	
Preparedness	▪ Integrate DM concerns in the ongoing welfare development schemes in the State ▪ Identify vulnerable population and social groups which require special attention during disaster times ▪ Undertake training of communities and build awareness of local environment and associated hazard risks, community measures which can reduce vulnerability within their location, promote Community based disaster risk management ▪ Identifying/communicate resource management at local level/community level to assist themselves to meet immediate needs of water, food, clothing and shelter (promote self-help)
Prevention & Mitigation	▪ Develop social safety nets taking into consideration of the hazard risks in the region where the welfare schemes are under implementation ▪
Alert & Warning Stage	▪ Identify evacuation points/centres for communities ▪ Facilitate provision of services to meet people's needs in risk prone areas
Response	▪ Provide welfare services to disaster affected people Ensure proper care of the uncared ▪ Provide protection of the most vulnerable sections of the society ▪ Facilitate the process of financial assistance
Recovery & Rehabilitation	▪ Participate and involve in recovery efforts and community rehabilitation ▪ Administer relief/financial assistance is made eligible to disaster affected individuals/communities ▪ Create an environment which is conducive to the all round development of children, women and physically challenged persons

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Agriculture Department	
Preparedness	▪ Undertake skill upgradation of department staff and farmers ▪ Prepare state wide preparedness plan to manage drought, other hazards such as floods, pest attack etc ▪ Generate awareness on hazards, weather monitoring and suggest actions
Prevention & Mitigation	▪ Drought monitoring system ▪ Pest and Disease monitoring system ▪ Provide information to undertake crop insurance ▪ Identify storage houses / godowns for early harvest ▪ Establish early warning mechanisms
Alert & Warning Stage	▪ Gather information related to warning of impeding floods, droughts or pest attacks ▪ Take necessary precaution actions, including moving of farm equipments/tools to safe locations ▪ In case of pest attack, determine the source/disease and take measures for protection of standing crop ▪ Advice for harvest if it permits, this will reduce losses which otherwise could be higher
Response	▪ Assessment of damage to crops ▪ Estimate needs for recovery ▪ Discuss with the farming community through agriculture extension cell and support to conduct cleaning operations (to avoid long term water-logging, salinity)
Recovery & Rehabilitation	▪ Provide technical support to prevent further damages and help restart agriculture/farming operations, restore soil conditions ▪ Provide support and material inputs/farm implements to assist in recovery ▪ Quantify loss estimate due to the event and suggest remedial/prevention measures ▪ Depending on the intensity of the damage, establish a programme for agriculture rehabilitation ▪ Ensure farmers are connected to the market (restore agriculture produce market) ▪ Equip farmers with knowledge to deal with drought risks / hydro-meteorological and climate related disasters ▪ Plan for establishment of ‘climate field schools’

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Water Resources Department	
Preparedness	▪ Update State and District wide contingency plan in consultation with the administration ▪ Update embankment maintenance manual ▪ Activate flood monitoring in all flood prone areas, capture information through flood bulletins ▪ Establish coordination linkages with village teams for embankment strengthening and safety ▪ Undertake mapping of vulnerable areas and risk spots
Prevention & Mitigation	▪ Undertake flood protection and erosion management measures ▪ Construction/strengthening/maintenance of embankment ▪ Undertake measures and direct action towards ensure embankment safety ▪ Undertake mitigation actions across the department following the design criteria mentioned in the guidelines for the preparation of DPR of Central Water Commisison, Govt of India. ▪ Conduct pre-monsoon preparedness meeting (April) to take stock of current status, discuss about critical areas, revisit protocol and operating procedures, preparedness checks etc. ▪ Identify active channel causing erosion and take remedial measures
Alert & Warning Stage	▪ Associated with the IMD (to know the rainfall pattern and short term forecasts) and CWC (flood information, to know the flood level) ▪ Maintain Flood Bulletin Chart in all stations. ▪ Embankment Maintenance Manual ▪ Watch flood protection work at all times, with support of locals ▪ Observe and collect local data to determine flash floods
Response	▪ Translate department action based on rainfall forecast and flood information ▪ Activate response plan on the basis of the flood bulletin ▪ Ensure safety of embankments, take immediate protection measures to prevent breach
Recovery & Rehabilitation	▪ Undertake possible interventions to minimize further damage ▪ Undertake emergency and long term flood protection works, embankments

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Power Department	
Preparedness	▪ Undertake DM plan preparation for department and guide support agencies in formulation of their plans ▪ Undertake condition survey of existing infrastructure and pin-point areas for intervention ▪ Skill upgradation and training of staff in DM ▪ Restoration Plan of supply following an interruption across services, communication to all service agencies for preparedness measures and installation of back-up measures
Prevention & Mitigation	▪ Conduct vulnerability assessment of buildings and power infrastructure ▪ Determine fragility of infrastructure to hazard risks and determine mitigation and non-structural mitigation actions ▪ Establish mitigation fund and prioritize actions for risk reduction within the power sector ▪ Identify weak spots in allied/liked infrastructure or power dependent sectors and recommend actions
Alert & Warning Stage	▪ On receipt of advisory, maintain vigil and undertake inspection works wherever necessary ▪ Undertake emergency repaid works if necessary
Response	▪ Undertake rapid assessment/inspection of damage to power infrastructure ▪ Undertake emergency repair of damage poles, other equipments ▪ Dispatch quick response teams for restoration of power lines ▪ In association with line agencies, address disruption to lifelines water and sewerage service, transport; arrange for alternate power supply arrangement at critical facilities ▪ Restore power supply to key lifeline /emergency services such as health care, decision support buildings, industries etc
Recovery & Rehabilitation	▪ Undertake detail damage assessment to power infrastructure ▪ Take steps towards speedy repair and complete restoration of services ▪ Document lessons learnt and incorporate/update in the Power sector DM plan

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Education Department	
Preparedness	▪ Develop a department wide plan in DM ▪ Ensure all schools/institutions within the department jurisdiction (Govt and Private) have Building Level Emergency Response/Preparedness Plan ▪ Undertake training of teachers in preparation of School Disaster Management Plan ▪ Undertake training of children and school staff in basic first-aid, select search and rescue methods. ▪ Organize rally and education programmes to raise awareness ▪ Encourage to volunteer and participate in DM activities, conduct preparedness drills
Prevention & Mitigation	▪ Undertake vulnerability assessment of education infrastructure and publish analysis/findings ▪ Identify structural and non-structural risk reduction/mitigation measures ▪ Develop state level mitigation plan ▪ Work towards developing safety policy and safety rules that can be applicable to Govt and Private run institutions ▪ Ensure hazard resistant design is an integral part of design and construction of new buildings/new rooms or any expansion activity
Alert & Warning Stage	▪ Convey appropriate information to the administration staff in the department, further relay of information based on established protocol
Response	▪ Undertake rapid damage assessment of health facilities. Declare facilities fit for continuing operations ▪ Notify continuation of activities or temporary closure till situation is normalized ▪ Based on the notification / disaster declaration, provide necessary support for schools to function as temporary shelters / relief distribution centres
Recovery & Rehabilitation	▪ Detailed damage assessment of education infrastructure ▪ Ensure drr concerns are considered in design of new facilities /strengthening of existing facilities

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Panchayat and Rural Development Department	
Preparedness	▪ Analyze type of hazard risk in the area ▪ Form various committees of the youth for effective response ▪ Organize drill practices to raise awareness and test the local plan ▪ Develop DM plan for the department ▪ Undertake training and capacity building of staff, elected representatives and other officials ▪ Promote the concept of village cluster DM plan
Prevention & Mitigation	▪ Ensure all development schemes routed though the department or through various schemes directed for implementation, take into consideration of DM requirements. ▪ Undertake measures to strengthen the department buildings across the state
Alert & Warning Stage	▪ Coordinate with the officials to relay information and activation of the plan (based on threat levels)
Response	▪ Coordinate support from line agencies to undertake response activities ▪ Coordinate with line agencies/departments and ensure supply of relief materials
Recovery & Rehabilitation	▪ Ensure that beneficiary receives the benefit of the rehabilitation and reconstruction scheme ▪ Strengthen the capacity by involving people in R&R efforts.

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Urban Development Department	
Preparedness	▪ Direct the urban areas to prepare city wide disaster management plan, and detail ward level DM plan to meet any type of exigency ▪ Provide training and capacity building to department staff in disaster management ▪ Direct the local government to submit the DM Plan to UDD and ASDMA. ASDMA to approve the DM Plan
Prevention & Mitigation	▪ Support activities to undertake risk assessment of the city ▪ Incorporate/integrate DM concerns or hazard resistant construction into process of: Land Use plan, Building byelaws, General development control regulations, City Development Plan, Master Plan ▪ Facilitate developing a robust response plan in urban areas ▪ Prepare department specific hazard mitigation plan
Alert & Warning Stage	▪ Identify mechanism for outreach of information to people residing in urban areas ▪ Set up areas for establishing relief camps ▪ Direct the local government to determine needs and take necessary measures for coordinated response ▪ Direct local government of undertake quick assessment of ground situation and direct allied urban systems to remain alert/activated (shelter/medial response/law and order/communication/water supply and sanitation etc).
Response	▪ Undertake rapid assessment of damage areas ▪ Housing back people to homes that are determined safe ▪ Work with line agency for removal of debris ▪ Mobilise efforts for undertaking heavy urban search and rescue, medical care/mass casualty care ▪ Provision of shelter to the needy and minimize failure of basic services
Recovery & Rehabilitation	▪ Restoration of basic services ▪ Provision of temporary housing and implementation of R&R package for urban areas

Note: **Guwahati Development Department** shall follow activities in conjunction to the Urban Development Department

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Finance Department	
Preparedness	▪ Garner Support towards making provisions for establishing State Disaster/Hazard Mitigation Fund
Prevention & Mitigation	▪ Establish State Disaster/Hazard Mitigation Fund ▪ Direct development planning activities/schemes to incorporate or build-in safety nets/mitigation measures
Alert & Warning Stage	▪ Pass information to key department officials. No action required.
Response	▪ Determine preliminary allocation of funds to undertake relief efforts ▪ Mobilization of resources
Recovery & Rehabilitation	▪ Review damage assessment studies ▪ Work out estimates for central/state assistance

ACTIVITIES IN DIFFERENT MISSION AREAS OF DISASTER MANAGEMENT Animal Husbandry & Veterinary Department	
Preparedness	▪ Determine livestock population risk to various hazards ▪ Identify list of possible shelter points ▪ Maintain livestock update and list down essential supplies/equipment required in case of disaster ▪ Train staff to ensure/undertake quarantine requirements ▪ Planning for response and recovery operations
Prevention & Mitigation	▪ Encourage farmers for insurance of livestock ▪ Establish monitoring mechanism for disease control
Alert & Warning Stage	▪ Identify shelter, fodder requirements, veterinary equipments ▪ In case of disease outbreak, follow necessary instruction and protocol identified by the department. ▪ Detection, diagnosis, assessment of risk and surveillance of the disease ▪ Vector control, Quarantine control
Response	▪ Eradicate and control of animal diseases ▪ Deploy team to do quick access of damage and identify requirement for relief/rescue, equipment and fodder ▪ Assessment of injured stock and undertake treatment measures ▪ Coordinate with wildlife department to take necessary measures and treatment of injured animals ▪ Manage livestock population in emergency period, provide treatment to injured animals ▪ Coordinate with agencies for supply and distribution of fodder and other materials ▪ Draw assistance from the local government and line agencies to dispose of carcass in a scientific manner, disinfection of contaminated areas ▪ Draw measures for protection and care of abandoned livestock ▪ Establish infrastructure support, include cattle camps, feeding centres, veterinary aid centres,
Recovery & Rehabilitation	▪ Ensure relief distribution and administer financial assistance ▪ Undertake detail damage and loss assessment for the Sector, determine financial assistance ▪ Continue giving veterinary advice till business returns to normal ▪ Continue undertaking assessments of injured animal stock, coordinate disposal of carcass

PART – IV INFORMATION & COMMUNICATION TECHNOLOGY SYSTEM (ICTS) FOR DISASTER MANAGEMENT

SECTION 1: GENERAL

Communication links across organizations is vital for coordination and effective response to disaster situations. Communication linkages between decision makers at all levels and operational response teams/personnel at the disaster site will have to be highly reliable. Unfortunately, at the time of emergency situations such as natural or man-made disasters, the first casualty is the public telecommunications infrastructure of wired phones and wireless (cell phones) phones as well as other communication network resources.

Public communication networks are affected during natural or manmade disasters due to multiple causes including:

1. Non availability of mains during floods due to failure of electrical generation / transmission equipment or switching off of supply to prevent electrocution
2. Back-up power supply equipment for cell phone systems or telephone exchanges installed on ground floor or in basements being flooded,
3. Damage to buildings housing communication equipment and transmission towers due to severe ground shaking caused by earthquake event or
4. Severe congestion of cellular as well as land line telephone network switches due to sudden rush of communication traffic after any major disasters

The unique geo-environmental setting of the North eastern region vis-à-vis the Eastern Himalayas, the heavy rainfall, weak geological formations, accelerated rates of erosion followed by silting and meandering of rivers, very high seismicity makes the North east one of the most disaster prone regions in the country. Considering this and also the comparative inaccessibility, the North-eastern region demands special attention to minimize loss of lives and social, private and community losses and to ensure sustainable development. The state of Assam is vulnerable to multiple natural / manmade disasters. Considering the crucial role of communication links during such emergencies, it is proposed to set-up reliable information and communication network employing both terrestrial as well as satellite-based systems with adequate redundancy for expected reliability standards (>99.5%).

In the immediate aftermath of a disaster, quick and efficient response during the first few hours of a disaster is very important for minimizing damage and personal injury. In this regard, communication links across organizations is vital for coordination and effective response to disaster situations. Communication linkages between decision makers at all levels and operational response teams/personnel at the disaster site will have to be highly reliable. Unfortunately, at the time of emergency situations such as natural or man-made disasters, the first casualty is the public telecommunications infrastructure of wired phones and wireless (cell phones) phones as well as other communication network resources.

To overcome existing impediment and establish a failsafe communication system, ASDMA proposes to build a fail-safe Information and Communications infrastructure, which will be necessary for effective and efficient disaster management activities.

SECTION 2: INFORMATION AND COMMUNICATIONS TECHNOLOGY SYSTEMS (ICTS) ARCHITECTURE

4.2.1 Design Criteria

State wide Emergency Communication Network (ECN) shall meet high reliability requirements. The proposed ECN shall be an integrated system of different technologies to satisfy following criteria:

- The availability and reliability of the system should be better than 99.5%
- At the minimum it would provide voice, and medium speed data links between various authorities / agencies involved in Disaster Management (DM) / Emergency Response tasks
- The system would remain operational for at least 24 hours even if mains power is not available
- The system would have capability for inter-operation between various communication networks used by Government agencies that are responsible for post disaster relief operations. It would be possible to establish communication between primary response forces (known as first responders) using VHF sets and VoIP phones based on wired or wireless LAN to provide connectivity with senior officers at various EOCs/DRICs
- The system *(except transportable and portable system that are to be deployed at disaster sites)* would be operational round the clock (24X7).

ECN will use following network resources:

- Public telecommunication network resources *(telephone and cellphone networks)*
- State Wide Area Network (SWAN)
- Dedicated VSAT networks for interconnection between State, District and Civil Sub-Division level EOCs and
- Broadband Internet links whereevr they are available
- Wireless networks of government departments
- Ham Radios during disaster situtaions from such sites where they are operational

Interconnection with Wireless networks of various departments of Assam State Government will be provided via universal interface system. Such wireless networks will include:

- Wireless radio networks of Police department
- Wireless networks of Irrigation and fire departments and
- Proposed wirless network of revenue department, police etc. Setting up of State ECN

4.2.2 Key functions areas of State ECN

This includes:

- Receive, monitor, and assess disaster information
- Keep track of available resources.
- Monitor, assess, and track response units and resource requests.
- Manage resource deployment for optimal usage.
- Make policy decisions and proclaim local emergencies as needed.
- Provide direction and management for DRIC operations through Standard Operations Guide (SOG), set priorities and establish strategies.
- Coordinate operations of all responding units, including law enforcement, fire, medical, logistics etc.
- Augment comprehensive emergency communication from EOC to any field operation when needed or appropriate.
- Provide recovery assistance in response to the situations and available resources
- Keep senior and subordinate officials informed on situation up dates
- Operate a message centre to log and post all key disaster information.
- Develop and disseminate public information warnings and instructions.
- Provide information to the news media.

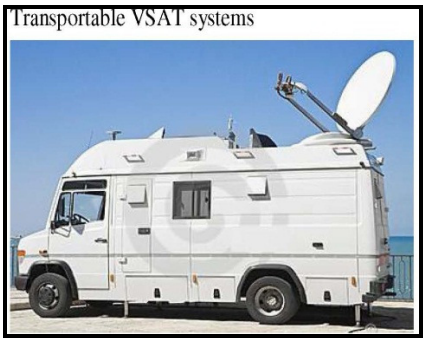
4.2.3 ASDMA - ICTS Architecture

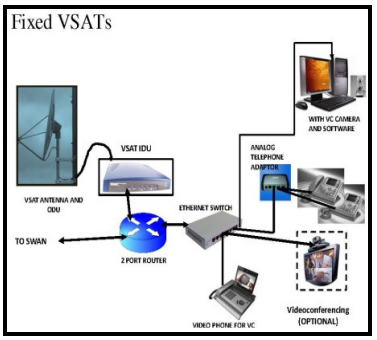
Assam State Disaster Management Authority –Information and Communications Technology Systems (ASDMA-ICTS) architecture would operate on a reliable communication network backbone that will be operational on 24x7 basis. The proposed communication network is expected to facilitate effective disaster response by maintaining continuous communication between the Emergency Operations Centres ("EOC") / Disaster Response & Information Centre ("DRIC") at State, District, Sub- Division & Revenue Circle and command centres specifically set-up at disaster sites using specially designed Emergency Response Vehicles ("ERV") or portable emergency communication systems. The network will be used for information management (data, video and voice communications) and to support incident and information management systems during all stages of disaster management. The following activities are envisaged to shape the ICTS Architecture:

4.2.3.1. Design Criteria of State Emergency Communication Network

The proposed State Emergency Communications Network (ECN) will provide voice, data and video communication facility (minimum data rate @ 128 Kbps). The system will also have data distribution capability so that information regarding disaster build up can be conveyed to district and Civil Sub-Division level authorities as well as other government agencies at State level. The State ECN will interconnect all State, Divisional and Civil Sub-Divisional Level Emergency Operation Centres (EOC) / State Disaster Response & Information Centre (SDRIC). ECN will incorporate existing / updated (if necessary) Early Warning System (EWS) to alert vulnerable population regarding impending disasters such as floods and cyclonic storm conditions. ECN will use the following network resources:

- Public telecommunication network resources (telephone and cell phone networks)
- State Wide Area Network (SWAN).
- Dedicated VSAT networks for interconnection between State, District, Civil Sub-Division and Revenue Circle level EOC





- Broadband Internet links wherever they are available.
- Wireless networks of government departments (Police, fire, irrigation department etc.).
- Ham Radios during disaster situations from such sites where they are operational.

4.2.3.2. Design of State Disaster Response and Information Centre (State - DRIC)

The State Control Room has been renamed as Assam State Disaster Response & Information Centre (SDRIC) and is operational round the clock (24X7). Alert and warning messages are sent to district offices via email and SMS. The SDRIC will be further upgraded and equipped with facilities as detailed below:

- Setting-up of a Call Centre for access to public and issuing alert messages.
- Information Management System Portal (IMSP)
- Emergency Helpline and service integration (Ambulance /Police/Fire) Activation process
- Voice communication and audio conferencing between various responsible Organisations and officials
- Data transfer for monitoring of scope of disasters and official communications (such as e-mails) for information collection as well as for issuing orders / directions etc.
- Video file transfers and Videoconferencing between various agencies to get pictorial information regarding disasters and face to face meetings for deciding on course of response to Disasters.
- State DRIC will also act as network hub for Emergency Communication Network (ECN) and control centre for issuing Emergency warning messages

4.2.3.3. Set up of Early Warning System:

The disaster Early Warning System (EWS) helps vulnerable communities in cases of natural or manmade disasters in taking timely defensive action to save themselves, their livestock, and valuables from effects of disaster situations. The EWS is highly

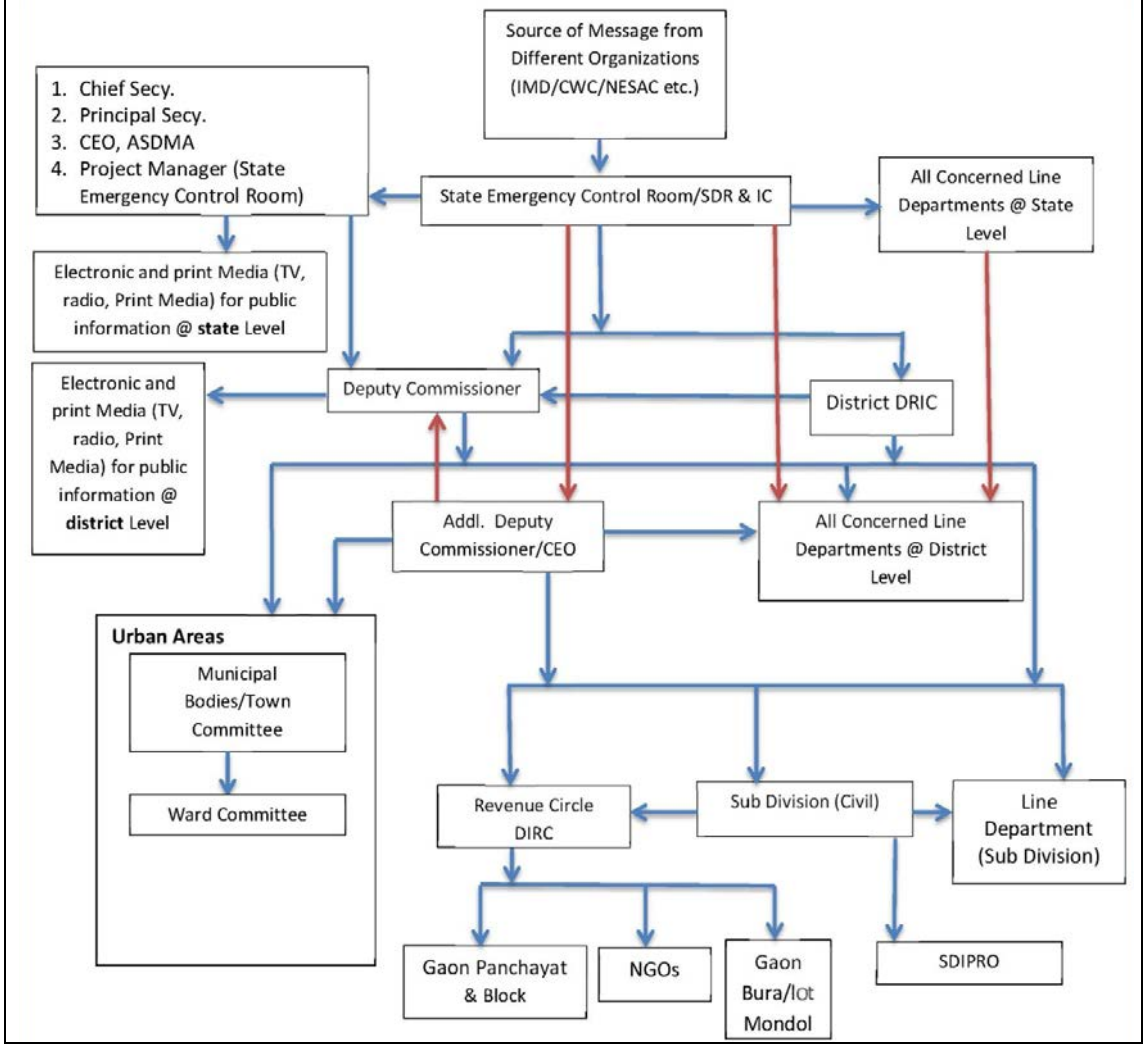
effective in reducing casualties in cases of Cyclones as well as Floods when accurate, timely and unambiguous warning messages are issued to people staying in vulnerable areas. All warning messages need to be disseminated to largest number of people at any time of the day. EWS design ensures that the dissemination system is functional round the clock (24X7). Necessary infrastructure for a reliable EWS will consist of:

- State Emergency Operations Centre (SEOC) will have necessary links to knowledge centres with analysis and prediction capabilities.
- Reliable communication links with organizations responsible for issuing disaster alerts such as IMD, CWC, Irrigation department, National EOC etc.
- Centralized warning dissemination system to be set-up at state EOC to generate alerts for Senior officers of government and Municipal Corporations, Organizations responsible for disaster response (first responders), Control Rooms at different levels and automatic warning message distribution to vulnerable public.
- ASDMA will support line departments for enhancing their prediction capabilities for developing an early warning mechanism with greater accuracy for mitigating disaster.

The flow of Early Warning messages is indicated in Fig 21. Further, a large numbers of technology options exist that are suitable for dissemination of early warning messages. The following technologies are suitable for the State of Assam:

- Very High Frequency (VHF) wireless radio network
- Land line phones or Wireless in Local Loop phones
- Cell phone network
- Public Frequency Modulation (FM) Radio Community radio
- Direct To Home (DTH) Television systems
- Inmarsat satellite based systems (Business Global Area Network (BGAN) or D+ systems)
- Interactive Voice Response (IVR) systems or call centres
- Very Small Aperture Terminals (VSAT) networks
- Village Resource Centres (VRC) or Village Knowledge Centres (VKC)
- Ham Radios
- DTH based audio warning and
- Automatic broadcast via telephone dialling system

Figure 21 Flow of warning messages to concerned departments



4.2.3.4. State Disaster Resource Network (SDRN)

SDRN is an online inventory designed as a decision support system for the use of decision makers responsible for disaster management to take appropriate steps in short time. The resource data includes information regarding vulnerable population within a specified area (Village, District), human resources and equipments in addition to a large data on parameters that help in prediction of losses (property as well human lives) in case of a disaster. Such predictions even though approximate, are useful to arrive at initial decisions regarding provisioning of relief materials and resources. SDRN data has proved an important tool in disaster preparedness, mitigation efforts as well planning for setting-up of new infrastructure facilities such as schools, hospitals etc. Assam State SDRN will be based on Census 2011 data.

4.2.3.5. Development of an Emergency Management Information System for Assam

Remote Sensing, GIS and GPS play an important role in decision making during pre and post disasters. All phases of emergency management depend on data from a

variety of sources. Most of the data requirements for emergency management are of a spatial nature and can be located on a map. Therefore, appropriate data has to be gathered, organised and displayed logically to start emergency management planning. During an actual emergency it is critical to have the right data, at the right time, displayed logically, to respond and take appropriate actions.

Realizing the importance of Remote Sensing, GIS and GPS technologies in disaster management strategy, Assam State Disaster Management Authority intends to build its GIS database to develop an Emergency Management Information System for Assam which will act as a decision support system and will help the administrative machinery in decision making during pre and post disasters.

SECTION 3: ARRANGEMENT AT DISTRICT LEVEL

The Deputy Commissioner (DC), who is the head of the District Administration, will be the responsible officer and the competent authority, who will be assisted by his deputies at district HQ and Sub divisional level officers. The DC will be supported by other departments that carry out emergency support functions such as police, fire, health, transport, Water Resources, food and civil supplies etc. All these organizations will have communication links based on Public Telephone and SWAN infrastructure. Wireless radios may be procured in case public telecom infrastructure is not up to the mark or doesn't exist in few places. Communication equipment and levels of back-up resources facilities will provide voice, data and videoconferencing facilities for officers involved in DM activities. DEOC/DDRIC may have a back-up system for issuing warning messages. This can be ensured by installing necessary software in the Desktop-PC as part of ECN.

SECTION 4: ARRANGEMENT AT LOCAL LEVEL

Local revenue officials will be responsible for emergency response activities. These officials are responsible for preparing local Disaster Management Plan and hence will have details of skilled manpower and material resources available at their disposal for planning emergency response activities.

Local officials will be responsible to ensure that warning messages are delivered to vulnerable population using automatic or manual public address systems or manual sirens as the case may be.

At local level a designated **Local Support Centre** may be notified. Schools having large areas in the neighborhood may be designated with a Centre Code. During a disaster, the head of the institution by default can be designated the role of the coordinating officer with a vital role of maintaining and updating the situation report. The coordinating officer shall further transmit the information to the next higher unit. The ward councilor, member of Panchayat, local DMT members, volunteers may function from the local Support Centre.

PART – V MITIGATION

SECTION 1: GENERAL

Mitigation means lessening or limitation of the adverse impacts of hazards and related disasters (UNISDR 2007). The adverse impacts of hazards often cannot be prevented fully, but their scale or severity can be substantially lessened by various strategies and actions. Mitigation measures encompass:

- Design improvements or hardening the infrastructure to hazard risks - engineering techniques and hazard resistant construction
- Enhancing the serviceability of systems and its elements under the action of the hazard (Includes, non-structural elements)
- Improved policies *(risk sensitive future landuse planning and regulatory frameworks for building standards, redevelopment of core areas with high vulnerability, risk transfer instruments)*
- Design improvements in the design and construction of all new infrastructures including extension works
- Planning/buildings resilience of the communities and systems including lifeline infrastructure

From the perspective of mission areas mentioned in Subsection 1.4.1, Mitigation measures is in continuum with development planning activities and have a clear over lap with Preparedness measures, Reconstruction and Rehabilitation interventions. With growing economic loss from every disaster, mitigation strand stands as a critical performer to reduce or eliminate risks to life, property and ensure safety of citizens.

All departments of the State (with or without specific portfolio in DM) , technical agencies supporting the development activities (including consultancy firms and individuals who provide technical advice/develop proposals), private sector and communities/society have role in undertaking mitigation measures, by recognizing, understanding, communicating and planning for building towards a resilient Assam. Measures towards mitigation can be realized in short-term and long-term *(example: retrofitting of all school buildings, hospitals, critical infrastructure, cultural heritage properties in the state of Assam)*.

SECTION 2: SETTING GOALS FOR HAZARD RISK MITIGATION

Goal 1: Hazard identification and arriving at comprehensive Composite Multi-Hazard Risk and Vulnerability Assessment (Atlas) for the State of Assam

It is utmost necessary to identify all hazards that occur in the geographical area of Assam and immediate boundaries, estimate probable hazard intensities – magnitude and frequency, and develop cascade effect mapping/scenario for various hazard risks individually and as composite. The results of the assessment can be utilized to prioritize vulnerability reduction / risk treatment options, investment planning across the state in DM, target specific sectors with significant annualized risk, mainstream risk reduction in development policy of the state including planned schemes and create an effective hazard specific response plan.

Risk assessment information will identify hazard proneness in a geographical area. New developments can be directed in safe locations so as to avoid or minimize exposure to hazard or enhance the design requirements to withstand

the intensity of the hazard. Such information will help to improve overall decision making process, bring or strengthen laws/regulations, build overall resilience of systems and communities of the State.

Information generated over MHRVA process will require wider dissemination strategy to substantially increase societal awareness of hazard risk in their specific zones and that people demands safer areas to live and work.

Goal 2: Minimize loss of life and injuries

Mitigation results in enhancing the safety parameters of existing elements and meets the safety standards in all new development works. Bringing amendments in the relevant legislations *(shift towards risk sensitive land-use planning, development control regulations takes into consideration of seismic-microzonation studies, building byelaws incorporate BIS/IS Code of Practice and enforcement mechanism established)* will significantly reduce loss of life and injuries. While new structures can be built safe, activities which involve repairs, alterations, redevelopment will also have to incorporate mitigation measures.

Goal 3: Minimize damage, disruption of services

Mitigation measures and policies applicable to new and existing development will not only minimize loss of life but also reduce disruption of services. Continuity of operations especially for critical/lifeline infrastructure and its supporting elements is vital for undertaking response actions and community well being, at no point in time these services should get disrupted.

Goal 4: Minimize loss of livelihood and business interruption

Mitigation actions ensure continuity in business and minimize disruption in the flow of goods and services. This ensures work at all times, liquidity in the market and prevents long-term loss of livelihood.

Goal 5: Minimize damage to environment

Disasters also cause significant damage to the environment. Large earthquakes have altered the course of rivers, landslides blockades have resulted in creating reservoirs and threaten to cause flash floods affecting large areas; catastrophic floods adversely affect the physical environment. Damage to environment also includes permanent landscape changes caused due to high intensity events. The quality of natural / environmental resources is adversely affected, thereby affecting the biodiversity. Flooding adversely effect water quality and throw a challenge to availability of drinking water. Debris disposal has emerged as major environmental challenge in pos-disaster situations. A well though strategy for debris removal, disposal and reuse is emphasized.

SECTION 3: PATH TOWARDS HAZARD MITIGATION

5.3.1 Integration of DM in future/ development plan, new programmes/schemes and projects

Incorporation of mitigation elements in new development minimize the risk to loss of life, property and protect State's assets. Development must assure stability and integrity of the area and not create/contribute towards instability

of slopes, changes in natural landform nor erosion. Large scale structural protection works should respect needs of the locals and not cause inconvenience/disruption to their well-being.

The State has laws that regulate landuse zoning and general development control regulations. The Model Building Byelaws *(issued by Ministry of Home Affairs, Sept 2004)* have attempted to guide landuse with development decisions. Development plan and sanction of projects should strictly be based on the recommendations provided in model building byelaws. There are many opportunities for various administration scales to reduce exposure in the planning process and while implementation of the schemes. In order to speed up the process, a separate law may be required for administration units and departments to adopt a comprehensive, long-term and measurable plan for integration of mitigation in development. At the urban level, the local Government has to regulate land use and implement 'local hazard zone map' in the preparation of perspective plan, development plan, economic plan or the city development plan, or any other plan which is a pre-requisite for avail of funds under the planned scheme.

5.3.2 Monitoring safety and strengthening of critical infrastructure/facilities, lifeline infrastructure from all hazards

In a high hazard prone State of Assam; consideration has to be taken towards protection of infrastructure that has to serve the most during the period of emergency response. There is no standard definition for critical infrastructure, critical facilities or lifeline infrastructure. The state should establish the definition and common vocabulary for this important area. A suggested diagram in the form of a pyramid with three or four levels can position all critical facilities/infrastructure that require attention and protection form hazard risks. Education buildings, hospital buildings and heritage properties (natural and cultural significance) must receive due position in the critical infrastructure/facilities pyramid diagram

Emergency services (emergency operations centre, fire stations, ambulance services, police stations, medical facilities), power infrastructure (generation, transmission and distribution), relief godowns and other storage facilities, manufacturing units/industries, telecommunication, reservoirs, utilities *(water mains and distribution lines, treatment plants, petrochemical pipelines)*, communication (air/rail/road/inland transport) will all form an important part of critical facilities/infrastructure.

Infrastructures are mutually dependent on each other. State's critical facilities/infrastructure is owned and operated by Government and Private sector. It is therefore essential to build a partnership between Government and Private Sector to ensure protection of critical assets from all hazards. A Business-Government Task Force on protection of critical infrastructure can enhance the work in this field. Periodic consultation and public-private sector partnership can be developed by establishing a Critical Infrastructure Protection Task Force (Government-Private Sector).

The State shall establish a mechanism to develop a common database of type and location of all critical facilities/structures and lifeline infrastructure *(location mapping of select facilities has already been initiated by ASDMA)*. A consistent reporting requirement in a secured network will enable updating and rating of all facilities at risk to various hazards.

5.3.3 Implementation of National Building Code 2007 and relevant BIS code for life safety in all construction and development activities

Building code has been the main mitigation tool for most buildings and infrastructure. The impacts of ground shaking, flooding, winds, fire and other hazards can be mitigated in all new development. A large number of buildings in the housing stock are found to be vulnerable to earthquake, floods and wind speeds *(Housing Risk Tables, Vulnerability Atlas of India, BMTPC 2007)*. Places of mass gathering such as cinema halls, places of worship, meeting halls, shopping complex (mall), parking areas must meet all compliance standards and must further expand to meet the requirement of multiple ingress and egress points for emergency access and evacuation. Buildings which cater to high capacity of people shall provide adequate street widths for two-directional movement in an emergency and easy movement of emergency vehicles.

Building above seven floors will require design check and approval from Assam Engineering College or Indian Institute of Technology, Guwahati .in order to translate design to practice, it is suggested to incorporate all formats as proposed in the Model Building Byelaws issues by the Ministry of Home Affairs (Sept 2004). Registration of professionals shall be made mandatory and professionals on record are only allowed to execute the design, construction, strengthening/retrofitting and maintenance of residential/commercial/public buildings.

Supportive policy and regulatory framework will have to be drawn to deal with retrofitting of existing weak and hazardous buildings. This should also be extended to all lifeline/critical infrastructure and critical buildings.

5.3.4 Strategy for implementation of Mitigation actions

All departments of the State are primarily responsible for implementing mitigation activities. ASDMA shall facilitate the much needed interagency discussion, cooperation with technical institutions and consulting firms, develop a comprehensive strategy (see section below), draw upon legislation requirements in consultation with key departments and experts, bring upon amendment to existing development control regulation or even the codes based on comprehensive risk assessment analysis results and monitor/review progress in the mission area of mitigation. Responsibility for oversight and implementation lies with the SEC.

5.3.5 Development of State wide comprehensive mitigation policy and plan

National Disaster Management Division (MHA), NDMA, ASDMA has increased emphasis on mitigation due to recent loss of life and damage to property observed from events in India and across the world. North-East region of India is considered to be among one of the most active seismic zones

in the world. The region is also probe to catastrophic floods and other hazards. Even an approximate estimate shows prospect of greater catastrophic loss in the future. The State should come with a policy which aims to achieve the goal to significantly reduce risk of loss of life, injury and economic costs.

The way forward for mitigation action for the State and ASDMA is to frame a State Mitigation Policy and discuss with stakeholders to further develop a State Hazard Mitigation Plan (for both 'significant' and 'others' hazard). Apart from establishing State Disaster Mitigation Fund (as suggested in DM Act 2005), another process could be developing a multi-agency approach to tap the resources of State Government departments/agencies, the private sector to develop a Public-Private Partnership arrangement. SDMF and PPP Model if knit together, can result in developing a comprehensive mitigation action programme. Fund disbursement from SDMF can also be directed to also implement Local Hazard Mitigation Plan with involvement and part contribution from Local Government and affected community. Community engagement is vital and it has to be an integral part of the process/fund support.

PART – VI PREPAREDNESS

SECTION 1: GENERAL

The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions. Preparedness action is carried out within the context of disaster risk management and aims to build the capacities needed to efficiently manage all types of emergencies and achieve orderly transitions from response through to sustained recovery. Preparedness is based on a sound analysis of disaster risks ***(risk assessment)*** and good linkages with early warning systems, and includes such activities as:

- contingency planning
- stockpiling of equipment and supplies
- the development of arrangements for coordination
- evacuation and public information, and
- associated training and field exercises

The related term "readiness" describes the ability to quickly and appropriately respond when required (Reference: UNISDR 2007).

Preparedness actions if undertaken in a timely manner will create conditions for safer and resilient communities. It enhances the spirit of cooperation and collaboration with all sections and institutions of the society.

Full scale preparedness also includes the development of response and recovery plans, and will have overlap with the mission measures included for specific hazard mitigation. For actions to be taken on a continued basis, this mission area must be supported by formal institutional, legal and budgetary capacities. Damage can be significantly reduced by participation of stakeholders in preparedness activities and through effective demonstration methods which in turn will build pubic confidence.

SECTION 2: ENHANCING RESILIENCE OF COMMUNITIES AND SYSTEMS

In the last decade the focus of DM has been towards building capacities and creating resilience communities in risk prone regions. Although Preparedness should start at the community it equally applies to Government, Departments functions and services (especially utilities), private sector, trade and commerce, CBOs/NGOs etc.

As per the definition by UNISDR (2007), it is the ability of a system, community or society exposed to hazards to resist, absorb, accommodate to and recover from the effects of a hazard in a timely and efficient manner, including through the preservation and restoration of its essential basic structures and functions. Resilience means the ability to "resile from" or "spring back from" a shock. The resilience of a community in respect to potential hazard events is determined by the degree to which the community has the necessary resources and is capable of organizing itself both prior to and during times of need.

This definition has now expanded its outreach from communities to national/state and critical or lifeline infrastructure systems (*refer National Disaster Management Guidelines for Threats to Municipal Water Supply and Water Reservoirs, NDMA 2010)*. From observations of past disaster events in the State as well as form disasters globally, it is clearly understood that infrastructure does not represent stand alone system belonging to one sector, but there is

increasing overlap of networks or inter-dependence link among sectors. A resilient infrastructure system combined with strengthening of connecting node in the network (all key sectors, including communities) will be able to withstand and function during adverse conditions.

SECTION 3: PREPAREDNESS PLANNING

6.3.1 Planning outline

Disaster management planning is the responsibility of all - SDMA, DDMA and Local Authorities. As per the DM Act 2005 and ASDMA DM rules 2010, all administration levels are required to incorporate preparedness component in their respective DM Plan. At the overall State level, consistency must be achieved between Preparedness Plans at State, District and Local level. In addition private sector and utility/lifeline agencies should prepare plan that threaten to disrupt their normal operations during events. The output of these processes can be captured in ***Business Continuity Plans*** with clear instructions to deal with specific events/multiple events, yet manage to function and not get severely affected. Specific agencies which are operational and provide basic service and lifeline services to the community will have to consider preparing ***Operational Plans*** which provides details of tasks (before, during and after disaster), timeline for actions and roles and responsibilities for response and minimize service outages.

The overall outline of the plan preparation shall involve conduct of a systematic process of engaging stakeholders at all levels *(Government, Private Sector, CBOs, Scientific and Technical organizations and Academic/Training institutions)* including the communities, as appropriate in the development of state wide strategy which is executable all through the year and measurable, operational at all levels with due focus on cooperation and collaboration with all sections of the society, and with deep engagement of the communities through a focused community based approach, The following objectives should be met:

- Develop plans at all levels (State/District/Local/Sector wide/Units wise for infrastructure and buildings including residential and commercial properties) by taking into consideration of all points mentioned herewith:
    - identify hazard risks and inform guidance brief on impact of disasters (covering events likely to occur in their respective areas)
    - provide a detailed/synoptic view of the sequence of risks (depending on the scale of risk assessment information available)
    - define the preparedness objective and achieve the same
    - state the intent to deal with disaster situation
    - arrangement and structures for response
    - risk communication (including translation of early warning information to the communities/stakeholders) and coordination arrangement
    - resource identification and

- implement planning requirements with a defined time frame and meet the target using available resources or made available through scheme, and
- monitor and report back progress to the concerned authority as outlined in the State DM Rules and DM Act.

- Implement the Preparedness Plan, exercise through drill and simulations to test the efficacy of the plan, update the plan based on the findings, involve additional stakeholders if need arise, and maintain plan to ensure its usability/applicability and ensure continuity and minimize interruption in disaster situations.

6.3.2 Hazard specific preparedness plan

Disaster impacts are hazard specific and in some cases there can be multiple scenarios which can emerge (collateral hazards). One of the examples is fault rupture, liquefaction – ground failure, landslides – earth movement, seiches in water bodies/reservoirs caused by earthquake. Authority, Departments, Stakeholders involved in preparation of plan will have to address specific hazards *(including associated collateral hazards)*.

Hazard specific plans will have to address hazard specific actions by respective government departments/agencies primarily responsible for the management function. A primary agency will have complete the responsibility to ensure development of State wide hazard specific preparedness plan. The plan shall address estimate potential scenarios, suggest actions against all impacts, outline mission overlaps (mitigation, response, recovery, rehabilitation and reconstruction), include information on links and arrangements with support / secondary agency for management of hazard specific event, outline coordination and operational support requirement, define communication arrangements (including ews), sharing of plan with stakeholders, testing the plan based on table-top exercises/simulation exercises/scenario planning, plan updation, monitoring progress and review. Primary agencies will be reporting to the SEC and ASDMA and will link to the arrangements outlined as per the National DM guidelines issued by NDMA.

Part III of the ASDMP outlines the Roles and Responsibilities of the Departments of the State Government in application of DM functionality across all mission areas. Taking the reference of 'Roles and Responsibilities' as outlined in Part III, table below indicates a list of primary agencies responsible for preparation of hazard specific for the State.

Hazard	**Primary Agency**	**Supporting Guidelines and Plans (issued by National / State)**
Earthquake	Revenue & Disaster Management Department / ASDMA	NDMG on Earthquakes
Landslides	Revenue & Disaster Management Department / ASDMA / UDD	NDMG on Landslides
Cyclone and Wind	Revenue & Disaster Management Department /	NDMG on Cyclones

Hazard	Primary Agency	Supporting Guidelines and Plans (issued by National / State)
	ASDMA	
Floods	Water Resources Department	NDMG on Floods
Urban flooding	Urban Development Department / Local Government	NDMG, Guidelines on Management of Urban Flooding
Drought	Agriculture Department	NDMG on Drought Management
Forest Fire	Environment & Forests Department	*Currently not available*
Lightning	Revenue & Disaster Management Department	*Currently not available*
Chemical / Hazardous Material release	Industries & Commerce Department	NDMG on Chemical Disaster (Industrial) NDMG for Strengthening of safety and security for transportation of POL tankers Petroleum and Natural Gas Regulatory Board (Codes of Practices for Emergency Response and Disaster Management Plan (ERDMP)) Regulations, 2010 Petroleum and Natural Gas Regulatory Board (Technical Standards and Specifications including Safety Standards for Natural Gas Pipelines) Regulations, 2009
Accident	Indian Railways (rail) Transport Department (road) Transport department (inland waterways)	Railways Disaster Management Plan
Epidemic / Biological related	Health and Family Welfare Department	NDMG on Medical Preparedness and Mass Casualty Management
Influenza Pandemic	Animal Husbandry and Veterinary Department	NDMG on Pandemic Preparedness Beyond Health
Structural collapse	Public Works Department or Urban Development Department or Department of Fire & Emergency Services (State Fire Services Organization)	*Currently not available*
CBRNE	Home Department	NDMG for Mechanism to Detect, Prevent and Respond to Radiological Emergencies in India NDMG for Chemical(Terrorism) Disaster Guidelines NDMG for Nuclear and Radiological Emergencies NDMG for Biological Disaster
Crop Failure	Agriculture Department	Crisis Management Plan Drought (Ministry of

Hazard	Primary Agency	Supporting Guidelines and Plans (issued by National / State)
		Agriculture, 2011) Manual for Drought Management (Ministry of Agriculture, 2009)
Power Failure	Power (Electricity) Department	*Currently not available*

6.3.3 Sector/Services or Function specific preparedness plan

Part III of the ASDMP outlines the key functions of the departments/agencies in regard to the mission components. Department/Agency along with their respective DM roles and responsibilities is mentioned in Section 3.2.2. SOPs for primary responsibility agency (functional lead agency) with specific functions as listed in Section 3.2.3.

Although a single department is featured with primary responsibility, the functions usually spread beyond the capabilities of an individual department. Primary responsibility agency will provide the leadership and coordination support, technical inputs for conduct of activities as per the intended function.

The following table outlines the primary responsibility and the title of the functional Preparedness Plan to be submitted by the Department in a time-frame of one year from publication of ASDMP.

PRIMARY RESPONSIBILITY	DEPARTMENT	PLAN TITLE
DM Operations and Plans, Warnings	**Revenue & DM Department**	**Multi-Hazard Early Warning Communication Plan**
Medical Care and Health Services	**Health & Family Welfare Department**	**State Medical Emergency Preparedness & Response Plan**
Law & Order, Safety & Security	**Home Department**	**Crisis Management Plan**
Emergency Response, Search & Rescue	**Home Department (Police, Fire, Civil Defence)**	**Emergency Response Plan for First Responders**
Buildings & Lifeline Infrastructure / Communication Infrastructure *(Roads & Bridges)*	**Public Works Department**	**Engineering & Critical Communication Infrastructure Services Response/Restoration/Recovery Plan**
Drinking Water Supply & Sanitation	**Public Health Engineering Department**	**Emergency Water Supply Preparedness Plan**
Transport Systems	**Transport Department**	**Emergency Transport Services Plan**
Emergency supply of food & basic needs	**Food & Civil Supplies Department**	**Emergency Supply Plan for Relief Supplies**
Broadcasting & relay of public information	**Information & Public Relations Department**	**Emergency Communication Plan**
Welfare Services	**Social Welfare**	**Human-Social Recovery Plan for**

PRIMARY RESPONSIBILITY	DEPARTMENT	PLAN TITLE
	Department	**emergencies**
Drought management	**Agriculture Department**	**Drought Risk Management Plan**
Flood Protection and River Erosion Management & Drainage Development Works	**Water Resources Department**	**Embankment Protection/Restoration and Contingency Plan** **Flood Preparedness Contingency Plan**
Power supply	**Power (Electricity) Department**	**Emergency Power Supply & Restoration Plan**
DM Education & School/Institution Safety	**Education Department**	**School Disaster Management Plan**
Vulnerability reduction in rural areas	**Panchayat & Rural Development Department**	**Village Disaster Management Plan**
Vulnerability reduction in urban areas & built environment	**Urban Development Department**	**City Disaster Management Plan**
Finance arrangements	**Finance Department**	**Economic Recovery Plan**
Livestock management, animal care services	**Animal Husbandry & Veterinary Department**	**Emergency Animal Care Plan**
Information Technology and Communication	**Information Technology Department**	**Continuity Plan of IT Infrastructure and DM Decision Support System**

* Note: Department of Drinking Water and Sanitation, Ministry of Rural Development GOI (2011) has issued ***Standard Operating Procedure for Responding to Natural disasters*** – Rural Drinking Water Supply & Sanitation http://www.ddws.gov.in/sites/upload_files/ddws/files/pdf/StandardOperatingProcedureForRespondingTonaturalDisasters.pdf (last accessed on 13Aug2012)

6.3.4 Monitoring, Evaluating and Updating the Plans

Plans must be monitored, evaluated and updated on a regular basis. Formal responsibility of coordination process and ***monitoring*** of progress at the State level is the task of ASDMA. The system of review of plan can be done through quarterly reports or update. The reports shall cite the progress achieved, problems encountered and expected solutions to mitigate, and self evaluation of the activities implemented. A performance monitoring plan will maintain and update the status on a quarterly basis.

Plan shall be submitted by the respective department to ASDMA and further tabled to SEC (through the SEC mechanism as directed by the DM Act 2005) for ***evaluation*** process. Evaluation process will be multi-stakeholder driven, and endorsed by SEC. Evaluation and approval process of the plan will typically look into the following aspects:

- Inclusion of relevant functions as per the mandate assigned by the State
- Continuity plan to ensure service delivery during normal period and disaster situation
- Appropriate coordination arrangements and have assigned responsibilities to undertake preparedness/response functions (as outlines in Part III of the plan, Roles and Responsibilities of State Govt Departments/Agencies)

All plan types must be systematically ***updated*** every two year *(preferably in the month of December)* in accordance with the circulars/guidance note issued by ASDMA. It shall take into consideration of the following:

- Most recent hazard risk and vulnerability analysis/assessment reports
- New information pertaining to hazards/vulnerability commissioned by the technical / scientific agencies of the Government and Research Institutions (Seismic microzonation maps, flood risk maps, landslide potential and susceptibility maps, climate variability and climate change studies, human development report, census reports etc)
- Scientific / feasibility studies commissioned by the department itself (Primary Responsibility Agency/Secondary or Support Agency) as part of ongoing development schemes or DM initiatives.
- Modifications to the changes in National/State Act, Policy and rules in DM; issue of Guidelines by NDMA/SDMA or any other Ministry (GoI)/Department of the State which has a scope for overlap with mission components of ASDMA and development of the State.

SECTION 4: CONTINUING COMMUNITY AWARENESS, EDUCATION AND TRAINING

In order to accomplish resilience, a set of actions is required to enhance the capacities of the communities. This includes ability to recognize the hazard, understand appropriate actions for mitigation and response and communication with the larger society. Community is the key stakeholder and action taken across will build resilience. The task in hand of the administration is to maximize the coverage of the population that are at risk and develop mechanisms/partnerships to keep constant engagement in DM for community in order to prioritize action. Capacity is enhanced through focused and targeted means of awareness building, education and training, and practice through drills. The pedagogy, content of packages and approach of delivery will depend on range of parameters including geographical, social, economic and cultural aspects.

ASDMA has outlined the needs through conduct of Training and Needs Assessment study for all key stakeholders in the State.

SECTION 5: TRAINING AND CERTIFICATION

6.5.1 Identification of capacity development streams

Capacity development of stakeholders shall be built across all mission streams and across all stakeholders. It involves development of a cadre of individuals across

SDMA and State Departments, DDMA and agencies working/supporting the District Administration and the Local Authority (including the PRIs, Urban Local Bodies).

Standardization of training is important and for this there is a need to develop target oriented curriculum, conduct ToT, evaluation and certification (for select groups say, Certification of masons in disaster resistant construction practices, Certification of Volunteers in Search & Rescue/First-Aid). Reporting of training across the State should be made available through the form of annual report.

ASDMA has already undertaken Training Need Assessment study to identify the training and non-training requirements of the different departments and capacity gap in DM. To bridge this gap, it is important to develop a holistic approach towards capacity development, consider a plan extending to address long term needs in DM and work towards a DM specific human resources development plan for the State. ASDMA has identified key national resource institutions to develop training module and impart quality assured trainings.

Following key areas have been identified (for design and development of modules, implement training):

- Earthquake resistant design for engineers and architects
- Seismic strengthening and Retrofitting of buildings and infrastructure
- Construction technology training for construction workers (masons, bar benders among others)
- Assessment of seismic safety of buildings and infrastructure
- Damage and Needs Assessment
- Search and Rescue & First Aid
- Flood Rescue
- Mass Casualty Management
- Trauma Management
- Hospital preparedness and Mass Casualty Management
- Collapsed Structure Search and Rescue and Medical First Response
- Pubic Health in Emergencies *(Safe drinking water and sanitation, Alternate water resources identification during emergency conditions, Supply management)*
- Procurement procedures for goods and services in emergency situations
- Shelter and Camp Management
- Climate Change and cross cutting themes
- Gender issues in Disaster Management
- Role of PRIs and ULBs in DM (mainstreaming efforts in development planning)
- Preparation of DM Plan (Sector, Department, Administration, Unit Level – School, Hospital, Business establishment etc)
- Community Based Disaster Preparedness
- Role of Volunteers in Disaster Management

SECTION 6: CONDUCT OF DISASTER MANAGEMENT EXERCISE OR EMERGENCY DRILLS

Regular or annual exercises/emergency Drills/mock-drills provides the opportunity to validate the Disaster Management Plan at all levels. The procedures are put to test and gaps if

identified can be addressed in 'normal time'. One of the significant benefits of conducting exercises/drills is to provide the opportunity to network with all agencies and at all levels in real time. Coordination between all actors is crucial, and face-to-face interaction during such exercises and participating in de-brief meetings gives an opportunity to work together.

Disaster Management Plan identifies the need for the exercise and the primary responsibility agency will ensure that the plan is tested / exercised annually and procedures are practiced. All exercise shall be documented and findings / recommendations for improvement shall be shared with all secondary/support agencies and ASDMA. State wide exercise will be facilitated by ASDMA with support from Assam Administrative Staff College (AASC), Centre for Disaster Management (Tezpur University Assam) and key resource institutions. .

SECTION 7: KNOWLEDGE MANAGEMENT STRATEGY

Networking of knowledge is essential for strategic thinking in DM. A well developed strategy involving all stakeholders will reduce the dependency on information flow, open the process of cross-learning and more importantly raise the bar of knowledge that is already validated.

There is need for establishing a platform which can feed to the needs of information sharing in DM as well as provide access to knowledge database on DM in Assam and the North-East region. ASDMA shall establish knowledge hub in disaster management with an aim to collaborate and connect stakeholders, share information and capture knowledge. The knowledge hub can serve as a regional hub for exchange of information and knowledge products in Disaster Management across North-East States of India. The platform can also serve as a nodal hub for interaction and responding during the time of crisis operations.

PART – VII RESPONSE

SECTION 1: GENERAL

Natural disasters and other severe incidents have shown the importance of emergency response in order to save lives, minimize damage and ensure continuity of societal functions as well as business operations of the State. Emergency response is not limited to single organizations of the national or state level government; however it is increasingly recognized to make this function multi-organizational and liaise with business/industry and non-governmental organizations. Community participation (established through Community Based Disaster Risk Management activities) in development of response plan and implementation is essential.

Response activities are sequence of actions required including conduct of search and rescue, mobilization of emergency equipments and services, undertake operations to keep population and assets from harm's way. Response requires immediate activation of functions, high level of planning, understand nature of the hazards/disaster ***(sudden onset, slow onset, escalating incident)***, interpretation of warning, gathering of structured information, mobilization/deployment of resources and demonstrate coordination skills while undertaking operations. The framework for response and conduct of response operations is in accordance with the DM Act 2005 and Assam DM Rules 2010. ASDMA will ensure coordination and monitor the implementation of response actions.

SECTION 2: ELEMENTS OF RESPONSE PLAN

7.2.1 Concept of Operations (CONOPS)

7.2.1.1. Response Operations Schematic

Activation and engagement of departments/agencies are determined by the Level* of disasters. Levels of disasters are categorized and disseminated as L0, L1, L2 and L3, based on the ability of various authorities to deal with them.

Response Severity Level	Description of the Level
L0	L0 denotes normal times which are expected to be utilized for close monitoring, documentation, prevention, mitigation and preparatory activities. This is the planning stage where plans at all levels from community to the State shall be put in place. Training on search and rescue, rehearsals, evaluation and inventory updation for response activities will be carried out during this time.
L1	L1 specifies disasters that can be managed at the district level, however, the state and centre will remain in readiness to provide assistance if needed.
L2	L2 specifies disaster situations that may require assistance and active participation of the state, and the mobilization of resources at the state level.
L3	L3 disaster situations arise from largescale disasters where districts and the state may not have the capacity to respond adequately and require assistance from the central government for reinstating the state and district machinery.

Activation at the State Level shall be initiated by State Crisis Management Group (SCMG) and is done in anticipation of activation at District/Local

Level due to impeding disaster situation or impact caused due to disaster (natural or manmade). The activation of various level of administration is best understood by typical steps of escalation. Arrows do not translate to sequential phases, but rather explains the scale of the event and support needed for response.

Local→District→State→National	**L0→L1→L2→L3**

** Note: the color shown below is indicative and is not drawn from the standard color scheme. State shall further explore detail mechanism for declaration of levels. if required, ASDMA may also explore statutory approval for this purpose..*

The process to declare the level will primarily depend on following six parameters:

1. **Type and magnitude** of incident/accident/crisis event
2. **Sensitivity** of the crisis event in terms of National/State security
3. **Duration/Timeline** of the crisis event phenomenon
4. **Intensity and geographical spread** of the crisis event (damage grade, access/remoteness)
5. **Impact** of the crisis event (injury, loss of life, degree of damage to assets and infrastructure, escalating situation of the event itself,)
6. **Resource capability** in the affected areas (human resources, equipment support, functioning capacity of institutions and administration machinery, ability of the administration to restore normalcy)

The levels described above shall operate within three bands: Strategic, Tactical and Attentiveness response bands. The purpose of the band is to bring in comprehensive and effective decisions in a timely manner taking into account necessary aspects of the emergency/incident. The functional hierarchy and description of the **Response Band** is indicated in the following table.

Functional hierarchy and Description				
Response Band	**Response Severity Level**	**Description of the Level**	**Resources Deployed**	**Emergency Support Functionaries (ESF)**
Strategic	**L3**	Disaster situations arise from large-scale events where districts and the state may not have the capacity to respond adequately and require assistance from the central government for reinstating the state and district machinery.	Event is dealt with resources deployed by the organization located within the jurisdiction, supported by mutual-aid assistance from geographical jurisdiction within State, obtain assistance from Central Government, cover management of incoming aid of all types and facilitated by Home & Revenue Department through existing protocols laid by the State Government.	Communication, Search and Rescue, Relief Coordination (Shelter, Water & Food), Engineering Services, Public Health & Medical Response, Water & Sanitation, Public Works, Damage Assessment, Law & Order, Social Welfare, Transport, Volunteer Management & Donations, Power, Livestock Management
	L2	Specifies disaster situations that may require assistance and active participation of the state, and the mobilization of resources at the state level.	Event is dealt with resources deployed by the organization located within the jurisdiction, supported by mutual-aid assistance from neighbouring jurisdiction, areas anywhere within the state	
Tactical	**L1**	Specifies disasters that can be managed at the district level, however, the state and centre will remain in readiness to provide assistance if needed.	Event is dealt by resources determined on regular pre-determined response. Response is undertaken by local resources deployed by the organization located within the jurisdiction	
Attentiveness	**L0**	Denotes normal times which are expected to be utilized for close monitoring, documentation, prevention, mitigation and preparatory activities. This is the planning stage where	Resources are determined to undertake preparedness activities and ensure state of readiness	

Functional hierarchy and Description				
Response Band	**Response Severity Level**	**Description of the Level**	**Resources Deployed**	**Emergency Support Functionaries (ESF)**
		plans at all levels from community to the State shall be put in place. Training on search and rescue, rehearsals, evaluation and inventory updation for response activities will be carried out during this time.		

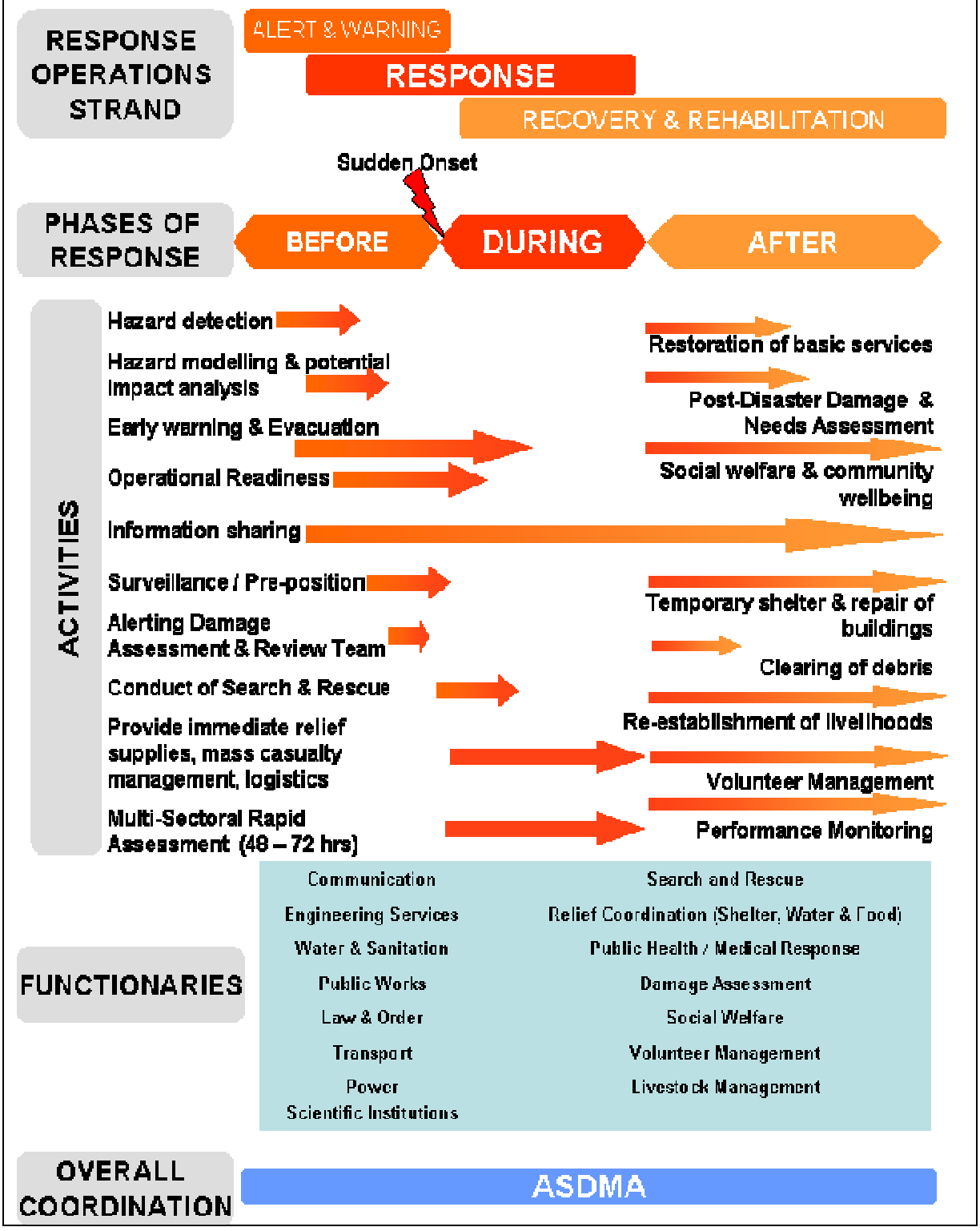
The objective of ESF component at all levels is to involve administrative departments and institutions directly in the response loop, deliver support services and assist in the return to normal conditions at the earliest possible time.

Response at all administrative levels within the State involves undertaking preventive measures at the first place and if condition warrants or deteriorates, initiate steps to respond to an event. Response phase of disaster management can also be understood through the steps of escalation. Response operations at administration, or institution/departmental level are sequence of activities undertaken
before the event **(Alert & Warning Stage)**
during the event **(Immediate Relief)** and
after an event **(Recovery & Rehabilitation)**.

SOP's for departments shall be organized in similar sequence (**Preparedness Stage →Prevention and Mitigation Stage →Alert & Warning Stage →Response Stage → Recovery & Rehabilitation Stage**) for ease of understanding the roles and responsibilities during various phase of operations.

The movement from one phase of response to the other is not sequential, and hence should be seen in continuum. Figure 22 indicates key functions which fall within the response operation framework. The diagram puts together a centre stage for all agencies to understand their roles and responsibilities. The diagram is an indicative representation and has been developed based on inputs and deliberations. This may be suitably modified in subsequent revision of the ASDMP.

Figure 22: Diagram - Response Operations Schematic



7.2.1.2. Response management arrangements – Planning, Execution and Coordination

Section 22(2), 24, 30 and 34 of DM Act 2005 has clearly laid down various duties relating to DM to be performed by various agencies. No single agency or department can handle a disaster situation of any scale alone. Different

departments have to work together to manage the disaster. For proper coordination and effective use of all available resources, the different departments and agencies need a formalized response management structure that lends consistency, fosters efficiency and provides appropriate direction during response. Response Management constitutes the following functions:

- Planning
- Execution and
- Coordination.

Planning in the pre-disaster phase is the responsibility of various authorities created under the DM Act, whereas the ***execution*** of the plans is to be carried out by the various line departments of the Government and the existing administrative structure in the District and State. For ***coordination*** and ensuring smooth execution of the plans, bodies such as NDMA, SEC, ASDMA, DDMA, Local Authority have been created at the National, State, District and Local Level. At the District level, planning, execution and coordination of all the activities have been vested to the District Authority itself. The Local Authorities are responsible to conduct response functions within their administrative and adjoining areas. The hierarchical arrangement detailed in the Act and this sub-section is aimed at ensuring that administration has effective control over the situation, no matter how small or big is the nature of the emergency. Planning-Execution-Coordination is managed using the principles and mechanisms laid down in the recent guidelines developed by NDMA – National Disaster Management Guidelines: Incident Response System (July 2010).

Response activities involve a number of simultaneous functions. Within the existing DM set-up in the State, departments/agencies have the understanding to perform tasks as Emergency Support Functionaries (ESFs). ESFs are featured in the District DM Plan and the agencies are involved in emergency/disaster response. The District DM Plan indicates the list of key function and functionaries are categorized as Primary and/or Support (Secondary) Agency. This chapter also highlights the roles and responsibilities of ESF at the State Level. Information on ESF roles and responsibilities at the District Level is available in the District Disaster Management Plan. ESF's shall serve as resource task force or will align themselves to other role as indicated in the IRS framework.

Other institutional arrangements for response arrangements include the agencies *responsible for prediction and providing warning information* (hydro-meteorological events) such as IMD, CWC, North Eastern Space Applications Centre (NESAC), ISRO, North East Institute of Science and Technology and agencies *responsible for conduct of search and rescue operations/provide immediate relief* which includes the Army, State Police, Fire Services, National Disaster Response Force (one NDRF battalion stationed in Guwahati), State Disaster Response Force (SDRF), Civil Defence & Home Guards, Trained Volunteers in basic First-aid/Search and rescue.

7.2.1.3. Coordination arrangements at State-District-Local level

Effective management of disaster response relies on coordination arrangements at all levels. Response stage (before event-during event – after event) brings together all organizations to ensure effective management and minimize disruption, work towards restoring normalcy. A successful response calls in for better understanding of each other's functions (in accordance with Functionaries), shared responsibility, sharing of ideas and resources (people, material, equipment and tools), communication and information sharing, teamwork within/among departments and working with the community.

Emergency Operation Centres/Disaster Response & Information Centre (DRIC) serves as a nerve centre of all coordination arrangements. Emergency communication plan will lay down the network starting form the State to the District, District to Civil Sub-Divisions, Civil Sub-Divisions to Revenue Circles. In order to connect to the last mile the network will further link to Lotmandal and the Gaonburhas.

During warning and response phase, DRIC remains activated for effective coordination of response operations. In addition other networks operated by the line agencies/departments for conduct of specific response operations/regular operations also complement and coordinate with District Authority State Departments.

Establishing clear lines of emergency communication network will result in measured response to a disaster event. ECN aims to establish:

- DRIC at State/District/Revenue Circle
- integration of emergency helpline numbers *(ongoing project undertaken with support of Police Communication, AMTRON, Assam State Fire Services Organization, Home Department, BSNL and GVK EMRI)*
- sharing of vital parameters from the Emergency Operation Centre/DRIC/Control Room of line department agencies/scientific institutions *(such as IMD, GSI, CWC, NESAC, ISRO among others)* to administration and ESFs

7.2.2 Key Activities - Before stage of response

This stage of response determines the tracking of the potential event/hazard and likelihood of causing an effect within a known boundary of enquiry. The threat is not accessed, however based on the intensity and elements at risk, hazard analysis and modeling results are undertaken to predict outfall. Scientific/Technical/Select Line agencies or Departments are involved in tracking and providing the potential outlook/scenarios which can determine the level of response.

7.2.2.1. Hazard detection, modeling /analysis

Floods/hydro-meteorological hazards based on weather information can be detected in advance with good level of accuracy. Modelling/assessments of hazard are undertaken by nodal agencies of the Government and this

information can be analyzed with vulnerability data sets to determine potential threat/impact scenarios. These information products generated from analysis inform or translate into advisories, determination of threat levels, alert messages and warning information for line agencies/ESFs and public for taking appropriate actions

7.2.2.2. Potential impact analysis/outlook or predicting damage scenarios

Weather induced events can be simulated in advance and impact analysis products in the form of maps etc can be generated. Predicting damage/ scenarios are simple measures which inform the possibilities of immediate future and risks associated should the hazard severity persist or increase with respect to time. Impact analysis tools guide response better.

7.2.2.3. Operational readiness (pre-deployment)

Identification of response operations for specific hazards including possible variations in the intensity of the hazards pose different challenges. Based on information received in pre-disaster phase, agencies/institutions should identify requirements and plan operations accordingly. Pre-deployment of human, material and equipments/tools may be carried out in case of know intensity or certain events.

7.2.2.4. Warning

When the event is certain based on modeling or has reached/crossed known thresholds for specific geographical areas, warning is to be provide to people and assets located in harm's way. Providing warning is one of the key activities as definite action such as evacuation or moving to identified safer places will reduce the exposure resulting in no loss or reduced loss. Warning information will have to be tailored and understood by recipients of warning. The message can be relayed through traditional mechanism of information relay in villages, or can be also communicated through public announcements or through use of mobile technology. Warning information has to be simple and easily understood; otherwise it looses its significance and can result in failure to take actions. All possible options must be put in place for relay of warning information. This will build redundancy in the system. Relying on one method/line of communication alone may not be sufficient.

7.2.3 Key activities - During stage of response

This stage refers to the period when the influence of hazard has begun to show its impacts on the local environment. ESF's are activated and actions are initiated to respond to the situation.

7.2.3.1. Activation of coordination mechanism

Disaster coordination centres at all levels undergo activation on the basis of Coordination Centre's SOP.

7.2.3.2. Deployment of emergency teams

Conduct of search and rescue requires skill and resource support. Following counterparts can undertake S&R activities within the State: State Disaster

Response Force, National Disaster Response force, Armed Forces, State Police Force, Department of Fire and Emergency Services, Civil Defence & Home Guards and Trained Volunteers.

7.2.3.3. Mass casualty management

While floods are better handled, mass casualty situation cannot be ignored given the state potential threat to earthquake hazard. Provision for mass casualty management system by the State's Health and Medical Service Institutions need to be established. Networking among hospitals can also benefit the process.

7.2.3.4. Evacuation to designated safe locations

Evacuation of people to safe locations and shelters shall be predetermined and must be in close vicinity to existing areas. In cases where areas are marooned or buildings are destroyed following an earthquake, temporary accommodation centers will be built along with provision of basis services.

7.2.3.5. Relief supplies and Logistics arrangement

Disaster calls in for mobilization of resources – men, material, equipments and supplies to conduct relief operations. In cases of marooned locations, staging area will have to be identified close to the affected area. Resource needs of the people will have to be quantified and sufficient materials must be mobilized. In case of pre-stock, this will eliminate wide range of logistical bottle-necks.

7.2.3.6. Volunteer and management

Help will pour in within no time and it is essential to streamline the flow of people in and out of the disaster affected regions. The impact of the event on the community will already have had stretched the resources, and with more people coming in for helping the victims, the existing stock of supplies may run out. For volunteers to be productive and participate further in the recovery ad rehabilitation stage, it is essential to streamline these activities.

7.2.3.7. Infrastructure restoration for conduct of emergency operations

Emergency repairs of critical infrastructure/lifelines is crucial for conduct of operations. Special restoration-task forces pooled from engineering sections of the department can restore basic services. This will help by large conduct of response. Emergency options / temporary options for access to services may also be explored.

7.2.4 Key activities - After stage of response

This is a phase when all coordination for response comes to an end. Standard minimum requirements of services are in place and the community is on the verge to move into recovery phase.

7.2.4.1. Post-Disaster Needs Assessment

PDNA is undertaken to determine R&R package. These studies give first hand insight to the losses within the sector and as a whole. A comprehensive

PDNA harmonize the assessment, analysis and prioritization of damages, losses and needs by a range of stakeholders. DNA pulls together information into a single, consolidated report, information on the physical impacts of a disaster, the economic value of the damages and losses, the human impacts as experienced by the affected population, and the resulting early and long-term recovery needs and priorities.

7.2.4.2. Transition to recovery

Response and recovery phase are two different phases, however recovery commences within the former. Detailed planning is required to ensure that the actions taken to support response will no longer continue the same way and more Self-Help activities will unfold in the time to come. Appropriate dialogue/consultation meetings to be held with the communities.

7.2.4.3. Lessons identified and guidance note for improvement in plan

With every disaster there is a new set of learning. The experiences from the field (What worked & What were the shortcomings) must be documented as valuable lessons from the event. The effectiveness of how response was undertaken should be captured in form of timeline analysis and see if any significant improvements can be undertaken. A catalogue of lessons learnt from various disasters will serve as a good point and guidance for improving the ASDMP.

SECTION 3: INCIDENT RESPONSE SYSTEM

7.3.1 General - Incident Response System (IRS)

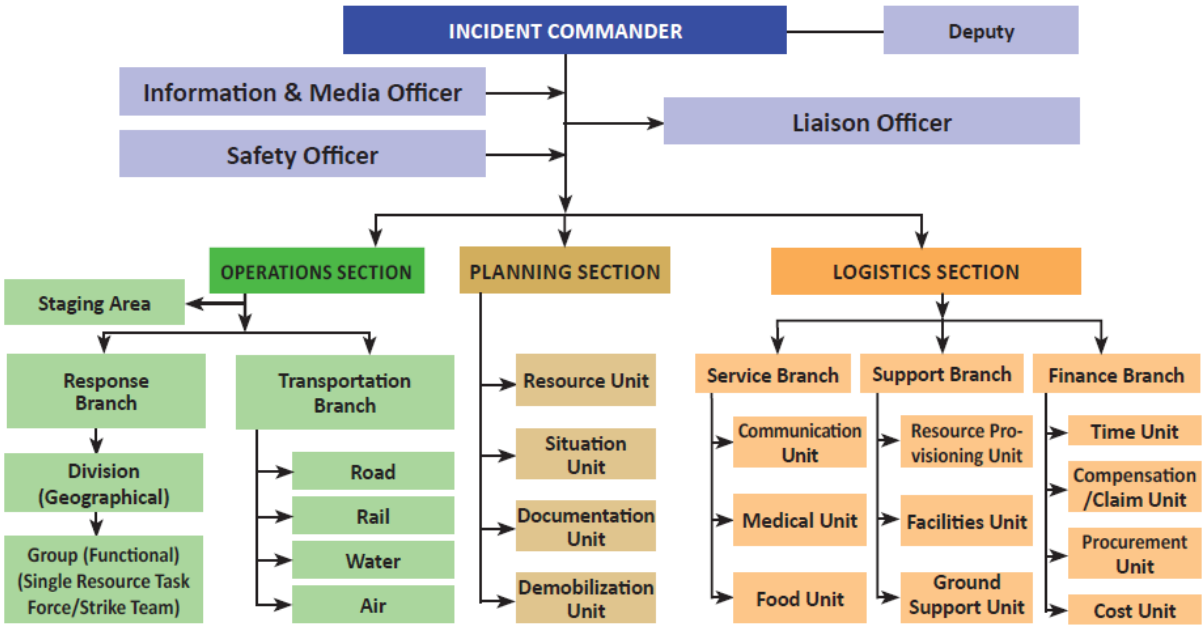
A fully understood IRS mechanism shall adapt to address various scale/extent of operations as well as suit individual agency requirements. IRS constitutes an important part of the disaster response at the National, State, District and Local level (disaster affected site).

Incident Response System (IRS) was carved out of principles that guided the formulation of Incident Command System (ICS). ICS is known as a popular management system while responding to disasters. Incident response is part of the emergency management process and it relates to actions taken in order to mitigate the consequences of an incident. The IRS is essentially a management system which is used for organizing the human and material resource which is pressed in to service while responding to disasters. IRS is guided by a thorough planning ensures that the critical resources which are used while responding to disasters are deployed in its rightful positions, are mobilized & demobilized in a timely manner to avoid wastage, and further emphasis on a detailed documentation of use of resources, actions and decisions.

IRS achieves this by identifying required functions for responding to disasters and organizes them within an organization chart *(organogram, see figure 23)* which is suitable while responding to disaster. The activation of the staffing is done on the scale of the event and the demand for response. As, it is not possible to keep dedicated human resources on stand-by 24x7

waiting for a disaster event, the IRS envisages to draw trained persons and press them in to service to respond to disasters. As the functional expertise required for responding to disasters are various kinds, the IRS envisages to draw human resource with different expertise from different department or agencies (such as Health, Water, Sanitation, Veterinary, food and Civil Supplies etc) and deploy them as a part of the responding team under the IRS framework.

Figure 23: IRS Organization highlighting Sections/Branches/Units



Source: NDMG Incident Response System, July 2010, NDMA

The IRS design acknowledges that the functional expertise required for responding to disasters are available within the functioning environment of the State but they are scattered and they need to brought within an established and known organization chart so that the staff are aware of their positions and function within the team.

One of the primary requisite for implementation of IRS is to get the team members trained in their respective roles and create management structure/arrangement through consultations with respective State agencies traditionally responsible for undertaking response actions/measures. Prior training helps these staff to understand their roles and responsibilities when mobilized. Training helps the staff to take quick action as they are aware of the position and location within the ICS system. A time bound strategy with fixed responsibilities is being planned by ASDMA towards implementation of IRS in the State of Assam.

The important features of the IRS are:

- It is a temporary team and shall handle only 'response'
- It can be implemented irrespective of size, location, type and complexity of disasters
- Develop a common understanding of the mission
- Develop a common operational picture

- It provides participatory, well structured, fail safe, multi-disciplinary, multi-departmental and systematic approach to guide administrative mechanisms at all levels of the Government
- Appoint persons with appropriate delegation of decision-making
- Create appropriate structures and process for coordinating operational decisions to be taken at lowest possible level, and scale to highest necessary level
- The team members trained in their function, role and IRS operation for maximum effectiveness
- Once the IRS team or the individual members are demobilized they return back to their original job/role & responsibility
- Continuous training of the identified staff enhances their role clarity and effectiveness and hence to the performance of the team

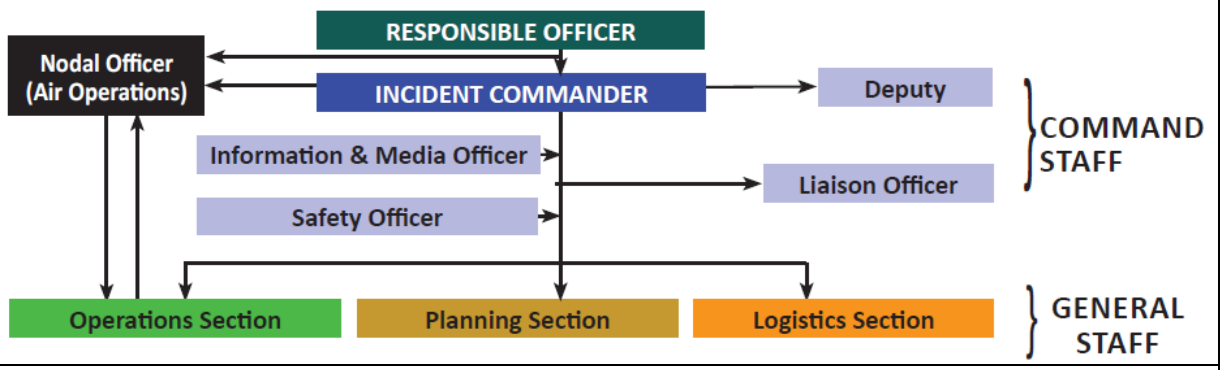
7.3.2 IRS Organization

7.3.2.1. Incident Response Teams, Command Staff and General Staff

IRS organization functions through Incident Response Teams (IRTs) in the field. Responsible Officers (ROs) have been designated at the State and District Level as overall in-charge of the incident response management. The RO may however delegate responsibilities to Incident Commander (IC), who in turn will manage the incident through IRTs.

IRTs are pre-designated at three levels - State, District, Civil Sub-Division and Revenue Circle. The RO will activate on receipt of early warning. In case of now warning, IRT will respond and contact RO for further support. A Nodal Officer (NO) has to be designated for proper coordination between the District, State and National Level in activating air support for response.

Figure 24: IRS Components



Source: NDMG Incident Response System, July 2010, NDMA

Apart from RO and NO, the IRS has two main components: Command Staff and General Staff.

7.3.2.2. Function of Command Staff

The Command Staff consists of Incident Commander (IC), Information & Media Officer (IMO), Safety Officer (SO) and Liaison Officer (LO). They report directly to the IC and may have assistants. The Command Staff may or may not have supporting organizations under them.

7.3.2.3. Functions of General Staff

General Staff has three components:

The **Operations Section (OS)** is responsible for directing the required tactical actions to meet incident objectives. Management of disaster may not immediately require activation of Branch, Division and Group. Expansion of the OS depends on the enormity of the situation and number of different types and kinds of functional Groups required in the response management.

Planning Section (PS) is responsible for collection, evaluation and display of incident information, maintaining and tracking resources, preparing the Incident Action Plan (IAP) and other necessary incident related documentation. They will assess the requirement of additional resources, propose from where it can be mobilized and keep IC informed.

Logistics Section (LS) is responsible for providing facilities, services, materials, equipment and other resources in support of the incident response. The Section Chief participates in development and implementation of the IAP, activates and supervises Branches and Units of his section. In order to ensure prompt and smooth procurement and supply of resources as per financial rules, the Finance Branch has been included in the LS.

7.3.2.4. IRT at State, District, Civil Sub-Division, Revenue Circle levels

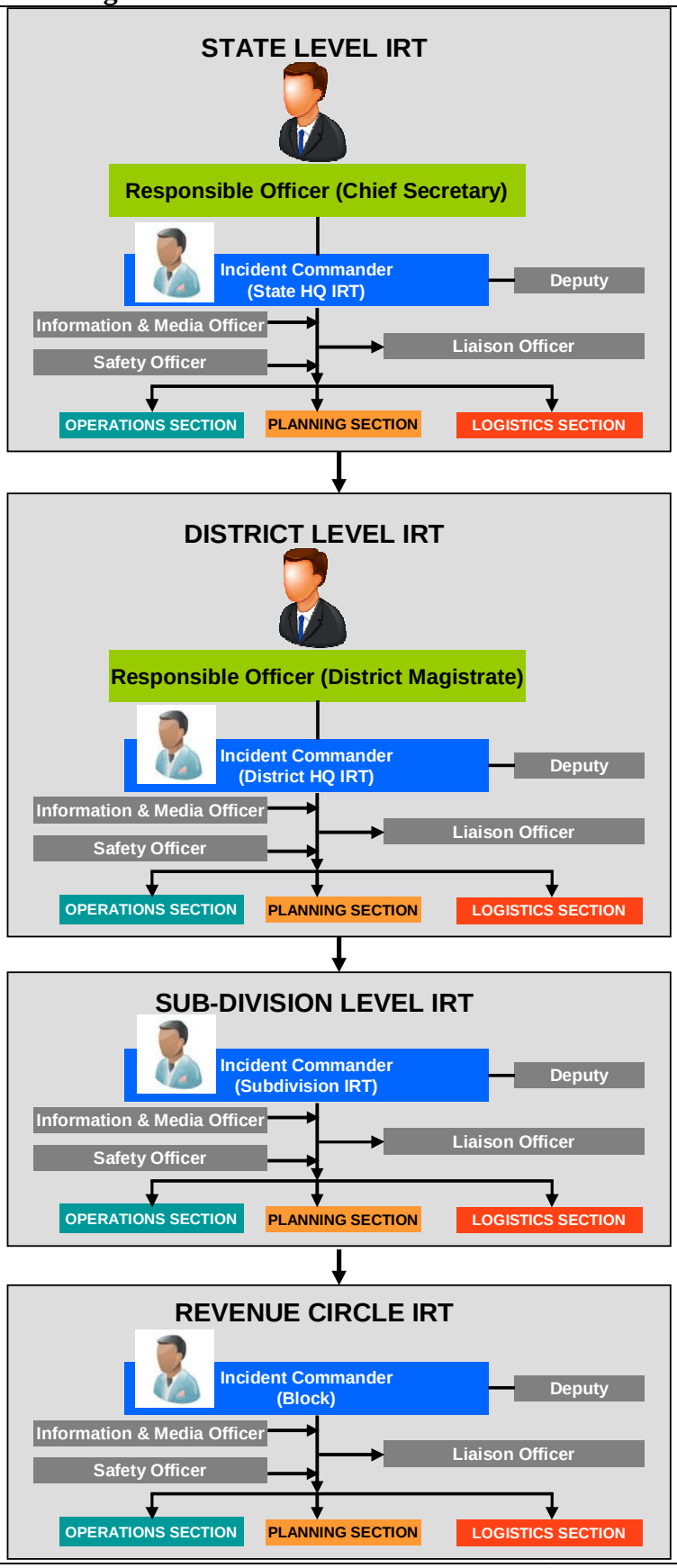
The IRT is a team comprising of all positions of IRS organisation headed by IC. The OS helps to prepare different tactical operations as required. The PS helps in obtaining different information and preparing plans as required. The LS assesses the availability and requirement of resources and takes action for obtaining them.

IRTs will function at State, District, Civil Sub-Division and Revenue Circle level as per response mechanism of State. These teams will respond to all natural and man-made disasters. The lowest administrative unit (Civil Sub-Division, Revenue Circle) will be the first responder as the case may be. If the incident becomes complex and is beyond the control of local IRT, the higher level IRT will be informed and they will take over the response management. In such cases the lower level IRT will merge with higher level IRT.

When a lower level of IRT (e.g. Revenue Circle) merges with a higher level (e.g. Civil Sub-Division, District or State) the role of IC of lower level of IRT will change. When the Revenue Circle level IRT merges with Civil Sub-Division level IRT, IC of the Revenue Circle level may play the role of Deputy IC or OSC or any other duty that the IC of higher authority assigns. This process will be applicable at all levels.

The GoI will play a supporting role by way of assistance in the form of resources, manpower (NDRF, Armed & Para Military Forces), equipment and funds. At the GoI level, the NCMC or NEC will coordinate and provide the required resources. NDMA will also help in monitoring the coordination of response.

Figure 25: IRTs at Various Level of State

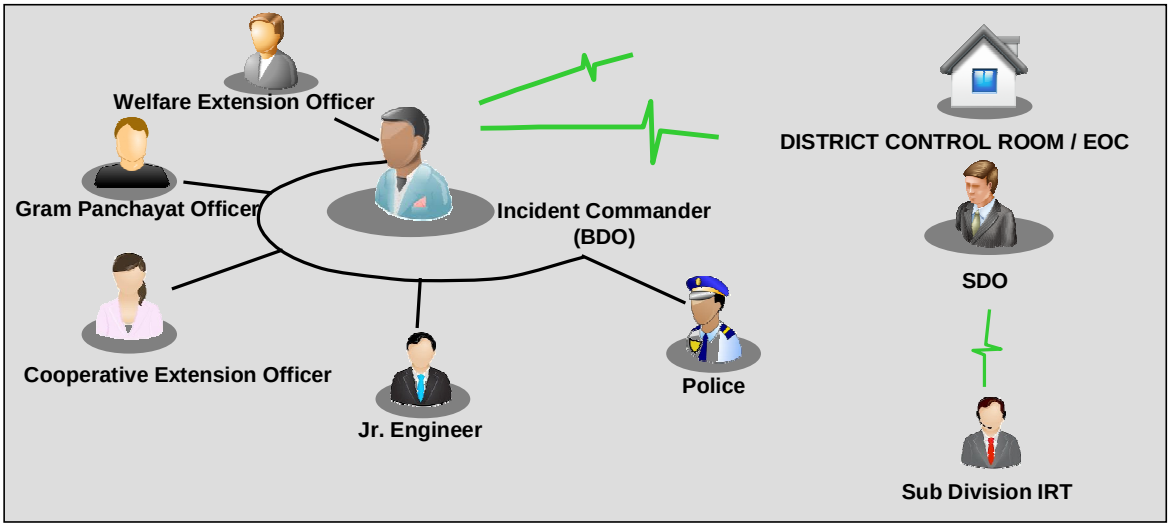


Reference: NDMA Guidelines on IRS

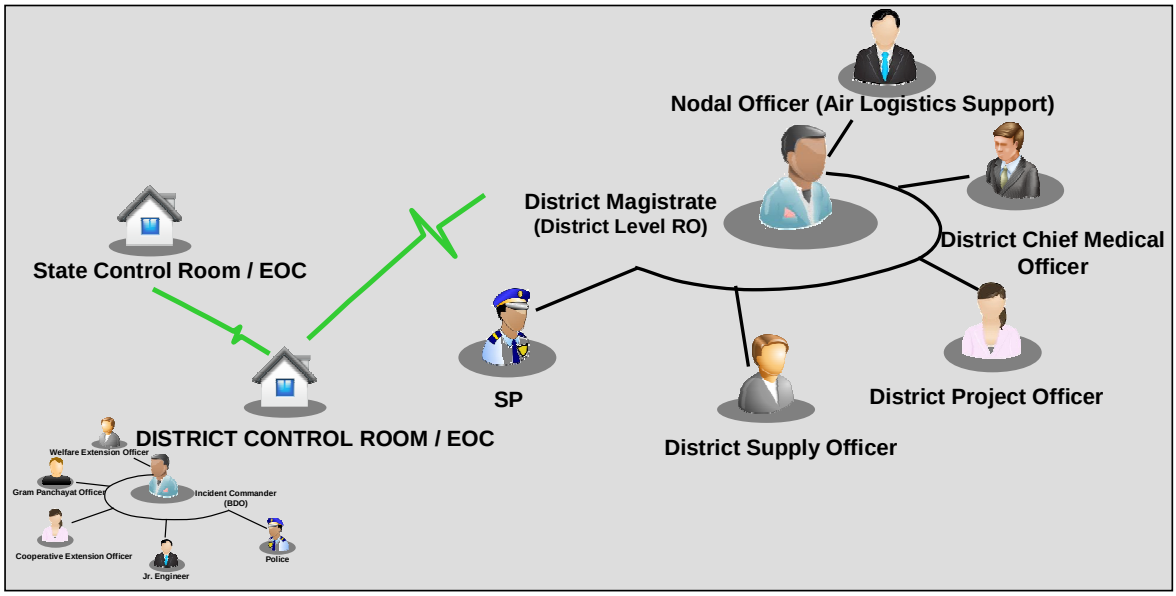
7.3.3 Coordination Arrangement for Response

IRS Guidelines lays down various tasks that may need to be performed by the existing administrative machinery at various levels. IRT will be pre-designated al levels. Overall coordination for response from Revenue Circle to District, District to State and to National level is highlighted in the Fig 26.

Figure 26: Coordination Arrangement for Response at Various Administration Levels

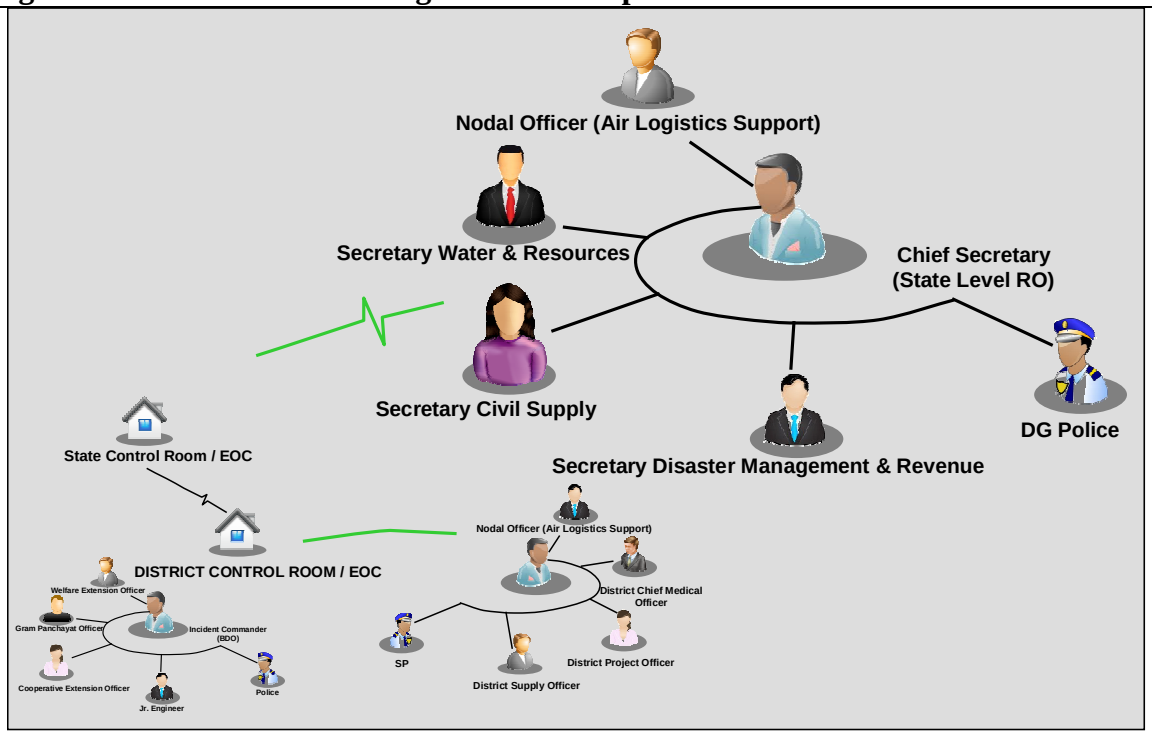


Incident Commander at Revenue Circle level to District Control Room and further to SDO and Sub Division IRT

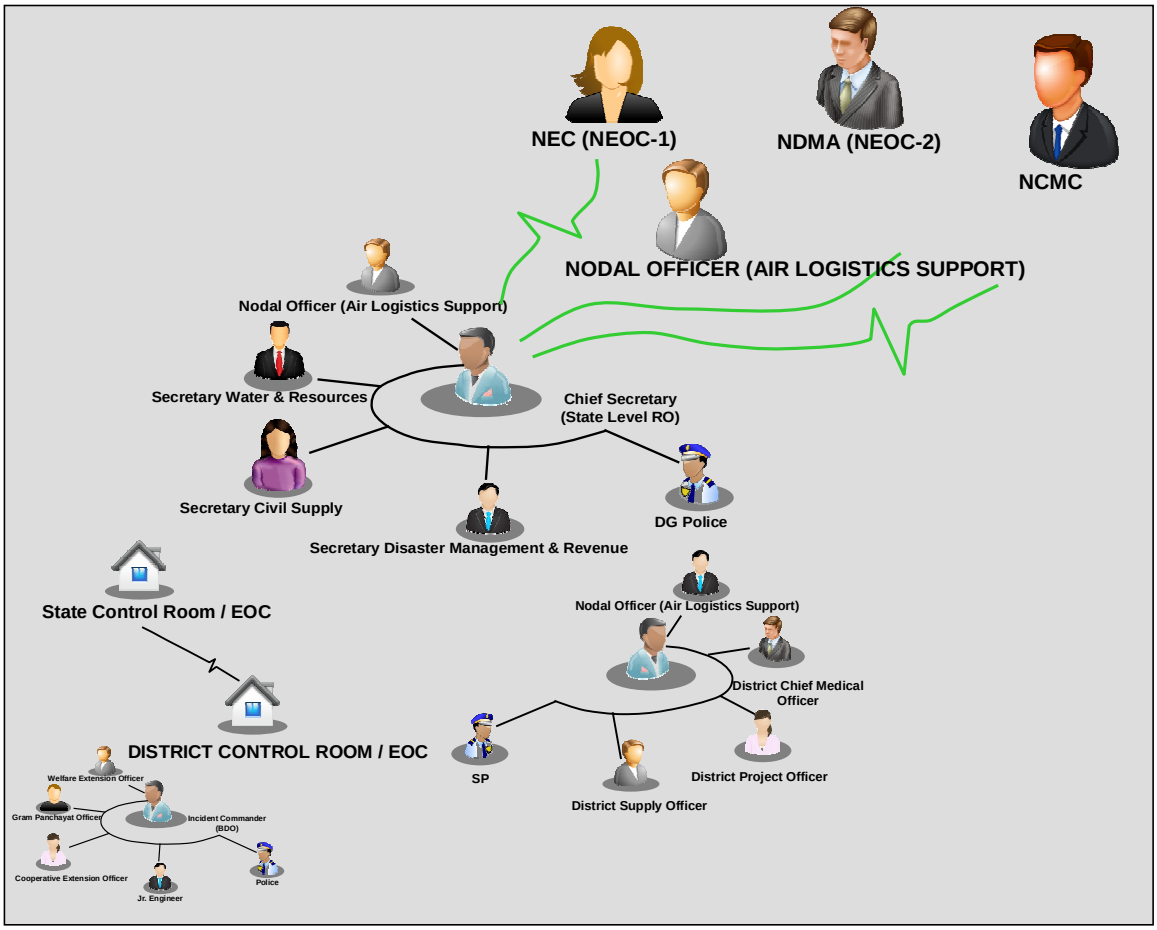


District Control Room to District Magistrate and State Control Room/DRIC

Figure 26: Coordination Arrangement for Response at Various Administration Levels



State Control Room to State Level RO



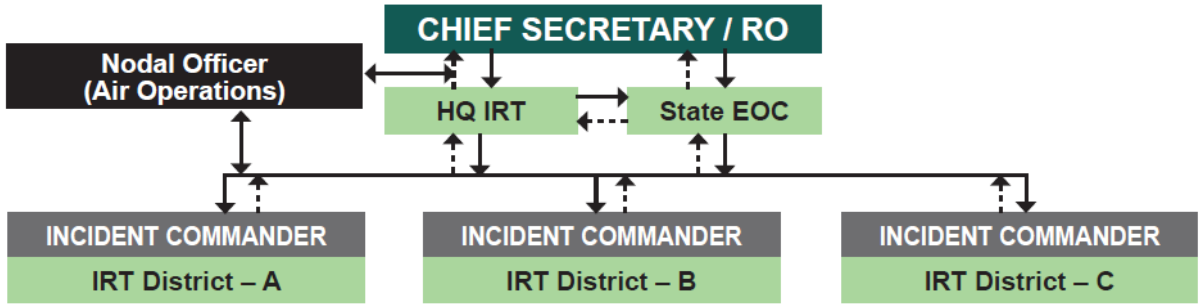
From State Level RO to NEC, NDMA and NCMC, and further NEC and NDMA to NO for Air Logistics Support. NO to contact State NO and District NO (Air Logistics Support)

Reference: NDMA Guidelines on IRS

7.3.3.1. Coordination of Response at State Level

In any disaster response, the initial efforts would always be taken by the District Administration. However, when District/s are overwhelmed in any situation, the support necessarily has to come from the State and National level. The hierarchical representation of RO with State EOC/Disaster Response & Information Centre, Headquarters IRT and its lower level of IRTs at District levels are shown in Fig 27.

Figure 27: IRTs at State Level



Source: NDMG Incident Response System, July 2010, NDMA

The Responsible Officer at State and District Level will have to ensure of the concerned departments in advance regarding their roles as Lead and Supporting agencies. Various departments of the Government may also nominate Nodal Officers to perform the tasks of ***Emergency Support Functionaries*** (ESFs) which may be required in a particular incident. Outline on ESFs is covered in Section 7.3.4.

The organization structure of the IRS is flexible and it need not necessarily to be activates in the management of all types and scales of disasters. For monitoring and support of the Incident Response, the RO shall involve all required ESFs at headquarters IRT to support the on scene IC. The IC will work in close coordination with the DRIC and report to the RO. ESF's if required can be accommodated at the DRIC/EOC.

The Roles and Responsibilities of the CS as RO of the State are outlined in the NDMA Guidelines on IRS.

7.3.3.2. Coordination of Response at District Level

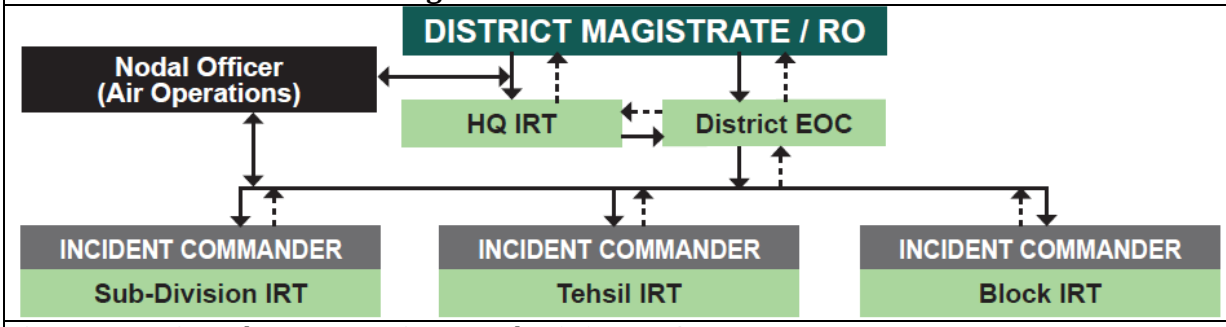
The heads of different departments in the District will have separate roles to play depending on the nature and kind of disaster. The roles and responsibilities of the members of the DDMA will be decided in advance in consultation with the concerned members. The roles of other line departments also have to be clearly delineated in various disaster situations in the District DM Plan. The District Magistrate / DC / RO will issue a Standing Order for formation of IRT at District headquarters / Civil Sub-Division and Revenue Circle levels.

Selection of Operation Sections Chief (OSC) will depend upon the nature of disaster. The table indicates the situation analysis for a typical hazard onset and the selection of OSC:

Hazard	Situation analysis	OSC
Flood	The situation requires reaching the inundated area, rescuing the affected people and providing relief to them is the main task of the responders. People have to leave their home in a hurry and they are not able to take away their valuables/move assets. These abandoned houses may also become vulnerable. The relief materials while being transported may also become prone to loot.	Police / CEO DDMA
Earthquake	The situation requires reaching the affected area, rescuing the affected people and providing relief to them is the main task of the responders. People have to leave their damaged homes and valuables/ assets. These abandoned houses may also become vulnerable. The relief materials while being transported may also become prone to loot.	Police / Additional Deputy Commissioners / CEO DDMA
Fire	This requires specialized team to handle fire spread and have to be backed with equipment cache.	Additional Deputy Commissioners / CEO DDMA / Director of Fire & Emergency Services (Technical)
Epidemics	Situation requires specialized team of doctors and trained health professionals to provide treatment to victims, manage rush to patients to health care facilities, and perform regular health care activities.	Additional Deputy Commissioners / CEO DDMA

In case of Civil Sub-Division, Revenue Circle, the respective heads, i.e. SDO, Circle Officer, BDO will function as the IC in their respective IRTs and the OSC will be selected as per nature of the disaster. The list of suitable officers at different levels has been given in NDMG IRS. During the pre-disaster period, the RO will ensure capacity building of all IRT members in their respective roles and responsibilities. IRS organizational structure at District level is depicted in Fig 28.

Figure 28: IRTs at District Level



Source: NDMG Incident Response System, July 2010, NDMA

The structure depicted may be activated as and when required. For monitoring and support of the incident response, the RO will involve all required ***Emergency Support Functionaries (ESFs)*** and headquarter IRT to support the onscene IC. In case when central teams (NDRF, Armed Forces) are deployed, the RO will ensure resolution of all conflicts. For this purpose he may attach a representative of such agencies in the EOC/DRIC where all conflicts can easily be resolved at the highest level. The teams so deployed will have to work in OS in the form of Single Resource, Strike Teams or Task Forces under the supervision of OSC. The IC will also exercise close supervision for resolution of all conflicts, if required. The IC will work in close coordination with EOC/DRIC and report to RO. The RO will ensure that the strategic goals are achieved through the implementation of the Incident Action Plan (IAP) by the IRTs working in the field.

The Roles and Responsibilities of DM as RO are outlined in the NDMA Guidelines on IRS.

7.3.3.3. Activation of Area Command

Area Command is activated when span of control becomes very large either because of geographical reasons or because of large number of incidents occurring at different places at the same time. Area Command may also be activated when a number of administrative jurisdictions are affected. It provides closer supervision, support to the IRTs and resolution of conflicts locally. When a number of Districts get affected, involving more than one Revenue Division, the concept of Area Command may be introduced Revenue Division wise by the State RO. In such cases the District Magistrate (RO) of the District will function as the IC. Similarly the District RO may introduce it Civil Sub-Division wise when a large number of Revenue Circles in different Civil Sub-Divisions get affected. The RO will ensure adequate supporting staff for the AC.

The Roles and Responsibilities of AC are outlined in the NDMA Guidelines on IRS.

7.3.3.4. Activation of Unified Command

In an incident involving multiple agencies, there is a critical need for integrating resources (men, materials and machines) into a single operational organization that is managed and supported by one command structure. This is best established through an integrated, multidisciplinary organization. In the IRS this critical need is addressed by the UC.

UC is a framework headed by the Governor / CM and assisted by the CS that allows all agencies with jurisdictional responsibilities for an incident, either geographical or functional, to participate in the management of the incident. This participation is demonstrated by developing and implementing a common set of incident objectives and strategies that all can subscribe to, without losing or abdicating specific agency authority, responsibilities and accountability. The organizations that constitute the UC have the mandate for specific task and functional responsibilities to address the incident requirements.

7.3.3.5. Coordination of Response in Urban Areas

The Metropolitan Cities are large and densely populated with a complex administrative setup. The different departments and agencies functioning within the cities are large with resources and independent hierarchical setups having autonomy and complete chain of command of their own. To visualize an IRT on the pattern of the other Districts of the country in such Metropolitan Cities would not be appropriate. A concept of UC will have to be introduced in such cases for effective disaster response.

For all Metropolitan Cities, the CM / CS shall set up a UC involving all the existing departments and agencies like the existing District Administrations, Armed Forces, Municipal Corporations and Local Bodies etc. The CS will function as the RO and constitute IRTs in advance on the principle of IRS to respond to and manage disasters. The IRT members will be identified in advance, roles assigned and trained accordingly. The existing District authorities of the Metropolitan Cities will function as per the directions of the UC.

7.3.3.6. Community Participation in Disaster Response

A number of community based organizations like NGOs, Self Help Groups (SHGs), Youth Organizations, Volunteers of NYK, Civil Defence (CD) & Home Guard, etc., and workers of different projects funded by Government of India like National Rural Health Mission (NRHM), Integrated Child Development Services (ICDS), etc., normally volunteer their services in the aftermath of any disaster. A large number of community based Disaster Management Teams (DMTs) / volunteer were also formulated in the GoI-UNDP DRM Programme.

In the IRS structure, these organizations are placed in the OS where the skills and services of the community may be utilized systematically in the form of Single Resource, Strike Team and Task Force. The Community Based Disaster Management Teams should be appropriately integrated in the State and District level IRTs. The ROs of the State and District will ensure that such resources at village, ward or Gram Panchayat levels are organized with the help of leadership of PRIs and other community leaders. Their resources should be identified as per hazard and they should be encouraged and trained to be a part of the IRT.

7.3.4 Emergency Support Functionaries (ESFs)

Disaster response is a multi-sectoral/multi-agency and coordination driven function. ESF's form integral part of the Emergency Operation Centres and each ESF should coordinate its activities from the allocated DRIC. Extension teams and designated team members of each ESF will be required to coordinate the response procedures at the affected site. Each identified ESF's should have a plan for mobilization, management and monitoring of their designated activities.

For efficient functioning and coordination of the agencies during a response situation, this plan recommends establishment of minimum fourteen ESF's at the State Level. Each ESF will be comprised of a primary agency-P ***(which will be required to coordinate the overall operations)*** and a number of support agencies or secondary agencies-S essential to complete given tasks during disasters. The selection of the primary agency has been selected based on its authorities, resource and capabilities to support the functional area. The ESF will coordinate directly with their functional

counterpart state agencies to provide the assistance required by the state. Request for assistance will be channeled from the district level through the designated state agencies for action. Based on the state identified response requirements, appropriate response assistance will be provided by an ESF to the state or at the state's request, directly to an affected area.

The interdependence of facilities and their management creates a difficult situation for disaster managers during a disaster. Therefore, a crisis situation demands the attention and assistance of experts from different fields and sectors in order to ensure a quick and effective recovery. However, if the assistance provided is not predefined and coordinated it can lead to slow progress and relief work gets adversely affected. Keeping this aspect of disaster management in view, fourteen Emergency Support Functions have been conceptualized (in National Disaster Response Plan) to take care of various response and infrastructure facilities, imperative for immediate as well as long term response to disasters (NDRP, 2001).

7.3.4.1. Primary and Secondary/Supporting Agencies

The designated primary agency, acting as the Central agency will be assisted by one or more support agencies (secondary agencies) and will be responsible for managing the activities of the ESF and ensuring that the response mission is accomplished. The primary and secondary agencies will function under the IRS Structure and shall have the authority to execute response operations to directly support the state needs.

7.3.4.2. List of Emergency Support Functionaries

List of select ESF's are indicated below:
ESF No. 1 - Communication
ESF No. 2 - Search and Rescue
ESF No. 3 - Relief Coordination (Shelter, Water & Food)
ESF No. 4 - Engineering Services & Public Works
ESF No. 5 - Public Health & Medical Response
ESF No. 6 - Water & Sanitation
ESF No. 7 - Damage Assessment
ESF No. 8 - Law & Order
ESF No. 9 - Social Welfare
ESF No. 10 - Transport
ESF No. 11 - Volunteer Management
ESF No. 12 - Power
ESF No. 13 - Livestock Management

The following state department can be considered as the primary agencies for each ESF.

ESF	Primary Agency
ESF No. 1 - Communications	Information Technology Department (ITD)
ESF No. 2 - Search and Rescue	Home Department (HD)
ESF No. 3 - Relief Coordination (Shelter, Water & Food)	Food & Civil Supplies Department (FSD)
ESF No. 4 - Engineering Services & Public Works	Public Works Department (PWD)
ESF No. 5 - Public Health & Medical Response	Health and Family Welfare Department (HFWD)
ESF No. 6 - Water & Sanitation	Public Health Engineering Department (PHED)
ESF No. 7 - Damage Assessment	Revenue & Disaster Management Department (RDMD)

ESF	Primary Agency
ESF No. 8 - Law & Order	Home Department (HD)
ESF No. 9 - Social Welfare	Social Welfare Department (SWD)
ESF No. 10 - Transport	Transport Department (TD)
ESF No. 11 - Volunteer Management	Revenue & Disaster Management Department (RDMD)
ESF No. 12 - Power	Electricity Department (PD)
ESF No. 13 - Livestock Management	Animal Husbandry & Veterinary Department (AHVD)

Primary (**P**) and Secondary (**S**) agencies for ESFs.

ES	ITD	HD	RDMD	HFWD	PD	AHVD	FCSD	PRDD	PHED	TD	PWD	SWD	UDD	WRD	SYWD	ID	IPRD	BAD	WPTBC	FD
ESF No. 1 – Communications*	P	S	S														S	S		
ESF No. 2 - Search and Rescue		P	S								S				S		S			
ESF No. 3 - Relief Coordination (Shelter, Water & Food)							P			S	S									
ESF No. 4 - Engineering Services								S	S		P		S	S						
ESF No. 5 - Public Health & Medical Response				P	S					S										
ESF No. 6 - Water & Sanitation					S				P						S					
ESF No. 7 - Damage Assessment		S	P				S	S	S		S		S		S					S
ESF No. 8 - Law & Order		P	S																	
ESF No. 9 - Social Welfare			S				S					P						S	S	
ESF No. 10 - Transport										P	S									
ESF No. 11 - Volunteer Management			P																	S
ESF No. 12 - Power					P						S									
ESF No. 13 - Livestock Management						P														

* Assam Police Radio Organization (APRO) will act as Secondary agency for ESF No.1: Communication.

Note: The ESF matrix was prepared through a consultative process, which included discussions with key individuals from departments, group discussions held with key line departments/agencies, and inputs from participants(representing key line departments/agencies) from the First State Consultation Workshop on Preparation of ASDMP, 30th Sept 2011, Guwahati (TARU)

List of additional acronyms (in addition to the Primary Agency list)
PRDD: Panchayat & Rural Development Department
UDD: Urban Development Department
WRD: Water Resources Department
SYWD: Sports and Youth Welfare Department
ID: Irrigation Department
IPRD: Information & Public Relations Department
BAD: Border Areas Department
WPTBC: Welfare of Plain Tribes & Backward Classes Department
FD: Finance Department

PART – VIII RECOVERY

SECTION 1: GENERAL

As per the definition laid down by UNISDR recovery refers to, The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors. The recovery task of rehabilitation and reconstruction begins soon after the emergency phase has ended, and should be based on pre-existing strategies and policies that facilitate clear institutional responsibilities for recovery action and enable public participation. Recovery programmes, coupled with the heightened public awareness and engagement after a disaster, afford a valuable opportunity to develop and implement disaster risk reduction measures and to apply the "build back better" principle.

Resilience of the community is measured in terms of the ability of community to accelerate the recovery process. A lot depends on the efforts that have already been made in mission areas of preparedness, prevention/mitigation and capacity building. Building earlier capacity in recovery improves the ability to withstand the event, respond with a plan and sequence activities (before-during-after), and recover faster with reduced loss.

Recovery focuses in timely restoration of basis services for the community including health care; shelter; renewal of infrastructure service functions; securing livelihoods; maintain/strengthen social fabric of communities; restoration of environmental services; support social and physical well-being of the communities; restoration of economy; preserving the historical and cultural identity of the affected region. Linkages in recovery spread across the communities, local administration, District administration and the State administration.

The overall lead role in recovery is played by the administration. It requires a unity effort form all departments of the State, inclusive planning approach by involving the communities, sector/subject expertize and inputs to aid common recovery objectives across the affected region. Mission to recovery shall be built on Post-disaster Damage and Needs Assessment study.

SECTION 2: PRINCIPLES OF RECOVERY

The State of Assam shall adopt the following key principles for successful recovery:

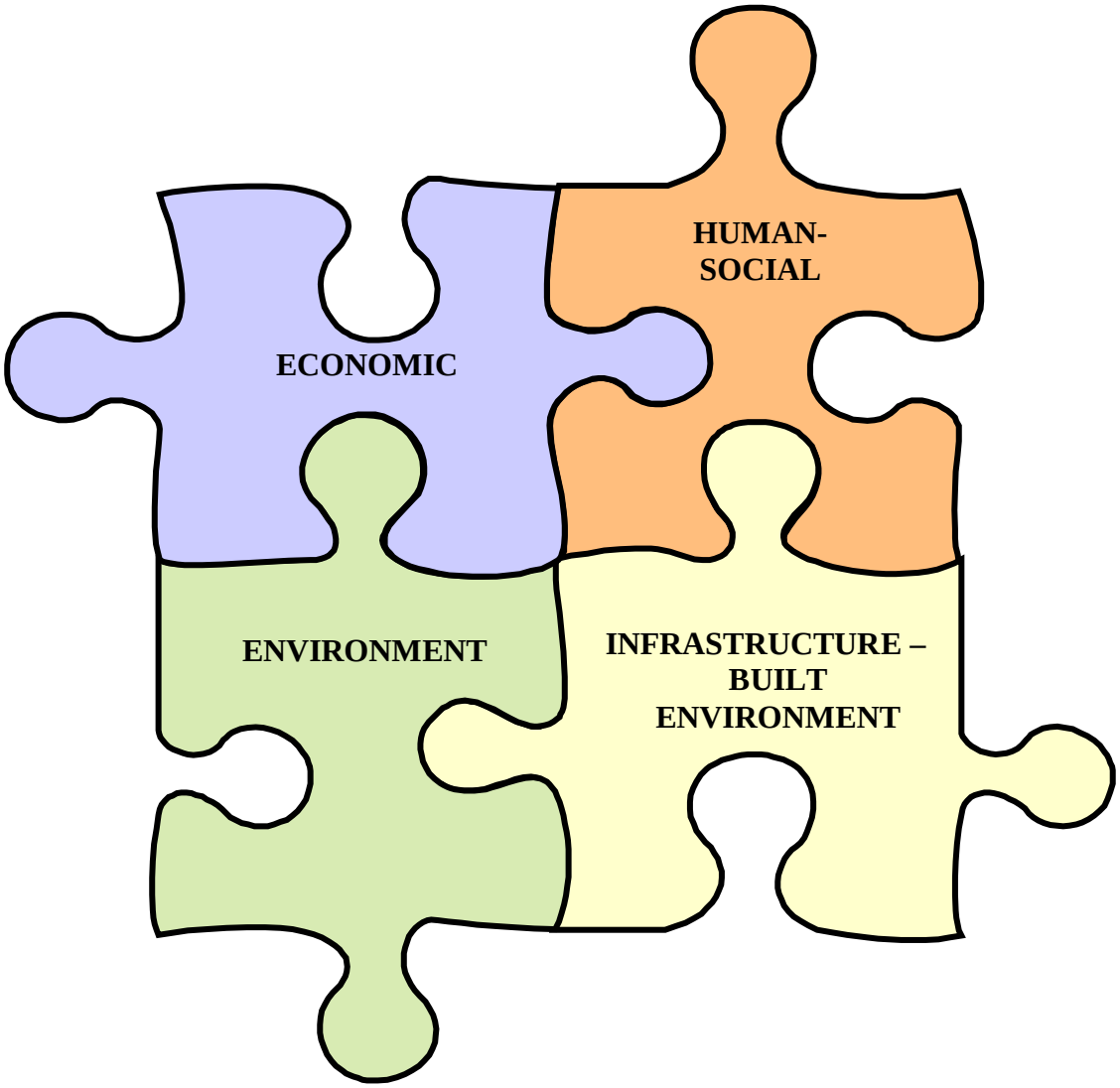
- understand the geographical and socio-economic context
- convene a team to assess the damage and identify the needs, unbundle the complexity before formulating the intervention strategies
- convene a core planning team to oversee the entire effort and remain accountable
- address interim needs
- prioritize restoration of functional services
- mainstreaming disaster risk reduction in the recovery/development process – build back better approach
- ensure high level of coordination at all times
- promote participatory approach and keep community as the central theme for programming recovery
- build an initial recovery plan covering all aspects and conduct stakeholder consultation meetings with stakeholders and communities, finalize the recovery plan

- ensure a common thread in explaining the recovery plan to the communities, employ effective communication mechanism while dealing with disaster affected people.
- design public information outreach to inform the community in regard to actions taken by all levels of administration and the assistance being made available to them
- create space for owner driven construction process and build their capacity through training and hands on activities
- enforce safety standards in all activities, demonstrate to gain public confidence
- improve the living condition of the affected communities
- increase resilience and promote sustainable development
- document key processes, measure progress, evaluate the efforts and monitor the change

SECTION 3: PRINCIPAL COMPONENTS OF RECOVERY FRAMEWORK

Recovery framework identifies four principal overlap/inter-relationship components as indicated in Fig 29:

Figure 29: Components of Recovery Framework



Programming is built within the four components of the framework and is informed by the detailed damage assessment, needs and capacities and underlying concerns in the disaster affected areas in the context of its regional connections/linkages. The four components are described as follows:

8.3.1 Social recovery

This recovery component emphasizes at a level of individual's personal support, access and basic function needs, shelter needs, linkages with social network, physical health and emotional well-being, livelihood, redefining the role in the society, financial assistance to meet immediate needs and recovering loss/damage.

8.3.2 Economic recovery

This component aims towards return of economic and business activities by identification of catalytic agents that can bring in stabilization as well as growth prospects to the affected communities (micro economy) and regional economy (macro economy). Economic recovery includes individual person/household (per capita income, employment, education, uninsured damage/loss, insurance claims etc), government, private/industry sector, trade and commerce. This includes assets, flow of goods and services, market potential of products and securing the confidence among the trade linkage.

8.3.3 Infrastructure/Built Environment recovery

Infrastructure/ built environment recovery includes repair and reconstruction, strengthening and retrofitting, replacement or newly built of elements such as all types of buildings (residential/commercial/government/private/critical category type), important structures (embankments, levees, reservoirs, dams etc), utility and services (water supply, sewage, power, telecommunications, transport and associated infrastructure).

Quick restoration of basic services leads to maintain the functioning of the community. Stabilizing basic infrastructure/built environment functions minimizes health and safety threats which otherwise may jeopardize the recovery effort and increase the timeline of recovery. Additional/temporary systems can also be brought in as interim arrangement to minimize service disruption.

Interconnectedness between society and infrastructure system is significant. In order for community to be resilient, communities have to be backed with resilient infrastructure systems.

8.3.4 Environment recovery/restoration and protection of natural and cultural heritage resources

Floods, landslides, earthquakes, erosion, chemical/hazardous release all cause significant changes/damage in the environment. Catastrophic events are also know to cause permanent landscape changes. The State of Assam is rich in its biodiversity and is home of natural and cultural properties, including world heritage list sites.

Natural environment recovery includes restoration of environmental infrastructure, regeneration of biodiversity (flora and fauna), natural resources, treatment or safe disposal of contaminated land/water caused due to hazardous material spill, and management of waste and debris.

Culturally significant sites and heritage properties requires implementation of various measures and is not limited to protection of sites after a disaster, stabilize the condition in the site *(temporary shoring*) before handing over to officials of Archaeological Survey of India. Preservation of cultural heritage should be factored

as part of the community recovery efforts (communities who stay in close proximity to the site and whose livelihood is dependent on the tourists/visitors to these properties) and in accordance with the guidelines / laws on preservation.

SECTION 4: INSTITUTIONAL MECHANISM FOR RECOVERY

In the aftermath of a major disaster (affecting one or several districts) the State Government will establish an efficient and transparent relief administration mechanism to handle long term recovery and reconstruction. If required, the SEC may decide to put up a mechanism such as establishment of a Recovery Committee with Secretary of select Departments as Members. In order to provide a strong leadership and coordination, SEC may also appoint a Relief Coordinator. Table below indicates the name of the State Department with the capability to take the role of primary responsibility in dealing with specific components of the recovery framework.

Recovery component lead role	**Department**
Social Recovery	Social Welfare Department
Economic Recovery	Planning & Development Department
Infrastructure Recovery	Public Works Department
Environment Recovery *a. Natural environment* *b. Natural and cultural heritage properties*	 a. Environment and Forest Department b. Department of Cultural Affairs

In the event of an emergency affecting one or several local areas within the District, DDMA will convene a meeting to discuss recovery implications with support from line departments and ESF's already identified in the DDMP. The CEO of DDMA will be responsible for providing the leadership and coordination and laying out the recovery time line, execution plan, monitoring progress and further reporting to SDMA. Recovery at a city level will be managed by the Local City Government. In rural areas the District Authority will continue to coordinate heavily with the local authority on recovery efforts.

PART – IX FINANCIAL ARRANGEMENTS

SECTION 1: EXISTING FINANCIAL ASSISTANCE

Financial assistance in the wake of natural calamities is provided in accordance with the schemes of relief funds. These schemes are based on the recommendations of the successive Finance Commissions. While the budgetary provision of these relief funds is dealt with by Ministry of Finance, the processing of request of the state government for these funds is done by the Ministry of Home Affairs (DM Division). The present scheme of State Disaster Response Fund (SDRF) and National Disaster Response Fund (NDRF) are based on the recommendations of the Thirteenth Finance Commission (TFC), operative from 1st April 2010 to 31st March 2015.

On the recommendation of the TFC, the Minister of Finance GOI has allocated funds for strengthening disaster management institutions, capacity building and response mechanisms.

SECTION 2: CAPACITY BUILDING GRANT AND ASDMA FUND

8.2.1 Capacity Building Grant

On the recommendation of the 13th Finance Commission, allocation has been made to the states for taking up activities for building capacity in the administrative machinery. The Ministry of Finance has issued the guidelines for the utilization of the fund. The fund would inter alia include items for training and capacity building of stakeholders and functionaries in states, preparation of disaster management plans based on hazard, risk and vulnerability analysis and setting up and strengthening of emergency operations centres in states.

(Rs in Crore)

2010-11	2011-2012	2012-13	2013-2014	2014-2015	Total
5.00	5.00	5.00	5.00	5.00	25.00

8.2.2 ASDMA Fund under State Budget

(Rs in Crore)

Year	Non-Plan Fund	Plan Fund
2009-10	2.44	Nil
2010-11	5.00	Nil
2011-12	6.00	Nil
2012-13	9.00	2.00

SECTION 3: LIST OF ONGOING DM ACTIVITIES AND FINANCING OF PROJECTS

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
1	Hazard Risk & Vulnerability Assessment (HRVA) for the State of Assam	HRVA will focus on developing a data-base of disasters which will be collated, analyzed and validated to make appropriate risk information available. In addition to structural and physical vulnerabilities, social and economic vulnerability indicators shall be identified and assessed. These will help develop feasible multi-hazard risk and vulnerability assessments and the likely hazard-scenario. It will include an assessment of the probability and incidence of all major hazards. Further, the activity will also look at differential indicators of vulnerability including occupational and settlement patterns, poverty and migration, and socio-economic and cultural vulnerabilities etc. The assessment reports will seek to prepare hazard maps, vulnerability and risk profiles and risk quantification and exposure data. As a pilot study, Assam State Disaster Management Authority has engaged the North East Space Application centre for conducting the HRVA for Dhemaji district and Guwahati city, Dibrugarh & Silchar towns	Running on Pilot basis	
2	Flood damage Mitigation Measures for Barak Valley in South Assam Including Effects of Climate Change	To tackle flood problems in the valley, solution must be achieved incorporating due weightage to all hydrologic and hydraulic factors effecting flood movement in the river system. A comprehensive integrated mitigation plan needs to be developed based on the hydraulic & hydrologic factors, local conditions of natural reservoirs, drainage system, etc.	2 years	60 Lakhs

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
		and in this context the study has been undertaken Civil Engineering Department, NIT, Silchar.		
3	Status Survey for School & Hospital Buildings in Guwahati City and Retrofitting Solutions	The scenarios developed for M8+ earthquakes in NE Region projects the risk for massive loss of life & infrastructures. Health care facilities are the community's lifeline in normal times which become non-functional mostly in post-earthquake situation. Besides, one of the major challenges faced today is that sizable number of the schools is unsafe. Under such scenario, ASDMA has undertaken a project with Civil Engineering Department of Assam Engineering College, Guwahati to study the multi-hazard safety aspect of School & Hospital Buildings in Guwahati City and related Retrofitting Solutions	1.5 Years	53.16 Lakhs
4	Flood Early Warning System (FLEWS)	The State of Assam suffers from annual flood events but unfortunately did not have any early warning mechanism that could alert the concerned authority. In the aftermath of devastating flood in Lakhimpur District in June 2008, the Government of Assam approached North East Space Application Centre (NESAC) to take up the responsibility of developing an effective early warning system for floods in coordination with different stakeholders viz. IMD, CWC, NEEPCO, Water Resources Department, etc. The FLEWS provides early warning of flood in magnitude (severity), location and probable time (within 12 – 24 hours range), high rainfall warning with location & time, pre & post monsoon status of embankment at		

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
		various river systems.		
5	Training & Capacity Building Programme	ASDMA envisages a multi stakeholder approach in the proposed perspective plans for capacity building (under 13th Finance Commission) which includes: Government Officials of the concerned departments Engineers, Architects, Masons Doctors and Paramedics Teachers, Students and Heads of Educational Institutions Community Volunteers, NGOs, CBOs To undertake the task of training the different stakeholders in the 25 identified areas, as was brought out in a Training needs Analysis, ASDMA has through a competitive and elaborate process empanelled three institutes viz Tata Institute of Social Sciences, All India Disaster Mitigation Institute of Institutions for undertaking these trainings.		
6	GIS Mapping of Utilities	The State should maintain an inventory of existing disaster management resources that can be pre-positioned appropriately to enhance and support response mechanism in case of any emergency. ASDMA therefore intends not only to build up a database of available resources but also to have it on a GIS platform for an effective decision support system and would be done in project mode.		
7	Integration of Emergency Helpline Numbers	Integration of emergency help line numbers i.e. Police, Fire Services & Health into a single helpline number 108 is being undertaken for a one point crisis response help	Expected to be flagged off in the first half	

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
		line in the State of Assam. 704 Police and Fire Stations across the State are being connected with PRI lines to EMRI call centre 108 where all emergency calls would be received and then diverted to the respective location based on the emergency i.e. Health, Fire or Police. Training of the Emergency Response personnel of the Fire & police stations is already underway and approx 4000 personnel (6 persons per station) is being trained on their roles and responsibilities. The Project is now ready for operationalization and is expected to be flagged off in the first half of 2012.	of 2012	
8	Strengthening of DDRIC, RCDRIC and SDRIC	The Disaster Response & Information Centre at the State, District and Revenue Circle levels has an important role to play in any emergent situations. It is the nerve centre for Response & Coordination and will have to receive information and dissemination of the same to the appropriate quarters expeditiously. At the time of any disaster, it will serve as the Incident Command Post (ICP) for the response & disaster Management operation in the State/District/Revenue Circle. The SDR&IC / DDR&IC / RCDR&IC would therefore be strengthened with specialized equipments, efficient communication network, and relevant, intelligent and easily accessible database. Further, the district and Revenue Circle level Response & Information Centres have to be made functional 24x7x365.		
9	Flood Hazard Atlas	The Flood Hazard Zonation Map		

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
	for the State of Assam	identifying the flood prone areas and the risk associated with each area offer significant cue for the planners for devising area specific mitigation measures. The Flood Hazard Atlas prepared by National Remote Sensing Centre (NRSC), Hyderabad and validated by all the Deputy Commissioners of the districts of Assam will be of immense use in Flood Risk Assessment, Planning and implementing necessary long term mitigation measures for minimizing the impact of Floods in the State. Assam is the first State in the country to have such an Atlas with much detail prepared by NRSC.		
10	Awareness campaign / Annual Media Plan	The aim of the Media Plan is to bring out a 360 degree unifying communications and awareness generation programme that is consistent and powerful for roll-out across ASDMA key audiences. Messages would be disseminated through Print Media, Electronic Media, Outdoor media, IEC materials. Besides these various below the line activities like Road Show & Mall Activity, Competitions like Slogan Writing, Photography, Quiz, Drawing Competitions etc., Rallies, Street Plays etc. Another major highlight of the media plan is to organise the Mock drills for Schools throughout Assam and Apartment Societies in Guwahati City.		
11	Landslide Risk Mitigation for Guwahati City	Landslides frequently pose serious threat to life, property, infrastructure and major communication links in all the States in North Eastern Region. Besides hilly districts of Assam,		

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
		there are sporadic cases of landslides in and around Guwahati City. The problem of landslides sometimes go unnoticed or individual landslides are being dealt with ad hoc response mechanism and the problem keep on recurring year after year. So, ASDMA has undertaken this project for studies landslide effected areas and suggest mitigation strategy.		
12	Landslide Hazard Zonation Mapping of Assam	Scope of the project includes : Detail landslide inventory as per guidelines of GSI and NDMA with location information in GIS platform and landslide incidence map both State & District levels Geotechnical mapping of areas with highest vulnerability to landslides as envisaged in the Landslide Hazard Zonation Map		
13	Setting up of Assam Institute of Disaster Management (AIDM)	Considering the vulnerability of Assam to natural hazards and the socio-economic vulnerability of the people living in the State, a comprehensive plan for disaster preparedness and mitigation is the need of the hour. Capacity building of officials of different line departments dealing with emergencies is a major component of preparedness & mitigation and it is this aspect which underlines the need to promote an Institute of Disaster Management in the State of Assam. The Assam Institute of Disaster Management could build and continuously upgrade the disaster management capabilities of public administration, communities and other stakeholders and strive for integration of disaster management		

Sl No	Title of Project	Project Brief	Timeline	Budget (Rs in Lakhs)
		perspective in the overall development process. It could also provide guidance and direction to the ASDMA on mitigation measures specific to each hazard that the State is vulnerable to. Further, the Institute could carry out activities on Research and Development, Consultancies, Documentation of best practices etc. It is envisaged that the Assam Institute of Disaster Management could be a Centre of Excellence for the entire North East, autonomous and self- sustaining so that it can overcome resource constraints.		

PART – X IMPLEMENTATION OF SDMP

SECTION 1: DISSEMINATION OF PLAN

Effective dissemination of plan is necessary for understanding of the process, participation / coordination of all stakeholders and appropriate decision-making. ASDMA shall carry the responsibility of plan dissemination as per the list approved by the SEC. Full scale version of the ASDMP shall be disseminated to the following:

- National Disaster Management Authority
- Ministry of Home Affairs
- Ministry for Development of North Eastern Region (DoNER) and all other relevant Ministry supporting centrally sponsored development schemes in the State
- Defence Services
- All Departments and agencies of the State Government of Assam
- District Disaster Management Authorities of the State of Assam
- Emergency Responders
- Multilateral and Bilateral Institutions supporting Development and DM actions in the State of Assam
- Civil Society Organizations
- Technical, Scientific, Academic, Management and Training Institutions involved in support of DM mission areas in the State of Assam

An appropriate/abridged version of the plan shall be made available for access and information to common people of the State.

SECTION 2: REVIEW, MONITOR, EVALUATE AND UPDATE

The preparation of ASDMP and maintenance of the Plan is responsibility of ASDMA. ASDMA will prepare an annual progress review based on the information received (sub-plans to be submitted on an annual basis during the month of November-December) by line/primary/secondary support departments.

A comprehensive review of the legislation and policies on DM will be taken up the by the SEC once in five years and make suggestions/recommendations to enhance the efficacy of the Disaster Management arrangements in the State of Assam.

The first comprehensive review of ASDMP (ASDMA, 2013), will be taken by SEC in 2014 to assess the appropriateness of the ASDMP, effectiveness and efficiency in establishing and delivering the anticipated outcomes under the mission areas, departments effectiveness to reorganize during disaster events and coordination arrangements among stakeholders, impact of disaster events on the communities and overall state economy and current state of preparedness for future events as per the results of the detailed hazard risk and vulnerability assessment studies.

For the review process of ASDMP, SEC shall convene a meeting of all Secretaries of the Government of Assam, CEO's of DDMA, representatives form technical/scientific/academic/research institutions and representatives from CSO's and will:

- Examine the status of the revised/comprehensive risk assessment of the state
- Examine progress towards establishing the DM Plans at the District and Local Authority Level
- Examine progress towards establishing DM Plans at the Department Level

- Examine in detail the implementation aspects of the Plan at all levels, identify problems and develop recommendations/mechanisms to overcome them
- Examine progress on and determine effectiveness of preparedness actions and initiatives
- Examine progress on and determine effectiveness of prevention/mitigation actions and initiatives
- Examine progress on and determine effectiveness of response mechanism and initiatives in strengthening partnership and involvement of local communities
- Examine progress on and determine effectiveness of capacity building activities and status of State Human Resources Development Plan on DM
- Determine the performance of early warning systems and their role in risk reduction of the state
- Examine progress on and determine effectiveness of mainstreaming disaster risk reduction activities in all development schemes of the State
- Examine the effectiveness of Central/State/Multilateral/Bilateral/Donor funded DM intervention projects, and determine the performance of those projects in influencing the vulnerability reduction and resilience building of the State
- Examine the control and coordination arrangements to ensure participation by all tiers of Administration and State Departments. Put a mechanism for increase/sustained participation at all times (Monsoon Forum may be established to determine the forecast for the year wherein departments can share their plans and actions over the monsoon period)
- Examine the progress made under each directive/order on DM, identify lacunae in implementation and direct for compliance
- Recommend necessary revisions for changes in policies, priorities and functions, new programs, and funding for DM
- Analyze the Plan maintenance process by ASDMA during the review period and suggest revision and submission of update DM Plan for the State
- Additionally, recommend any activity which will build guide the State on achieving the Vision and Mission Objective of the Plan.

The first review shall be undertaken in a one year timeframe (due for 2014). The three-year review and revision cycle will provide the basis for updating the State DM Plan. Subsequent review may be staged within a time span of 3years.

SECTION 3: ACTION PLAN

In order to document key progress areas in DM, it is proposed to sequence the activities for the period of three years. This will be followed by the SEC review in 2014. The action plan below is list of key areas which will require attention over a time frame of three years. The list of actions is essentially to direct full scale operations of DM across all mission areas – Preparedness, Prevention, Mitigation, Response & Rehabilitation. The list of actions given in the table below is indicative. Stakeholders identified in the ASDMP can make reference and expand it further in their respective DM plan. A three year time horizon is split into three Phases. It is broadly categorised as:

Phase I Planning Phase
Phase II Integration Phase
Phase III Operational Phase

Phasing of Activities			
Phase	**I**	**II**	**III**
Description	**PLANNING PHASE**	**INTEGRATION PHASE**	**OPERATIONAL PHASE**
Time in elapsed years	*upto 12 months*	*upto 2 years*	*upto 3 years*
Preparedness	▪ Circulation of ASDMP 2013 ▪ Guidelines to Stakeholders for Preparation of Department / Sector Sub-Plans ▪ Development of State HRD Plan by ASDMA ▪ Discussion on Disaster Preparedness Policy for the State ▪ Training and Capacity Building activities by ASDMA ▪ Identification of SDMG and commissioning through formation of expert group	▪ Conduct / Compilation of detail risk assessment studies across the State by ASDMA ▪ Release of SDMG ▪ State Preparedness Policy ▪ Department wide preparation of DM Plan ▪ Training on DM by department to select staff involved / identified to handle DM tasks ▪ EW protocol fully established in pilot districts and implemented with support of the local communities (End-to-end EWS)	▪ Department DM Preparedness Plan ▪ State DM Preparedness Plan
Prevention and Mitigation	▪ Discussion on Disaster Mitigation Policy for the State ▪ Sharing of SOP outline indicated in the Plan and request for resubmission of SOP wrt mitigation guidance note ▪ Discussion on arrangement for protection of Critical Infrastructure Protection	▪ State Mitigation Policy ▪ Department wise mitigation options identified and action plan submitted to ASDMA	▪ Department DM Prevention and Mitigation Plan ▪ State DM Prevention and Mitigation Plan
Response	▪ Sharing of SOP outline indicated in the Plan and request	▪ Response SOP's finalized by all participating	▪ Department DM Response Plan ▪ State DM Response

Phasing of Activities			
Phase	**I**	**II**	**III**
Description	**PLANNING PHASE**	**INTEGRATION PHASE**	**OPERATIONAL PHASE**
Time in elapsed years	*upto 12 months*	*upto 2 years*	*upto 3 years*
	for resubmission of SOP wrt response guidance note	departments and other institutions including the Indian Red Cross ▪ State Response Plan prepared on the lies of finalized department SOP's for Hazard specific response	Plan
Rehabilitation	▪ Discussion with departmental lead engaged in recovery role and suggesting plan of action wrt guidance note on recovery ▪ Revisit of rehabilitation policy in light of the ASDMP	▪ Guidance note highlighting principles and phase wise approach for immediate post-disaster recovery phase, rehabilitation and reconstruction issues to all Departments of the State.	▪ State Rehabilitation and Reconstruction Plan

ANNEXURE 1 - KEY GOVERNMENT NOTIFICATION & ORDER

GOVERNMENT OF ASSAM
REVENUE & DISASTER MANAGEMENT DEPARTMENT
ASSAM SECRTARIAT
DISPUR : : GUWAHATI

ORDERS BY THE GOVERNOR OF ASSAM

NOTIFICATION

Dated Dispur the 5th August, 2010

No.RGR.364/2007/Pt.V/31: The Governor of Assam is pleased to constitute an Advisory Group for preparation of a road map for training and institutionalization of the Incident Command System (Since renamed as Incident Response System) in the State with the following composition :-

1. Shri Bhaskar Barua, IAS (Retd.) - Chairman
2. Shri Atul Chaturvedi, IAS, CEO, ASDMA - Member
3. Shri Ariz Ahmed, IAS,
   Secretary to Government of Assam - Member
4. Shri Rupak Mazumdar, ACS
   Director, Food & Civil Supplies - Member
5. Shri Pabitra Khound, ACS,
   Joint Director, Assam Administrative Staff College - Member
6. Shri Debo Prasad Mishra, ACS, - Member
   Deputy Director, Assam Administrative Staff College - Member
7. Mrs. Nandita Hazarika, ACS,
   State Project Officer, Disaster Risk Reduction Programme
   Revenue & Disaster Management Department - Member-Secretary

The Advisory Group will make recommendations regarding the road map for implementation of Incident Command System in all districts of the State and also suggest a comprehensive strategy for institutionalization of the same.

(V. K. Pipersenia)
Principal Secretary to the Govt. of Assam
Revenue & Disaster Management Department

Memo No.RGR.364/2007/Pt.V/31-A Dated Dispur the 5th August, 2010

Copy forwarded to:

All concerned.

By orders etc.,

Principal Secretary to the Govt. of Assam
Revenue & Disaster Management Department

(Atul Chaturvedi)

GOVERNMENT OF ASSAM
REVENUE & DISASTER MANAGEMENT DEPARTMENT
DISPUR:GUWAHATI

NOTIFICATION

Dated 30th September 2010

No. RGR/DM/25/2010/4 : A core Committee for Review of the implementation of the Building Bye-laws is hereby constituted with the following members:

1.	Chief Executive Officer, Assam State Disaster Management Authority	Chairperson
2.	Commissioner & Secretary, GDD Department	Member
3.	Commissioner, GMC	Member
4.	Chief Executive Officer , GMDA	Member
5.	Deputy Commissioner, Kamrup Metro	Member
6.	Prof. Sajal Kanti Dev, IIT, Guwahati	Member
7.	Prof. Hemant Kaushik, IIT, Guwahati	Member
8.	Prof. Jayanta Pathak, AEC, Guwahati	Member
9.	State Project Officer, Disaster Risk Reduction	Member Secretary

The Committee will suggest the strategy for conducting the study regarding compliance of Building Bye-Laws in Guwahati City after its enforcement in December 2006, select / recommend technical institute for the conduct of the study and submit a report to the Authority with suggestions for strengthening the enforcement, if required.

(V.K. Pipersenia)
Principal Secretary
Revenue & Disaster Management Department

Memo No. RGR/ DM/25/2010/4-A Dated 30th September 2010

Copy forwarded to-

All members

(V.K. Pipersenia)
Principal Secretary
Revenue & Disaster Management Department

GOVERNMENT OF ASSAM
REVENUE & DISASTER MANAGEMENT DEPARTMENT
DISPUR :: ASSAM.

No. RGR/DM/06/15 (A) Dated.16th June 2011

OFFICE MEMORANDUM

Sub: Allocation of resources for preparedness, mitigation and response activities related to Disaster Management by Departments of the Government of Assam

While natural hazards may be inevitable, disaster losses, however, can be minimized through adequate disaster risk management. Taking into consideration the value of development gains which are wiped out through disasters, as also the huge quantum of funds required for post disaster relief and rehabilitation, any investment in disaster mitigation will yield a higher rate of return than any other development project. Therefore, a paradigm shift has now taken place with the shift in focus from reactive to proactive i.e. from relief to prevention and mitigation of disasters.

The Assam State Disaster Management Policy explicitly states that the Government of Assam recognizes the need to have a proactive, comprehensive, and sustained approach to disaster management to reduce the detrimental effects of disasters on overall socio-economic development of the state.

Further, the Policy also states that Critical infrastructure like dams, roads, bridges, power stations, embankments etc shall be constantly monitored for their safety standards and strengthened where deficient. The concerned departments would ensure that requisite actions and measures are taken to ensure that the building standards for these infrastructures are aligned to the safety norms. The State Government shall take steps to ensure that all lifeline buildings in the Government sector are examined for their structural vulnerabilities and if required, retrofitted. The State Government shall also ensure that existing multi-storied buildings in the private sector or such buildings where public congregate like cinema halls, shopping complexes etc are examined for their structural vulnerabilities and if required, retrofitted. Therefore adequate strategy will have to be devised by the government to ensure that mitigation concerns are addressed in all aspects of development planning.

It has however been observed that most of the departments do not have any provision for disaster management activities in their departmental budgets. Proposals relating to risk reduction (mitigation), preparedness, procurement of equipments, operation and maintenance of their facilities for disaster response, assessment of buildings, retrofitting of vulnerable structures etc is submitted to Revenue & Disaster Management Department for funding. But

as already pointed out in different meetings of SDMA, SEC etc, and clearly enunciated in the Assam State Disaster Management Policy, departments will have to take primary responsibility for related disaster management concerns and find the required funds within their own departmental budgets.

All departments are therefore advised to ensure allocation of adequate resources for preparedness, mitigation and response activities related to Disaster Management within their own departmental budget.

(N.K. Das)
Chief Secretary to the government of Assam

Memo No. RGR/DM/06/15 (A) Dated.16th June 2011

Copy to:

1. The Principal Secretary to the Chief Minister, Assam.
2. The Private Secretary to all Minister of Assam, Dispur
3. The Staff Officer to the Chief Secretary, Assam, Dispur
4. All Additional Chief Secretaries to the Government of Assam, Dispur
5. All Principal Secretaries to the Government of Assam, Dispur
6. All Commissioner & Secretaries to the Government of Assam, Dispur
7. All Secretaries to the Government of Assam, Dispur
8. All Heads of Departments

By order etc..

(V.K. Pipersenia)
Principal Secretary
Revenue & Disaster Management Department

GOVERNMENT OF ASSAM
REVENUE & DISASTER MANAGEMENT DEPARTMENT
DISPUR: GUWAHATI

NOTIFICATION

Dated 21st September, 2011

No RGR/DM/09/2011/71 : An Advisory Committee is hereby constituted as follows to advise the Assam State Disaster Management Authority (ASDMA) on various issues pertaining to landslide hazard mitigation and risk reduction in the State:

1	Principal Secretary, Revenue & Disaster Management Department	Chairperson
2	Principal Secretary, Department of Mines & Minerals	Member
3	Principal Secretary, Urban Development Department	Member
4	Chief Executive Officer, Assam State Disaster Management Authority	Member Secretary
5	Commissioner & Secretary, Guwahati Development Department	Member
6	Commissioner & Secretary, Department of Mines & Minerals	Member
7	Director, Directorate of Geology & Mines	Member
8	Director, Geological Survey of India, Guwahati	Member
9	Deputy Commissioner & Chairman DDMA, Kamrup (Metro)	Member
10	Prof Chandan Mahanta, IIT, Guwahati	Member
11	Head of the Department, Geology Department, Guwahati University	Member

The Committee will particularly suggest to ASDMA the strategy for framing roadmap in the following areas:

- Devising a Landslide Hazard Zonation Map for the State
- Guwahati Landslide Mitigation Project
- Coordinating Studies related to Landslide Hazard
- Incorporating Landslide Hazard Risk Zonation in Guwahati Master Plan

(V. K. Pipersenia)
Principal Secretary
Revenue & Disaster Management Department

Memo No RGR/DM/09/2011/71 - A Dated 21st September, 2011

Copy forwarded to-

1. All members

(Atul Chaturvedi)
Chief Executive Officer
Assam State Disaster Management Authority

GOVERNMENT OF ASSAM
PLANNING AND DEVELOPMENT DEPARTMENT

NO. PDP 82/2010/127 **Dated, Dispur the 13th October, 2011.**

To : 1) The Additional Chief Secretary to the Govt. of Assam,

_____ Department.

2) The Principal Secretary to the Govt. of Assam,

_____ Department.

3) The Commissioner and Secretary to the Govt. of Assam,

_____ Department.

Sub : Modified guidelines for Disaster Management issues to be addressed by all Departments for any new / ongoing Project.

Sir,

I am directed to enclose herewith the modified guidelines to be followed in case of new and ongoing projects to address the disaster management issues.

Alongwith the modified guidelines the Checklist and list of Codes is also enclosed for submission with project proposal from now onwards.

Enclosed: 1) Format I (General issues)
2) Annexure-I (Checklist of NDIA)
3) List of Codes.

Yours faithfully,

O/O the Chief Executive Officer
Assam State Disaster Management Authority, Assam, Dispur, Guwahati-6
Dy. No... 1216...
Date... 20/10/11

13/10/11

(DR. N.C. BORAH)
Additional Director (PC),
Planning & Development Department.

Copy to:-

1. The Chief Executive Officer, Assam State Disaster Management Authority, Dispur, Guwahati-6 for kind information.

13/10/11

Additional Director (PC),
Planning & Development Department.

GOVERNMENT OF ASSAM
PLANNING & DEVELOPMENT DEPARTMENT
DISPUR::ASSAM

No. .....

Sub: Disaster Management issues to be addressed by all Departments for new projects/ ongoing projects.

Disaster Management mandates factoring in Disaster Management concerns in all works, plans etc of Government Departments. A broad framework of issues to be addressed by all departments for any project is hereby circulated for compliance. Checklist for natural disaster impact assessment and list of codes is attached as annexure I & II.

Departments in their proposals for approval / concurrence of P & D Department are advised to submit the information regarding Disaster Management concerns in the projects, as per format enclosed. Further, a self certification regarding the correctness of the responses to the Disaster Management related issues vis-a-vis the guidelines / codes is also required to be submitted with any proposal.

FORMAT-I

General issues to be addressed by all Departments while submitting any project proposals to P & D Department

Sl No	Particulars	Description
1.	Nature /Type of Projects	
2.	Sitting / Location of the Project Lat: Long :	
3.	3.1Reasons for selecting the site 3.2Have possible alternatives sites been considered? 3.3 Is the of activity envisaged in the area compatible with the provisions of relevant Guidelines for setting up and operation of such activities?	
4.	Mention the Hazard and Risk the project is exposed to (Flood, earthquake, storms, landslide etc)	
5.	Have the likelihood and impact of such risks been estimated?	
6.	What are the preventive measures envisaged to confirm compliance to mitigate the identified risks from the probable identified hazards?	
7.	Brief note on the risk reduction / mitigation measures.	
8.	What are the possible impact of the Project on the Environment and the People	
9.	Will the mitigation measures create new risk (structural & Non- structural) ?	
10.	Are the relevant guidelines / norms / codes being followed in planning, design, construction/ operation and maintenance of the project ? If yes mention the guidelines.	
11.	Has the cost of disaster treatment/ mitigation measures been included in the overall project cost?	
12.	Certify that the whole process of risk management has been done based on available information and secondary evidence and the mitigation measure(s) are in conformity with the statutory and other regulatory requirements and are the most viable ones in the present circumstances.	

Note: Measures against blasts/ terrorism related activities do not form part of this suggested activity.

Signature:
Head of the Department

Annexure-I

1. Check List for Natural Disaster Impact Assessment

Name of the project:
State:
District :
Project Estimate Rs. ---------- (Lakhs)

1. Sitting of the project

1.1 Location of project site

- Latitude:
- Longitude:
- Height above mean sea level:

1.2. Earthquake Zone (Any known geological fault nearby may be listed)

1.3 Flood Proneness & Vulnerability:

- Past history of floods in the area
- Observed Highest flood level
- Frequency of flooding in last 30 years
- Depth of flooding
- Duration of flooding
- Damage/loss (maximum, average , potential)

1.4. High wind Proneness & Vulnerability:

- Frequency and Intensity
- Information on highest wind speed
- Record of past wind surge

1.5 Landslide Proneness & Vulnerability:

- Location of hill slope vis –a vis the project's location
- Past history of landslides,
- Possibility of rock falls etc.

1.7 Existence of Dams or Barrages upstream

- Distance from the project. Was dam breach effect considered on the project?
- If so, have the dam break analyses been carried out? Has their impact on safety of the project been evaluated?

Signature:
Head of the Department:

2. Nature/Type of Project

- Communications : towers, lines, building
- Transportation : Roads, Railways, Bridges, Tunnels
- Power: Power houses, sub stations, power lines
- Water Resources: Dams, barrages, appurtenant structures, river training structures, Canals
- Habitations: townships-planning from the point of view of safety against hazards
- Water supply and sanitation projects including water supply and sewer lines
- Ports and Harbours
- Building projects
- Any other

3. Hazards Risk to the Project

Have the following been evaluated:

- Probable maximum seismicity at site and site dependant seismic design parameters
- Probable maximum wind speed
- Probable maximum precipitation
- Probable maximum flood discharge and level
- Probability of occurrence of floods, earthquakes, landslides Soil liquefaction proneness under probable earthquake intensities

4. Mitigation / Reduction of Risk:

4.1 There are specific codes, manuals, guidelines etc. developed by Bureau of Indian Standards, NDMA, and concerned organisations for sitting, design, Construction and maintenance of various types of Infrastructures. **(An Indicative but not exhaustive list of some of them is at Annex-II.)**

4.2 Have the relevant BIS codes and guidelines been complied with?

4.3 Have adequate safeguards to meet the risks of natural hazards as evaluated at Para 3 above, been adopted?

5. Impact of the Project on the Environment and the People

Has the impact of the project on the environment and the people been studied with the respect to the following :

Damages to pipelines to transport and storages of harmful and inflammable materials and gases in the project area.

I Has any study been made to assess the danger to the environment and the people posed by those occurrences? And if so what measures have been proposed?

Signature:
Head of the Department:

II The location of a particular project may be in a flood prone area that may be submerged/ flooded for a considerable period of time. In case human habitation and livelihood issues are bound to be affected adversely due to a particular project in flood prone area/ flood affected areas .

What measures have been undertaken to assess the danger to Environment, what provision is made for detailed Environmental Impact Assessment and for detailed disaster/ flood mitigation risk .

Similar criterion shall apply for erosion prone areas also .

III The railway lines and roads run across the drainage lines and if adequate waterways at appropriate locations are not provided, it may result in rise in water level and drainage congestion in up-stream areas.

Has this aspect been studied and if so, what mitigation measures have been proposed?

IV Land-slides triggered by earthquake as well as due to inherent instability of slopes accentuated by rains may lead to blockage of drainage channels and accumulation of water up-stream. These blockages may collapse due to their inherent instability and aided by rains. Men, machines and explosives can also be used to remove blockages and reduce flooding up-stream.

These may lead to sudden release of water and flooding and erosion in down- stream areas.

Whether any study has been carried out in this regard and what mitigation measures have been proposed?

V As all the projects involved acquisition of land and influx of large number of people in the area to take up construction activities, it may result in deforestation and soil erosion. Measures for prevention of deforestation and arresting soil erosion are required to be taken.

Whether any study has been carried out in this regard and what mitigation measures have been proposed?

VI If the project involves storage of water, failure of any component may cause flooding and large scale damage to lives, property and infrastructure etc.

Whether any study has been made and if there is a possibility thereof, what measures have been proposed to meet the eventuality?

Signature:
Head of the Department:

IV. LIST OF CODES / GUIDELINES FORSAFETY OF BUILDINGS/ STRUCTURES FROM NATURAL HAZARDS

As these codes and guidelines are being updated from time to time by different institutions/ organisations therefore the latest updated version shall be referred at the time of conceiving a project. List has been attempted which may not be complete.

I. For General Structural Safety

1. BIS national Building Code 2005
2. IS: 456:2000 "Code of Practice for Plain and Reinforced Concrete.
3. IS: 800-1984 "Code of Practice for General Construction in Steel
4. IS: 801-1975 "Code of Practice for use of Cold Formal Light Gauge Steel Structural Members in General Building Construction.
5. IS 875 (Part 2): 1987 Design Loads (other than earthquake) for building and structures Part2 Imposed Loads
6. IS 875 (Part 4): 1987 Design loads(other than earthquake) for building and structures Part 4 Snow Loads.
7. Is 875(part 5): 1987 Design loads (Other than earthquake) for building and structure part 5 special local loads and load combination
8. IS: 883:1966"Code of Practice for Design of Structural Timber in Buildings
9. IS: 1940:1987 "Code of Practice for Structural Safety of Buildings: Foundation's
10. IS: 1905:1987 "Code of Practice for Structural safety of Buildings: Masonry Walls
11. IS: 2911 (part I) Section 1 : 1979 "Code of Practice for Design and Construction of Pile Foundation Section 1.

Part 1: Section 2 Based Cast-in-situ Piles
Part 1: Section 3 Driven Precast Concrete Piles
Part 1: Section 4 based precast Concrete Piles
Part 2: Timber Piles
Part 3: Under Reamed Piles
Part 4 Load Test on Piles

II. Protection from Cyclones/Wind Storms

12. IS 875 (3) – 1987 "Code of Practice for Design Loads (Other than Earthquake) for Building and Structures Part 3, Wind Loads"
13. IS: 2911-1973 "Guideline for construction of cyclone shelters."
14. IS: 15498 – 2004 "Guidelines for improving the cyclonic resistance of low rise houses & other building/structures.
15. Guideline (Based on IS 875 (3) – 1987) for Improving the Cyclonic Resistance of Low rise houses and other building.

Signature:
Head of the Department:

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15. Guideline (Based on IS 875 (3) – 1987) for Improving the Cyclonic Resistance of Low rise houses and other building.

Signature:
Head of the Department:

37. IS: 14680 1999 Guidelines for land slide control.
38. IS: 14948: Code of practice for Reinforcement of Rock Slopes with plain edge of failure.
39. BIS 12023: Code of Practice for Field Monitoring and Movement of Structures using Tape Extensometer.
40. BIS 14804: Guidelines for Sitting, design and selection of materials for Residential Building in Hilly Areas.

VI. For protection of Saline Embankments and Coastal Canals

41. IS: 8835-1978 "Feasibility study and preparation of preliminary project report".
42. IS: 10635-1993 (reaffirmed 2003) "Freeboard requirements in embankments and dams".
43. IS: 12169-1987- "Criteria for design of small embankments dams".
44. IS: 8835-1978: Feasibility study, preparation of
45. IS: 12094-1978 Preliminary Project Report.
46. IS: 10635-1993 (reaffirmed 2003): Freeboard requirements in embankments and dams.
47. IS: 11532-1995 (reaffirmed 2005): Construction and maintenance of river embankments.
48. IS: 12094-2000 (reaffirmed 2005): Planning and design of river embankment.
49. IS: 12169-1987: Criteria for design of small embankment dams.

Signature:
Head of the Department:

ANNEXURE 2 - EMERGENCY TELEPHONE DIRECTORY

Fire Station in Districts *(Last updated on Jan2011, ASDMA)*

Sl	District	Contact Nos
1	Goalpara	(03663) 240101
2	Darrang	(03713) 222133
3	Nagaon	(03672) 235605
5	Lakhimpur	(03712) 220101
6	Lakhimpur	(03752) 222201
7	Dhemaji	(03753) 225007
8	Morigaon	(03678) 240318
9	Sibsagar	(03772) 2222999
10	Udalguri	(03711)
11	Nalbari	(03624) 220222
12	Cachar	(03842) 220101
13	Hailakandi	(03843) 262101
14	NC Hills	(03673) 236301
15	Jorhat	(0376) 2320101
16	Dibrugarh	(0373) 2320382
17	Tinsukia	(0374) 2332101
18	Barpeta	(03665) 252132
19	Kamrup	(0361) 240517
20	Bongaigaon	(03664) 231226, 228381
21	Dhubri	(03662) 220033
22	Golaghat	(03774) 280300
23	K-Anglong	(03671) 272265
24	Kokrajhar	(03661) 270776

Fire Stations in Guwahati (Last updated on Jan2011, ASDMA)

1	Fire Emergency	101
2	Air Port	0361 2638386
3	Chandmari	0361 2550489
4	Dispur	0361 2260221
5	Mirza	0361 2300089
6	New Guwahati	0361 2550168
7	Noonmati (Refinary)	0361 2558454
8	North Guwahati	0361 2690768
9	Panbazar	0361 2540117, 2540222
10	Pandu	0361 2570888
11	Railway Station	0361 2540117
12	Santipur	0361 2637680

Telephone numbers of key resource institutions (Last updated on Jan2011, ASDMA)

Central Seismological Observatory	09863022211
Central Water Commission	0361-2674268/
Indian Meteorological Department, Borjhar	0361-2840201/2840552
NDRF, Guwahati	2840284
NEEPCO (Control Room)	03642-504153/2222938
NESAC	03642-908830
ARSAC	0361 – 2464617

Telephone numbers of ASDMA Officials (Last updated on Jan2011, ASDMA)

Name	**Designation**	**Contact number**
Atul Chaturvedi ,IAS	CEO, ASDMA	0361-2237293 / 94351-43281
Mirza Md. Irshad	Project Manager (Response)	94350-41806
Kusumber Choudhury	Project Officer(Response)	96157-79038
BM Lahon	Project Officer, Kamrup Metro / Kamrup	94351-92533
Neelam Yadav	Project Officer, Karimganj	94351-71863
Iqbal Hussain Laskar	Project Officer, Cachar	99541-40710
Joydeep Choudhury	Project Officer, Dhemaji	94350-88805
Rajib Dutta Chowdhury	Project Officer, Lakhimpur	94350-23991
Dipjyoti Hatikaoti	Project Officer, Dibrugarh	96784-68787
Jagadish Bhattacharya	Project Officer, Goalpara	98641-16646
Lohit Gogoi	Project Officer, Dhubri	957755-0399
Prankrishna Gogoi	Project Officer, Jorhat	986485-5138
G Thaosen	Project Officer, Nalbari	98641-74925
Niranjan Das	Project Officer, Nagaon	88764-61329

Telephone number of Police Control Room (Last updated on Jan2011, ASDMA)

GOALPARA	(03663) 240003
DARRANG	(03713) 225220
NAGAON	(03672) 235620
SONITPUR	(03712) 232800
LAKHIMPUR	(03752) 223737
DHEMAJI	(03753) 224195
MORIGAON	(03678) 241161
SIVASAGAR	(03772) 222801
UDALGURI	(03711) 225538
CHIRANG	(03664) 243201
NALBARI	(03624) 220440
CACHAR	(03842) 248744
HAILAKANDI	(03844)224595
KARIMGANJ	(03843) 266838
N.C. HILLS	(03673) 236121
JORHAT	(0376) 2320018
DIBRUGARH	(0373) 2329655
TINSUKIA	(0374) 2331476
BARPETA	(03665) 252231

KAMRUP	(0361) 2684402
BONGAIGAON	(03664) 231226
DHUBRI	(03662) 232180
GOLAGHAT	(03774) 280224
KARBI ANGLONG	(03671) 272594
KOKRAJHAR	(03661) 270637

Police Stations in Guwahati City (Last updated on Jan2011, ASDMA)

Sl. No	Police Station Name	Phone Nos.
1	Police Control Room	100 / 0361 2540138 / 2540113
2	Jalukbari PS	0361 2570522
3	Bharalumukh PS	0361 2540137
4	Fatashil Ambari PS	0361 2471412
5	Panbazar PS	0361 2540106
6	Paltan Bazar PS	0361 2540126
7	Latasil PS	0361 2540136
8	Chandmari PS	0361 2660204
9	Noonmati PS	0361 2550281
10	Geeta Nagar PS	0361 2557323
11	Dispur PS	0361 2261510
12	Basistha PS	0361 2302158
13	Woman PS	0361 2524627

Contact numbers of Sadar Police Stations (Last updated on Jan2011, ASDMA)

GOALPARA	(03663) 240031
DARRANG	(03713) 222136
NAGAON	(03672) 235606
SONITPUR	(03712) 220027
LAKHIMPUR	(03752) 222115
DHEMAJI	(03753) 224220
MORIGAON	(03678) 240237
SIVASAGAR	2222923/100
UDALGURI	(03711) 224425
CHIRANG (Dhaligaon)	(03664) 241262
NALBARI	(03624) 220445
CACHAR	(03842) 246279/246214
HAILAKANDI	(03844) 222253
KARIMGANJ	(03843) 262023
N.C. HILLS (Haflong)	(03673) 236228
JORHAT	(0376) 2320063 / 2320022
DIBRUGARH	(0373) 2329067
TINSUKIA	(0374) 2332100
BARPETA	(03665) 252113
KAMRUP Rangia	(03621) 240515
BONGAIGAON	(03664) 220994
GOLAGHAT	(03774) 280081
DHUBRI	(03662) 230979

KARBI ANGLONG	(03671) 272253
KOKRAJHAR	(03661) 270732

Contact number of SPs (Last updated on Jan2011, ASDMA)

District	**Office**	**Residence**	**Fax**	**Email**
Goalpara	(03663) 240161	240026	240595	sp_gpara@assampolice.com
Darrang	(03713) 222214	222149	222198	sp_darr@assampolice.com
Nagaon	(03672) 235624	233444	237939	sp_nagn@assampolice.com
Sonitpur	(03712) 230593	230581	230593	sp_sonit@assampolice.com
Lakhimpur	03752) 242599 / 222302	242088 / 222197	242599	sp_lakh@assampolice.com
Dhemaji	(03753) 224396	224312	224024	sp_dhem@assampolice.com
Morigaon	(03678) 240238	240204	240766	sp_mori@assampolice.com
Sibsagar	(03772) 222124	222139	225603	sp_sivgr@assampolice.com
Udalguri	(03711) 225117	225075	225300	
Chirang	(03664) 243189	242822	243131	
Nalbari	(03624) 220466	220324	222031	sp_nal@assampolice.com
Cachar	(03842) 245866	245057	231525	sp_cach@assampolice.com
Hailakandi	(03843) 262371	262030	263396	sp_karim@assampolice.com
NC Hills	(03673) 236325	236331	236332	sp_nch@assampolice.com
Jorhat	(0376) 2320021	2320027	2320190	sp_jor@assampolice.com
Dibrugarh	(0373) 2324424	2324414	2326065	sp_dib@assampolice.com
Tinsukia	(0374) 2331468	2331444	2333642	sp_tinsk@assampolice.com
Barpeta	(03665) 236254	236255	235959	sp_barp@assampolice.com
Kamrup	(0361) 2684400	2230529	2684403	sp_kam@assampolice.com
Kamrup Metro	(0361)2540278	2540105	2546286	
Bongaigaon	(03664) 230898		230996	
Dhubri	(03662) 230014 / 230974	230004 / 233354	231100	
Golaghat	(03774) 285233	284234	285107	sp_gola@assampolice.com
Dima Hasao	(03671) 272254	272264	273821	sp_karbi@assampolice.com
Kokrajhar	(03661) 270725	270759	270597	sp_kok@assampolice.com
Karimganj	(03843) 262371	262030	263396	sp_karim@assampolice.com
Baksa	(03624) 282770	282770		

Contact list of Deputy Commissioner of Assam (last updated on 20Jan2012, ASDMA)

Sl.No	District	Name	Std Code	Office	Fax	Residence	Mobile No.
1	BAKSA	Shri Babul Ch. Barbarua, ACS	(03624)	234524	234556	221574	94351-18553
2	BARPETA	Shri Siddharth Singh, IAS	(03665)	252129	252211 / 252059	252105	94355-45275
3	BONGAIGAON	Shri Shantanu P. Gotmare, IAS	(03664)	230889	231338	230490/23089	99540-44500
4	CACHAR	Shri H.K.Dev Mahanta, ACS	(03842-)	245056	233000 / 261705	261054	94350-50143
5	CHlRANG	Dr. Upendra Nath Bora, ACS	(03664)	241992	241103	242302	98640-91296/99571-73933
6	DARRANG	Shri Kumud Ch. Kalita, ACS	(03713)	222135	222153	222138	94353-86146/94351-06399
7	DHEMAJI	Shri M. S. Manivannan, IAS	(03753)	224208	224393	224203	94355-45273
8	DHUBRI	Shri Sunil Dutta, ACS	(03662)	230050	232760 / 230019	230030	94351-09061
9	DffiRUGARH	Smti Aruna Rajoria, IAS	(0373)	2316063	2316034 / 2313800	2316062	94350-19262
10	DlMAHASAO	Shri Dilip Borthakur, IAS	(03673)	236222	236094	236221	94351-18356
11	GOALPARA	Shri Preetom Saikia, IAS	(03663)	240030	240314 / 241553	240028	94350-10577
12	GOLAGHAT	Shri S. K. Gohain Baruah, ACS	(03774)	280222	280455 / 281340	280221	98640-16504
13	HAILAKANDI	Shri S. Thiek, ACS	(03844)	222251	222496 / 222254	222204	94351-66718
14	JORHAT	Shri Ramesh Chand Jain, ACS	(0376)	2320020	2320073 / 2309521	2320025	94353-40540
15	KAMRUP METRO	Shri Ashutosh Agnihotri, IAS	(0361)	2540149	2544452	2540104	94350-49546 96780-74774
16	KAMRUP	Shri S. K. Roy, ACS	(0361)	2684404	2684412 2684405	2466482 2604343	94350-13551
17	KARBI ANGLONG	Shri Rakesh Kumar, IAS	(03671)	272257	272693	272255	94355-45272
18	KARIMGANJ	Shri Jiten Borgoyari, ACS	(03843)	262345	264150	262103	94350-46154

Sl.No	District	Name	Std Code	Office	Fax	Residence	Mobile No.
19	KOKRAJHAR	Shri Donald Gilfellon, ACS	(03661)	270741 .	270867 / 270863	270740	94353-40196 94351-53000
20	LAKHIMPUR	Dr. Anwaruddin Choudhury, ACS	(03752)	222196	222929	222104	94350-79376
21	MORIGAON	Shri Solanki Vishal Vasant, IAS	(03678)	240225	240308 / 240303	240235	94355-45274
22	NAGAON	Dr. Patibandla Ashok Babu, IAS	(03672)	233185	233222 / 233193	233202	94353-68444
23	NALBARI	Shri Lalit Gogoi, ACS	(03624)	220496	220469 / 220371 .	220218	94350-54474
24	SIVASAGAR	Shri Jatindra Lahkar, ACS	(03772)	222137	222655 / 222131	222138	94350-13255
25	SONITPUR	Shri Tapan Chandra Sarma, ACS	(03712)	220011	221601 / 220744	220005	94350-87812/94353-86040
26	TINSUKIA	Shri S.S.Meenakshi Sundaram, !AS	(0374)	2331572	2333310 / 2330028	2330576	99545-33789/94353-88358
27	UDALGURI	Shri Thaneswar Malakar, ACS	(03711)	224433	224433 / 225230	224281	94350-54384

ANNEXURE 3 - LIST OF REFERENCE DOCUMENTS IN CONJUNCTION WITH SDMP

DM Act 2005
Assam State DM Policy 2010
Assam State DM Rules 2010

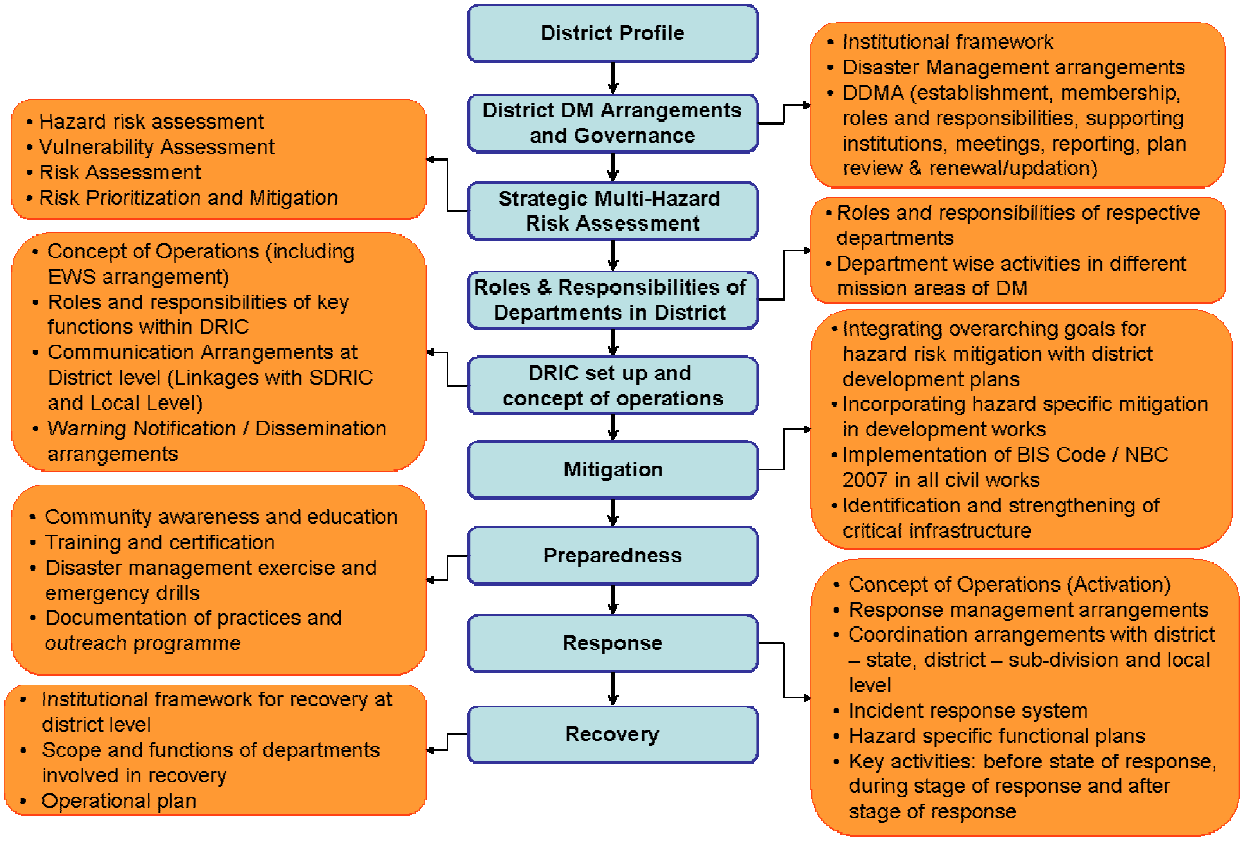
ANNEXURE 4 – District Disaster Management Plan (DDMP) Structure *(Outline)*

4.1 Process Overview

Effective disaster management arrangement requires planning at all levels. The plan document essentially highlights the process of developing (including review and renew) and implementing set procedures towards mitigation/prevention-preparedness and emergency response. The planning process will adopt the 'integrated approach' and all suggested practices as outlined in the ASDMP. District Disaster Management Authority (DDMA) and its members will participate/assist in formalizing the process of developing and shall take complete ownership of the DDMP.

4.2 Using NIDM's model template, existing DDMP and the proposed Outline to conduct district planning

National Institute of Disaster Management has issued model template/guidelines for preparation of District Disaster Management Plan (Download: http://nidm.gov.in/PDF/manuals/DDMP_Guidelines_Template.pdf). In addition several districts in Assam have existing DDMP which are reviewed and renewed form time to time. The outline shared herewith is to provide guidance and provide a structure for alignment of DDMP with ASDMP. The proposed plan outline is indicated below:



Annexure shall include:

- Key notification and order issued by DDMA
- Emergency telephone directory
- Risk maps of the district
- Activation level for response at district level
- Standard Operating Procedures (SOP) of departments
- Register of incident (annual and cumulative)

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http://www.censusindia.gov.in/ (Census of India)
http://www.ccaasm.nic.in/default.html (Controller of Communication Accounts, Assam Telecom Circle)
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http://pnrdassam.nic.in/ (Panchayat & Rural Development Department, Govt of Assam)
http://ndmindia.nic.in (National Disaster Management Division, MHA, GoI)
http://ndma.gov.in (National Disaster Management Authority)
http://sdmassam.nic.in/ (Assam State Disaster Management Authority)
http://asfo.org (State Fire Service Organization, Assam)
http://www.envisassam.nic.in/soilerosion.asp (Environmental Information System, ASTEC)
http://dod.nic.in/ (Ministry of Earth Sciences, Government of India)
http://www.portal.gsi.gov.in (Geological Survey of India)
http://www.seismo.ethz.ch/static/GSHAP/ (The Global Seismic Hazard Assessment Program)

http://managedisasters.org/state.asp?countryID=1&stateID=2 (Manage Disasters)

http://www.unisdr.org (United Nations International Strategy for Disaster Reduction

ASSAM STATE DISASTER MANAGEMENT AUTHORITY
Assam Secretariat, Dispur
Guwahati 781006, Assam

www.sdmassam.nic.in