State Disaster Management Perspective Plan

2018 - 2030

TAMIL NADU STATE DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF TAMIL NADU

State at a Glance - Tamil Nadu – 2018

S.No	Facts	Data		
1	Number of Districts:			32
2	No. of Revenue Divisions			86
3	Number of Taluks			292
4	Number of Revenue Villages			16,682
5	Number of Municipal Corporation			11
	Greater Chennai Corporation			1
6	Number of Municipalities			124
7	Number of Panchayat Blocks			385
8	Number of Town Panchayats			528
9	Number of Village Panchayats			12,524
10	Number of Firkas			1,189
11	Area in sq.km.:			1,30,058
12	Total Population: *	Persons	Males	Females
	Absolute Numbers	7,21,47,030	3,61,37,975	3,60,09,055
13	Decadal Population Growth: *			
	1) Absolute Numbers			97,33,279
	2) Percentage			15.60
14	Population Density (Persons per sq.km.) *			555
15	Sex Ratio (Females per 1000 Males) *			996
16	0-6 Population: *	Persons	Males	Females
	1) Absolute Numbers	68,94,821	35,42,351	33,52,470
	2) Percentage to Total Population	9.56	9.80	9.32
17	Child Sex Ratio * (Girls per 1000 Boys in 0-6 age group)			946
18	Literates	Persons	Males	Females
	1) Absolute Numbers	5,24,13,116	2,83,14,595	2,40,98,521
	2) Literacy Rate	80.33	86.81	73.86

* As per 2011 census.

State Disaster Management Perspective Plan

2018 - 2030

Thiru Edappadi K. Palaniswami

Hon'ble Chief Minister of Tamil Nadu
&
Chairman,
Tamil Nadu State Disaster Management Authority

TAMIL NADU STATE DISASTER MANAGEMENT AUTHORITY
GOVERNMENT OF TAMIL NADU

STATE DISASTER MANAGEMENT PERSPECTIVE PLAN 2018 – 2030

INDEX

EXECUTIVE SUMMARY

Tamil Nadu covers an area of 13 Million hectares and has a coastline of 1,076 kms whichis about 15% of the coastline of India. The State is known for its multi-hazard vulnerability, the major natural hazards being Cyclonic storms, Urban and Rural floods and periodic Droughts. The State is also prone to Landslides, Sea Erosion and Sea Water Incursion in specific pockets. The State is also exposed to the risk of Tsunami. The State has witnessed natural disasters of severe intensity since the beginning of the current century. The large scale losses of lives and colossal damages to the infrastructure during Tsunami 2004, battering of Cuddalore, Nagapattinam, Chennai and its surroundings during 2015 Floods, extensive damages in several districts during Thane, Nilam and Vardah, cyclones and severe damages in Kanyakumari during Ockhi cyclone and crippling of the entire State due to the severe drought in 2016-2017,unknown to recorded history in Tamil Nadu, are some of the major disasters that impacted Tamil Nadu already during the current century. Government of Tamil Nadu which is committed to reduce the risks due to different disasters has initiated several measures to strengthen preparedness, response, relief and reconstruction measures over the years. The Tamil Nadu State Disaster Management Authority has approved a perspective plan that is co-terminus with the Sendai frame work period.

The Government of India came up with the National Disaster Management Plan in May, 2016 integrating the Sendai Framework for Disaster Risk Reduction 2015-2030 adopted at the third United Nations World Conference in Sendai, Japan, in 2015. The Sendai Framework was the first International agreement adopted within the context of the post-2015 development agenda. Two other major international agreements followed it in the same year, the "Sustainable Development Goals 2015 – 2030" in September 2015, and the UNCOP21 Climate Change agreement to combat human-induced climate change in December 2015. Disaster Risk Reduction is a common theme in these three global agreements. The Paris Agreement of 2016 on global climate change highlights the importance of averting, minimizing, and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events and the role of sustainable development in reducing the risk of loss and damage. Intrinsic to sustainable development is disaster risk reduction and the building of resilience to disasters. The Hon'ble Prime Minister of India declared a 10 point agenda in the Second Asian Ministerial Conference on Disaster Risk Reduction (AMCDRR), held at New Delhi on November 2016. The 10 point agenda is the Roadmap for Disaster Risk Management to Climate Resilient and Sustainable Development.

The State Disaster Management Perspective Plan 2018-2030 has accorded primacy to the priorities enunciated in the Sendai Framework for risk reduction, Sustainable Development Goals, the Paris agreement on Climate Change agreement and the Hon'ble Prime Ministers 10 Point Agenda. The plan has been prepared, as per the Disaster Management Act 2005(Para 23 item 4) and also relied on the NDMA Guidelines on State Disaster Management Plan. The Plan was developed based on an elaborate consultative process with the DDMAs, Departments of Government, civil society and other multi-stakeholders.

The Plan includes,

a) The profile of the State (Chapter 1)

b) The Hazard vulnerability analysis of different parts of the State to different forms of disasters; (Chapter 2)

c) The institutional mechanism for risk governance- the roles and responsibilities of different Departments of the State (Chapter 4)

d) Preparedness measures to be taken and the capacity-building;(Chapter 5)

e) Disaster response, relief and rehabilitation (Chapter 6) & responsibility matrix of preparedness and Response Central, State & District agencies in in responding to any threatening disaster situation or disaster; (Annexure 1)

f) The measures to be adopted for prevention and mitigation of disasters;(Chapter 7)

g) The manner in which the mitigation measures shall be integrated with the development plans and projects; (Chapter 9)

h) Financial arrangements (Chapter 10)

Salient features of the Plan.

Vision:

"To build a safe and disaster resistant Tamil Nadu through systems approach, inclusive development and mainstreaming disaster risk concerns into the development ethos of the State"

Systems Approach for Risk Management

Systems approach recognizes that the disturbances caused in the local ecosystems are due to factors that emanate in the ecosystems that are upstream due to their interconnectedness. Moreover no ecosystem can be free from the influences of other ecosystems due to environmental factors such as Cyclonic storms, extreme weather events be it excess or deficit rainfall etc. The Risk Reduction strategies can be successful only when mitigation measures are adopted holistically to provide a permanent solution. Therefore, the Government has decided to adopt systems approach in prevention and mitigation strategies for risk reduction so as to provide a holistic solution. As per this approach the problems confronting the coastal and non-coastal districts will be examined on the ecosystems basis. In case of floods and drought a River Basin System will be the unit for treatment rather than treating each district as an entity by itself. This approach is necessitated by the fact that in many

districts the causative source for the risk lies in the upstream areas of the river system rather than due to inadequacies within that district. It is also imperative to focus on the river basin system in its entirety to address the risks that are faced as a consequence of floods, cyclonic storms, landslides and drought which are triggered due to the vagaries of Monsoon. The Systems approach looks at the causes and effects of the disaster in a holistic and integrated manner encompassing environmental, physical, social, economic and cultural aspects.

The systems approach takes into account that systems are interrelated to each other requiring a holistic management unlike the linear cause and effect chains where one tends to address issues that emerge only from snapshots. Systems approach will address the basic questions of disasters such as why there is a risk, what is the type of risk, when the risk is likely to occur, where the risk is likely to occur, who all will be affected by the disaster and how to reduce the risks.

The system approach stands out by the following characteristics

a) Understanding the big picture as against the local picture alone

b) Data analytics and aerial photogrammetric studies of river basins will provide the big picture that is required to address the disasters such as floods and drought.

c) Understanding the dynamic, complex and interdependent nature of different ecosystems viz. relation between fresh water and coastal ecosystems.

The systems approach addresses the different ecosystems in a holistic manner. Special focus will be on special ecosystems such as wetland marshland and creek ecosystems to secure their ecosystem service of flood and drought mitigation.

The focus areas for risk reduction will be "Natural Resources Conservation on watershed basis, Comprehensive Management of River Basins, Sustainable Management of Ecologically Fragile areas, Sustainable Agricultural Development, Mainstreaming of DRR into Developmental Plans, Social Inclusion and Integrated Development of the Vulnerable Areas". (Chapter 3)

The perspective plan enunciates the major goals that have been identified for prioritising the Disaster Risk Reduction mitigation measures to address the recurring threats of cyclones, floods, sea water incursion, sea erosion & drought. The goals are listed below:

1. Comprehensive Flood Protection through structural and non-structural interventions to reduce the risks and enhance resilience and resistance of the Community with special reference to Thiruvallur, Kancheepuram, Cuddalore, Nagapattinam, Thoothukudi, Ramanathapuram and Kanyakumari Districts.
2. Minimise the risk of urban floods with special focus on Greater Chennai Corporation and its neighborhood.
3. Enhance the resilience of farmers to face the vagaries of monsoon and impacts of Climate Change with special reference to Delta Districts.

4. Recharge the aquifers in Blocks where Ground Water is currently overexploited/Critical/ Semi Critical categories and convert into Safe Category.
5. Restore and protect ecologically fragile Wet Land and Marsh Lands with Special Focus on Pallikaranai and Ennore Creek Areas and Gulf of Mannar.
6. Reclaim and Restore Areas affected by Sea Water Intrusion and prevent Sea Water Intrusion in Coastal Areas with special focus on Chennai, Thiruvallur and Cauvery Delta Districts.
7. Enhance Bio Shields to mitigate Floods and Storms in Coastal Districts
8. Restore and Strengthen Water bodies and enhance the capacity of the Water Bodies through desiltation to mitigate floods and drought.
9. Promote Sustainable Agricultural practices in Rainfed Areas with special focus on Ramanathapuram, Dindigul, Perambalur, Sivagangai, Virudhunagar, Dharmapuri, Namakkal and Ariyalur Districts.
10. Reduce the risks in areas which are prone to specific Disasters like Land Slides, Forest Fire etc. with a special focus on The Nilgris, Coimbatore, Erode, Theni, Krishnagiri, Vellore, Villupuram, Dindigul and Thiruvallur Districts.
11. Enhance Mulitistakeholder participation, especially community participation with social inclusion.
12. Strengthen Non-structural measures to reduce the risks due to Man- made and Natural Disasters.
13. Deliver climate resilient hydraulic infrastructure for irrigation and drainage to reduce inundation and flood damages, as well as Sea water incursion with special focus on Delta Districts.
14. Build the capacity to manage CBRN and other man-made disaster

The Plan narrates how the Government of Tamil Nadu has been consistently committed to building resilient infrastructure incorporating "Build Back Better" principles (Chapter 8)

Way Forward

The plan describes in detail the efforts that will be initiated towards achieving the four priorities 1) Understanding disaster risk 2) Strengthening disaster risk governance to manage disaster risk 3) Investing in disaster risk reduction for resilience and 4) Enhancing disaster preparedness for effective response, and to "Build Back Better" during recovery, rehabilitation and reconstruction phases of a disaster. The long-term perspective plan, details the concepts and ideas that will guide the prevention and mitigation (structural and non-structural) measures that will be put in place to reduce the disaster risks.

The ongoing initiatives of the Government of Tamil Nadu under implementation, approved programmes that will be taken up, new programmes proposed to be launched have been described in detail. The plan has also identified the specific disaster problems that confront the different

districts and has come out with Long Term, Medium Term and Short-term solutions. Details of District specific, River Basin specific proposals have been spelt out. The indicative timelines for disaster risk reduction measures will be the agenda for action (Chapter 11)

The Plan provides the detailed SOPs for Pre and Post Disaster Phases like Preparedness, Prevention & Mitigation, Response, Relief and Rehabilitation with the Responsibility Matrix. The Plan narrates how the Government of Tamil Nadu has been consistently committed to building resilient infrastructure incorporating Build Back Better principles. A list of guidelines of the NDMA with hyperlink is provided in Annexure 2, for reference of DDMAs.

The State Disaster Management Perspective Plan 2018-2030, sets the priorities, lists out the strategic action plans and shows the way forward in accordance with the priorities of Sendai Framework for risk reduction. 2015-2030 and National Disaster Management Plan 2016.

01 PROFILE OF TAMIL NADU

The State of Tamil Nadu is situated in the southernmost part of the Indian Peninsula between the northern latitude of 8°05' and 13°35' and the eastern longitude of 76°15' and 80°20'. It is bordered by the Union Territory of Puducherry and the States of Kerala, Karnataka and Andhra Pradesh. It is also bounded by the Eastern Ghats on the north, by the Nilgiris and the Anamalai Hills, on the west, by the Bay of Bengal on the east, by the Gulf of Mannar and the Palk Strait on the southeast and by the Indian Ocean on the south. It shares a maritime border with the country of Sri Lanka. Major parts of Tamil Nadu lie in the rain shadow region of the Western Ghats and hence, Tamil Nadu does not benefit greatly from Southwest Monsoon which brings rainfall to major parts of India.

1.1 State at a Glance

Tamil Nadu has a population of 72 million (population density of 555/sqkm), out of which the proportion of rural population is 51.6%, while that of urban is 48.40%. Over 50% of the State's population lives in the densely packed coastal districts, including approximately 9 million people in the State capital of Chennai.

1.2 Description

1.2.1 Coastal Areas

The coastal stretch extends for 1,076 km from Pazhaverkadu of Thiruvallur district to Ezhudesam of Kanyakumari district. Kanyakumari, forms the southernmost tip of the Indian subcontinent where Indian Ocean, Bay of Bengal and Arabian Sea meet. Pamban Island forms part of Ramanathapuram district separating Gulf of Mannar and Palk strait. There are 13 districts that share the coastline namely Thiruvallur (27.9 Km), Chennai(19Km), Kancheepuram (87.2Km), Villupuram (40.7Km), Cuddalore (57.5Km), Nagapattinam(187.9), Thiruvarur(47.2Km), Thanjavur (45.1Km), Pudukottai(42.8Km),Ramanathapuram(235.6Km), Thoothukudi (163.5Km), Thirunelveli (48.9 Km) and Kanyakumari (70 Km).

The coastal areas are not only densely populated but also constitute the economic hub of Tamil Nadu with fishing, agriculture, tourism, shipping and industry etc. being important drivers of the overall State's economy. Marine fishing provides livelihood to about 2,00,000 families, dwelling in 608 coastal habitations. Three Major Ports, namely, Ennore, Chennai and Tuticorin notified under the Major Port Trust Act, 1963 and 19 Non-major (Minor) Ports notified under the Indian Ports Act 1908, are located on its coastline. The major ports are under the control of Government of India and the non-major ports are under the control of the Government of Tamil Nadu

The physiographical divisions of Tamil Nadu broadly consist of the coastal plains in the east and the Kongu uplands and hills which proceed westwards. The plains account for more than half the area of the State. Geomorphologically, three major units are recognised from west to east. The western part comprises the Western Ghats roughly trending North-South and marked by a continuous range of Hills, extending from Mahendragiri hills in Kanyakumari district in the south upto the Nilgiris Hills in the north and further northwards through Karnataka. The elevation of these Hills ranges between 1,275m and 2,637m above MSL. The prominent Hills are Mahendragiri, Agasthiarmalai, Anaimalai, Palani and the Nilgiris. Doddabetta with an elevation of 2,637m is the highest peak in the Nilgiri Hills.

The east-west trending Palaghat Gap is a prominent physiographic break in the Western Ghats. The central part of the State is a vast track of dissected pediments and pediplains. Residual Hills in this part viz., Shevaroy, Kalrayan, Javadi, Yelagiri, Kollimalai and Pachaimalai demarcate the extensions of fragments of Eastern Ghats, while Karandamalai, Sirumalai and Kodaikanal Hills form another set of residual Hills, further south. The eastern part of Tamil Nadu and Pondicherry and Karaikkal are marked by a coastal plain with associated landforms like vast tidal flats, continuous beach ridges, estuaries and lagoons and a narrow but fairly continuous beach. The area is drained by a number of Rivers such as Araniyar, Kosathalayar, Cooum Adyar, Palar, Cheyyar, Varahanadhi, Pennaiyar, Gadilam, Paravanar, Vellar, Cauvery, Moyar, Bhavani, Amaravathi, Vaigai, Gundar, Thamirabarani etc.

1.2.2 Climate

The climate of Tamil Nadu is categorised as Tropical Monsoon. Due to its proximity to the sea, the summer is not very hot and winters are not severe in most of the districts.

a. Temperature

The State experiences sunshine and moderate to high temperature throughout the year, with a maximum temperature of 43°C. The State never records a minimum temperature below 18°C, except in the hilly areas. The hot weather sets in the middle of March and lasts until the middle of June. The hot winds of the plains blow during April and May with an average velocity of 8–16 km/hour. The cold weather commences early in November and comes to an end in the middle of March.

b. Rainfall

The State receives a long term annual average rainfall of around 920.9 mm, Winter, Summer, Southwest and Northeast Monsoon rainfall account for 3.4%, 13.9%, 34.9% and 47.8% respectively of the total rainfall. The Western Ghats acting as a barrier deprives the State from receiving the full benefit of South-west monsoon winds. However, 1/3rd of the normal rainfall received in Tamil Nadu which helps in taking up the rainfed cultivation is obtained from Southwest Monsoon. The State depends mainly on the Northeast Monsoon rains which are brought by the troughs of low pressure in south Bay of Bengal between October and December. The following is the normal rainfall pattern during the major season of the State.

High Rainfall Regions: It covers the Nilgiris, Palani and Anaimalai hills in the west and the coastal belt of Thiruvallur, Kancheepuram and Cuddalore districts in the east and Kanyakumari district in the south.

Medium Rainfall Regions: Western part of Cuddalore, Thiruvallur and Kancheepuram districts, whole of Vellore, Thiruvannamalai, eastern parts of the Salem, Western part of Thanjavur, Thiruvarur, Nagapattinam, eastern and northern parts of Tiruchirappalli, eastern part of Madurai, Dindigul, northern part of Ramanathapuram, Sivagangai, Virudhunagar, Thirunelveli, Coimbatore and Salem.

Low Rainfall Regions: Central and Southern parts of Ramanathpuram, Sivagangai,Virudhunagar and Thoothukudi and Central part of Coimbatore, Central and Western parts of Madurai, Dindigul and the southern part of Tiruchirapalli.

1.2.3 Geology

Crystalline rocks of Archaean to late Proterozoic age occupy over 80 per cent of the area of the Tamil Nadu, while the rest is covered by Phanerozoic sedimentary rocks mainly along the coastal belt and in a few inland river valleys. The hard rock terrain comprises predominantly Charnokite and Khondalite groups and their migmatic derivatives, supracrustal sequences of Sathyamangalam and Kolar groups and Pennisular Gneissic Comples (Bhavani Group), intruded by ultramafic-mafic complexes, basic dykes, granites and syenites. The sedimentary rocks of the coastal belt include fluviatile, fluvio-marine and marine sequences, such as Gondwana Supergroup (Carboniferous to Permian and Upper Jurassic to Lower Cretaceous), marine sedimants of Cauvery basin (Lower Cretaceous to Paleogene), Cuddalore/ Panambarai Formation (Mio-Pliocene) and sediments of Quaternary and Recent age.

1.2.4 Hydrogeology

Nearly 73% of the total area of the State is occupied by a variety of hard & fissured crystalline rocks like charnockite, gneisses and granites. The depth of open wells varies from 6 to 30 m bgl, while the depth of bore wells generally varies from 30-100 m bgl.

The State Ground Water Directorate has taken up a Firka level assessment of ground water utilization. Out of the 1129

Firkas, 374 have been classified as over exploited, 48 as critical, 235 as semi-critical, 437 as safe and 35 as saline.(Source: G.O.Ms.No.113 PWD dt:09.06.2016)

1.2.5 Soil and Agro-Climatic Zone

The predominant soils of Tamil Nadu are red loam, laterite, black, alluvial and saline soils. The Agro-Climatic zone of Tamil Nadu have been divided into seven major categories and the zone wise classification, alongwith, the soil type and rainfall, is as follows;

Table 1.1: Soil Distribution and Agro-Climatic Zones of Tamil Nadu

Sl. No	Agro Climatic Zones	Districts Covered	Soil Texture	Rain fall (mm)
1	North Eastern Zone	Kancheepuram, Thiruvallur, Cuddalore, Vellore, Villupuram and Tirunvannamalai	1. Red Sandy Loam 2. Clay Loam 3. Saline coastal Alluvium	1,105
2	North Western Zone	Dharmapuri, Krishnagiri, Salem and Namakkal (Part)	1. Non Calcareous Red 2. Non Calcareous Brown 3. Calcareous Black	875
3	Western Zone	Erode, Coimbatore, Tiruppur, Theni, Karur (part), Namakkal (part), Dindigul, Perambalur and Ariyalur (part)	1. Red Loamy 2. Black	715
4	Cauvery Delta	Thanjavur, Nagapattinam, Thiruvarur, Trichy and parts of - Karur, Ariyalur, Pudukkottai and Cuddalore	1. Red Loamy 2.Alluvium	984
5	Southern Zone	Madurai, Sivagangaii, Ramanathapuram, Virudhunagar, Thirunelveli and Thoothukudi	1. Coastal Alluvium 2. Black 3. Red Sandy soil 4. Deep red soil	857
6	High Rainfall Zone	Kanyakumari	1. Saline Coastal 2. Alluvium 3. Deep Red Loam	1420
7	Hilly Zone	The Nilgiris and Kodaikanal (Dindigul)	Lateritic	2,124

(Source: TNAU)


TAMIL NADU STATE
Agro-Climatic Zones
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
Basin Boundary
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0' N
Andhra Pradesh
Karnataka State
Kerala State
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Bay of Bengal
Namakkal
Perambalur
Ariyalur
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Coimbatore
Tiruppur
Thanjavur
Thiruvarur
Nagapattinam
Dindigul
Pudukkottai
Palk Strait
Theni
Madurai
Sivaganga
Palk Bay
Virudhunagar
Ramanathapuram
Pamban Channel
Adam's Bridge
Thoothukkudi
Gulf of Mannar
Tirunelveli
Lakshadweep Sea
Kanniyakumari
Indian Ocean
Agro-Climatic Zones
Source: TNAU, Tamil Nadu Agriculture University,
1. High Altitude and Hilly Zone
2. High Rainfall Zone
3. Southern Zone
4. Cauvery Delta Zone
5. Western Zone
6. Northwestern Zone
7. Northeastern Zone

1.2.6 Drainage System

Drainage system of Tamil Nadu can be grouped into 17 river basins (127 sub-basins) a majority of which are water-stressed. Among the several rivers flowing through the State, Cauvery River, with 760 km of length, is the longest among all the rivers in Tamil Nadu. The total surface water potential of the State is 24,864 M cum. There are 17 major river basins in the State with 89 reservoirs and about 41,948 tanks. The 17 major River Basins Found in Tamil Nadu are Chennai, Palar, Varahanadhi, Pennaiyar, Paravanar, Vellar, Cauvery, Agniyar, Pambar & Kottakaraiyar, Vaigai, Gundar, Vaippar, Kallar, Thambaraparani, Nambiyar and Kodaiyar and Parambikulam Aliyar Project (PAP). Most of the rivers which drain in to Tamil Nadu, originate from Western Ghats uplands and Eastern Ghats. Among the 17 basins, Cauvery River Catchment is the widest.

Lakes / Reservoirs

Tamil Nadu has a total of 126 large dams, out of which 89 dams are operated and maintained by the Water Resources Department. Dams in Tamil Nadu are known for their multipurpose utility in the field of irrigation, production of hydro-electricity, fisheries and drinking water, etc. There are several lakes/tanks in Tamil Nadu, which contribute immensely in boosting the agricultural economy of the State. The locations of the lakes/dams also serve as major tourist attractions with several reservoirs acting as fish breeding centers in the State.

1.2.7 Forests/Natural Vegetation

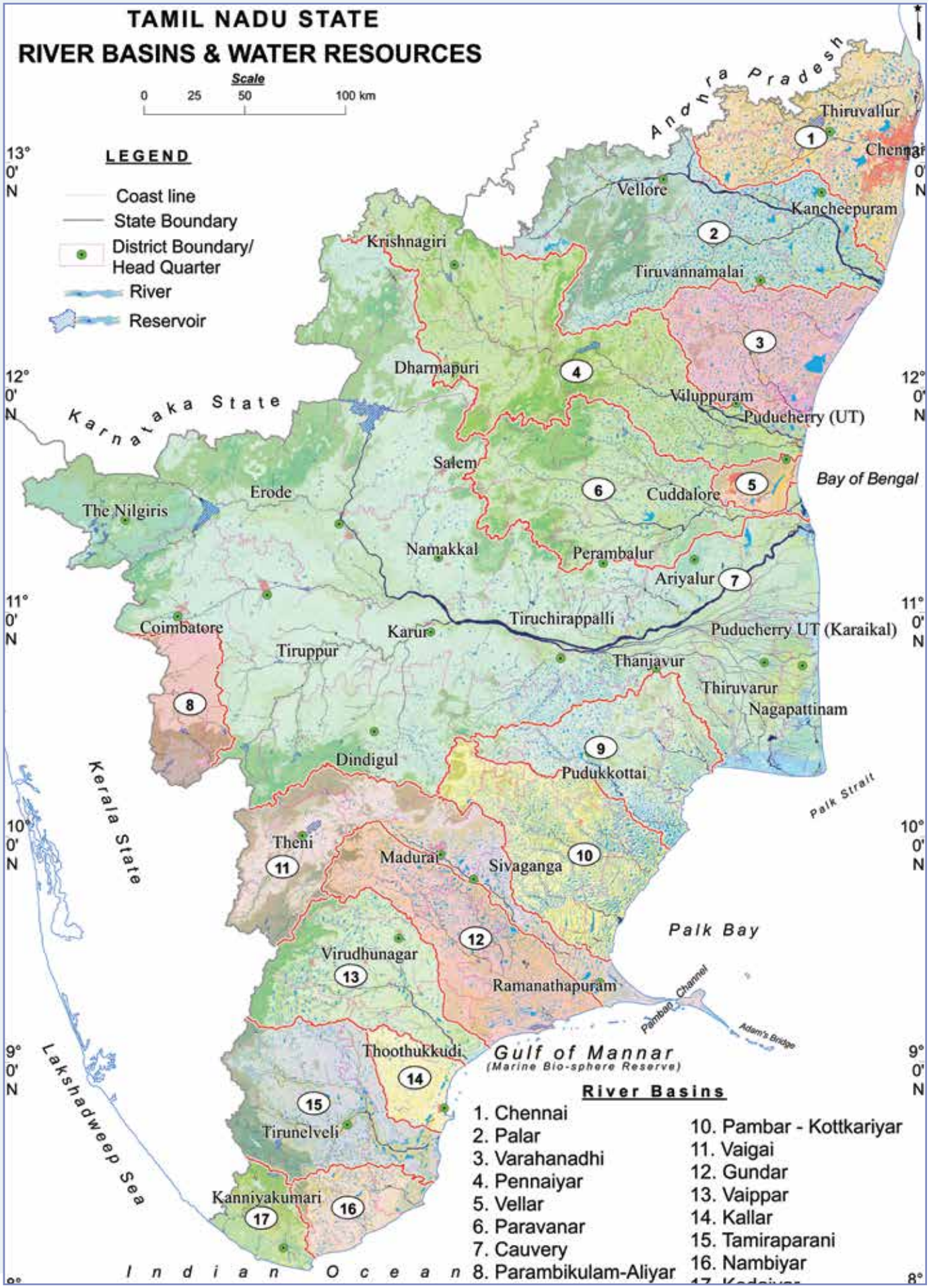
Tamil Nadu has an area of 22,877 sqkm under forests, which constitute 17.59 percent of the geographical area of the State as against 33.33 percent required under the National Forest Policy, 1988. Out of 22877 sq.km under forests, Reserved Forests comprise 84.75%, Protected forests 9.54% and Unclassified Forests, 5.71% Major forest types occurring in the State are Tropical Wet Evergreen, Tropical Semi-Evergreen, Tropical Moist Deciduous, Littoral and Swamp/ Mangroves, Tropical Dry Deciduous, Tropical Thorn, Sub-Tropical Broadleaved and Montane Wet Temperate forests. The Nilgiris district has about 56% of its total area under forest, followed by Krishnagiri with 39.4%, Dharmapuri with 36.5%, Kanyakumari with 32.4% and Theni with 32.0%. Erode, Krishnagiri, Dharmapuri, Vellore, Coimbatore, Thiruvannamalai, the Nilgiris, Dindigul, Salem, Namakkal, Thirunelveli and Theni Districts together account for nearly 80.1% of the total forest area of the State.

1.2.8 Demography

According to the 2011 census, the total population stood at 7,21,47,030 persons with a sex ratio of 996 females per 1000 males. The officially recorded decadal growth rate of Tamil Nadu was 15.6 percent.

1.2.9 Administrative Units

The State of Tamil Nadu covers an area of 1,30,058 Sq.km. The major administrative units of the State constitutes, 32 districts, 86 revenue divisions, 292 taluks, 1,189 Firkas and 16,682 Revenue villages. There are 12 municipal corporations, (including Greater Chennai Corporation) 124 municipalities, 528 town panchayats and 385 panchayat unions (Blocks) 12,524 village panchayats.


TAMIL NADU STATE
RIVER BASINS & WATER RESOURCES
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary/ Head Quarter
River
Reservoir
Andhra Pradesh
Karnataka State
Kerala State
Bay of Bengal
Palk Strait
Palk Bay
Gulf of Mannar
(Marine Bio-sphere Reserve)
Lakshadweep Sea
Indian Ocean
Pamban Channel
Adam's Bridge
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Cuddalore
Erode
The Nilgiris
Namakkal
Perambalur
Ariyalur
Coimbatore
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Tiruppur
Thanjavur
Thiruvarur
Nagapattinam
Dindigul
Pudukkottai
Theni
Madurai
Sivaganga
Virudhunagar
Ramanathapuram
Thoothukkudi
Tirunelveli
Kanniyakumari
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8°
River Basins
1. Chennai
2. Palar
3. Varahanadhi
4. Pennaiyar
5. Vellar
6. Paravanar
7. Cauvery
8. Parambikulam-Aliyar
10. Pambar - Kottkariyar
11. Vaigai
12. Gundar
13. Vaippar
14. Kallar
15. Tamiraparani
16. Nambiyar

1.2.10 Urbanization

Tamil Nadu is one of the most urbanized State of India with 48.45% of its population living in urban areas. The State has several major urban agglomerations on the coast. Chennai, the capital City of Tamil Nadu is the fourth largest Metropolitan City in India, located on the Coromandel Coast of the Bay of Bengal.

1.2.11 Transport

a. Road Net work

Tamil Nadu has an extensive road network, which covers about 153 km per 100 km^2 area, which is higher than the country's average road network coverage of 103 km per 100 sqkm area. Tamil Nadu has 28 National Highways running through it. The State is also an important terminus in the Golden Quadrilateral road link of the National Highways Authority of India (NHAI). The district centers are linked through 187 State Highways. Tamil Nadu is one of the few States in India to have 100 per cent metalled road connectivity even in the rural areas.

b. Railways Network

Tamil Nadu has a total railway track length of 5,952 km and there are 532 railway stations in the State. It has six divisions, of which four are in Tamil Nadu. Chennai also has a well-established suburban railway network that connects it to the suburbs and the neighboring cities. The Mass-Rapid-Transit System (MRTS) is an elevated line of the suburban railway in Chennai. The State also has established Metro Rail to augment the transport system in Chennai.

c. Airports

Tamil Nadu has international airports at Chennai, Trichirappalli and Coimbatore; it has domestic airports at Chennai, Coimbatore, Tuticorin, Salem and Madurai. The Chennai International Airport was the first in the country to get ISO 9001-2000 certification. Chennai International Airport is considered among the third busiest airports of India after Delhi and Mumbai. It is also the second largest cargo hub after Mumbai. The airport is connected to 19 countries and has more than 169 direct flights every week.

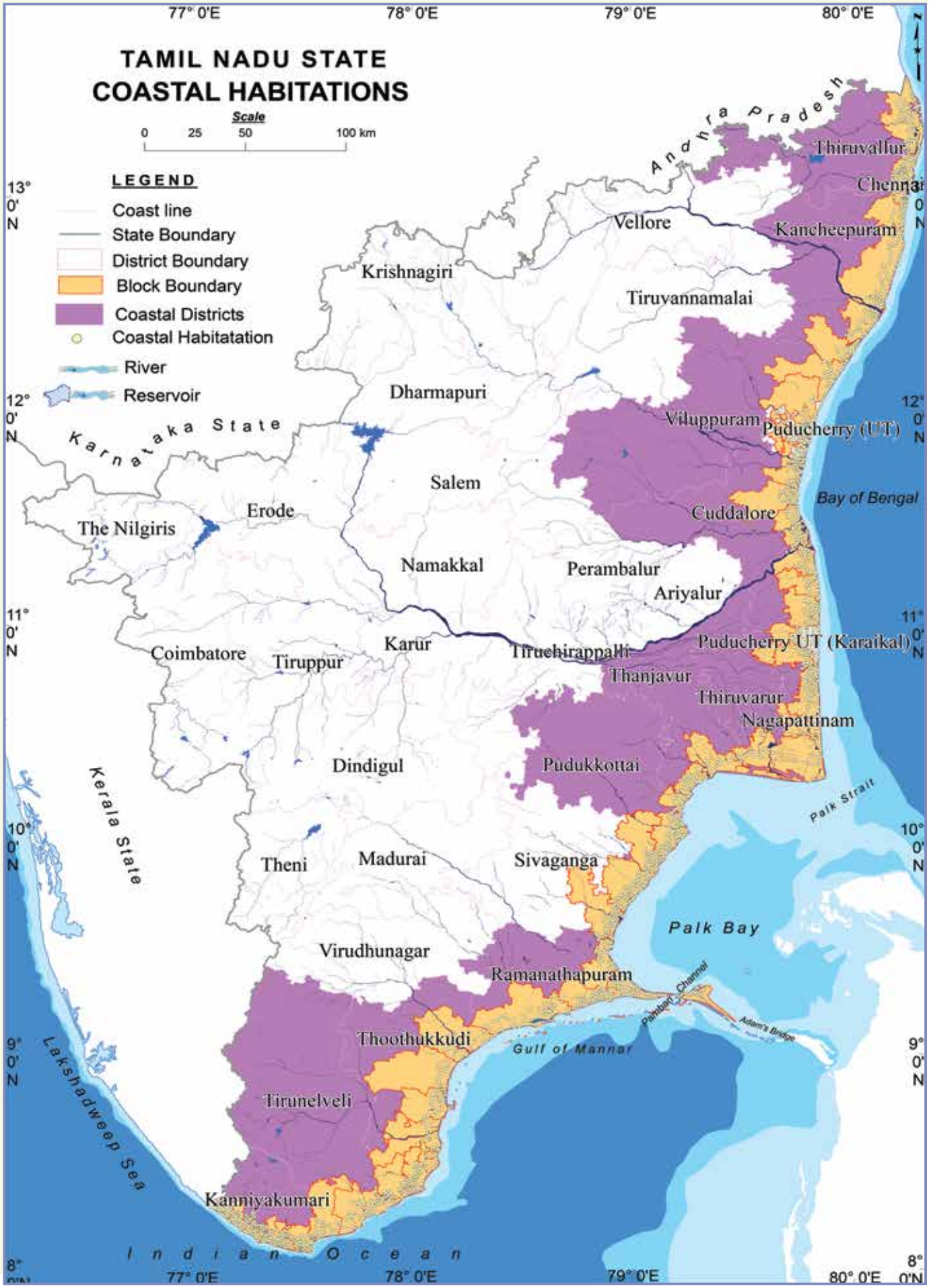
d. Harbour and Ports

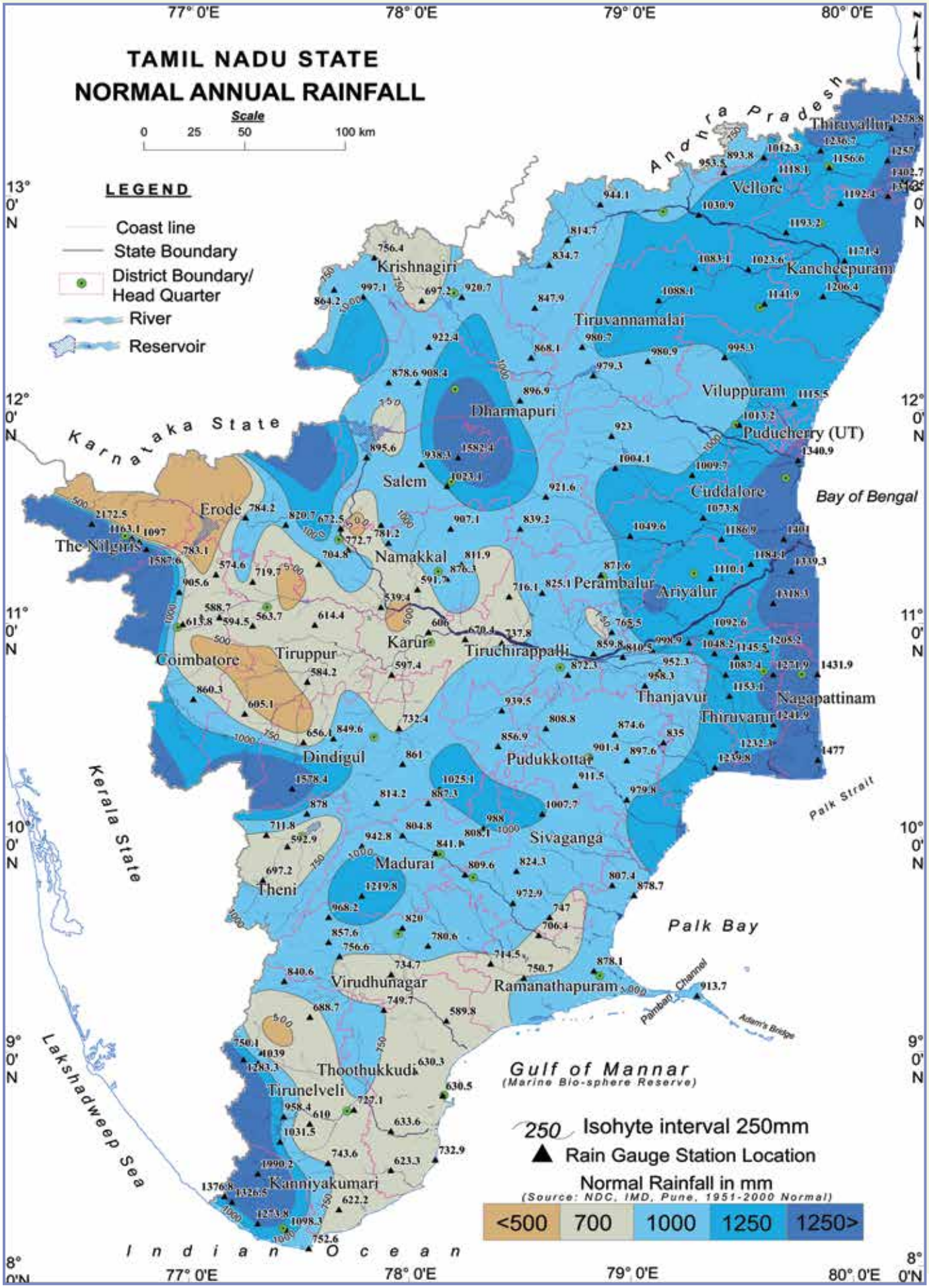
Tamil Nadu has three major ports, at Chennai, Ennore and Tuticorin and 15 minor ports.

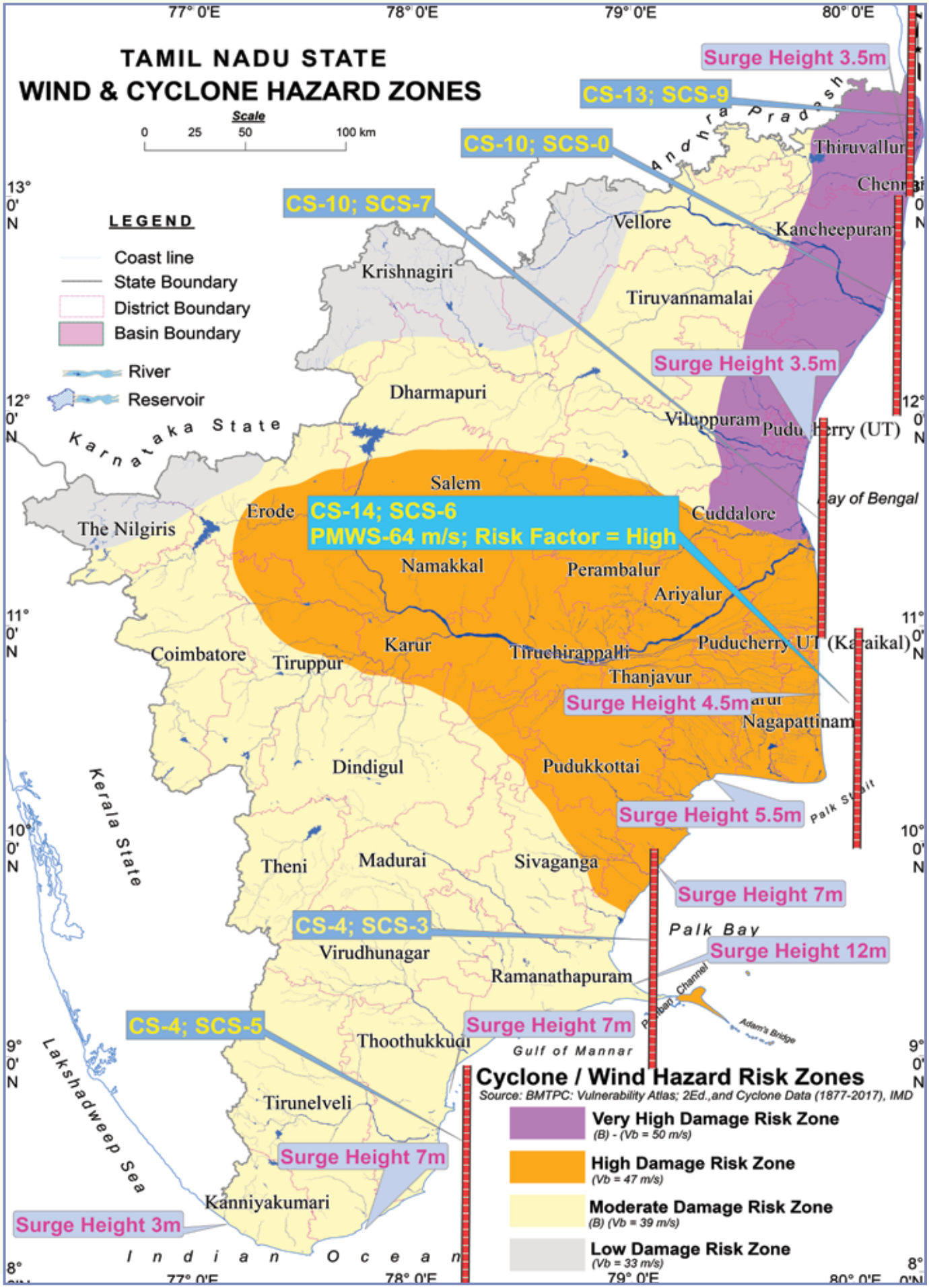
Chennai port is second largest and third oldest port in India. It is considered as a big hub for cargo traffic, car and big containers in east coast of India. Chennai port is known for its coastal breakwater, artificial, large seaport type of harbor.

Kamarajar Port located in Chennai (Tamil Nadu) was earlier known as Ennore port. It is the twelfth major port in India and is the first port which is owned by a public company.

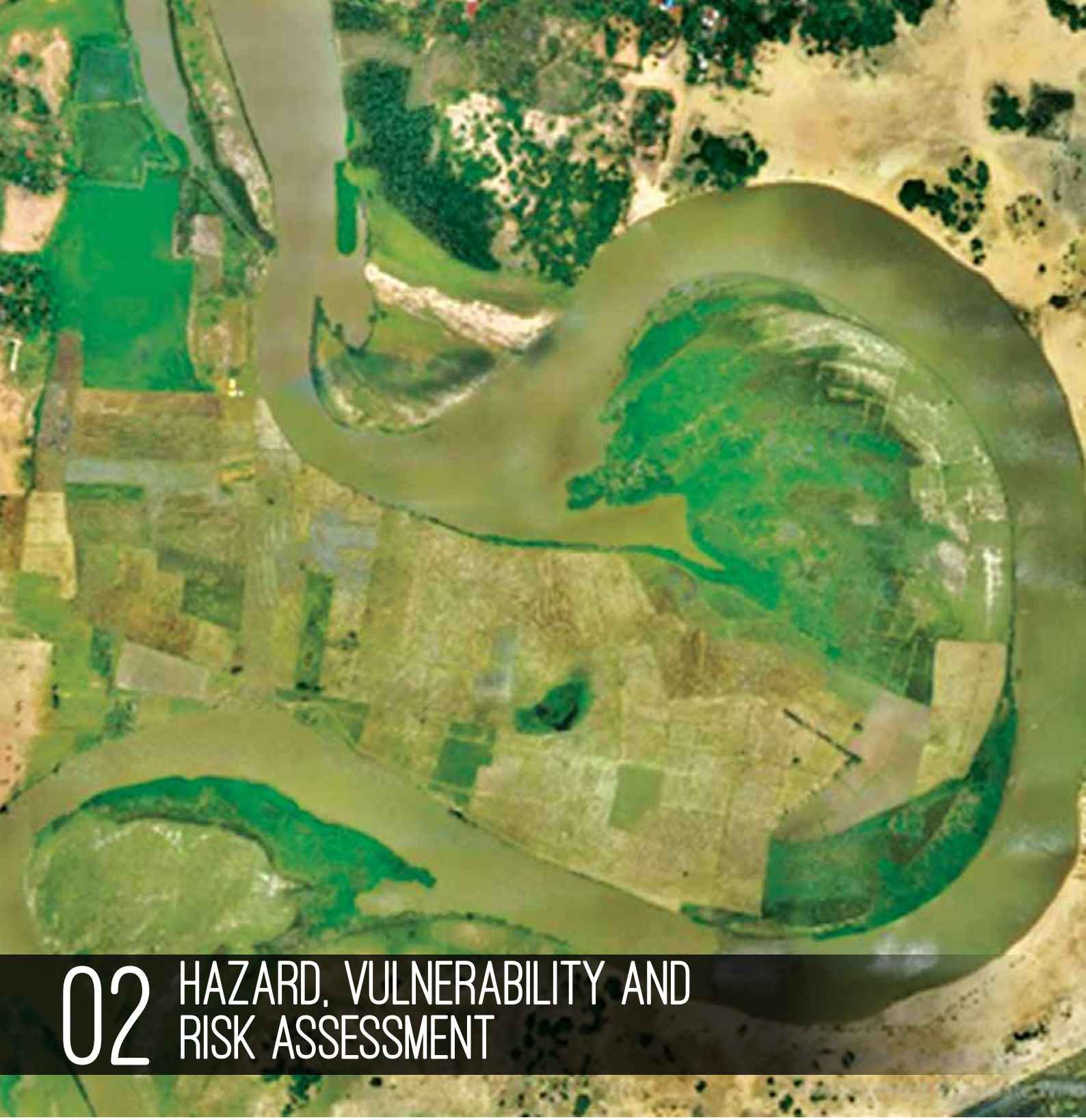
V.O Chidambaranar Port also known as Tuticorin Port is located in Tamil Nadu. It is the second largest port in Tamil Nadu and has fourth largest container terminal in India.


TAMIL NADU STATE
COASTAL HABITATIONS
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
Block Boundary
Coastal Districts
Coastal Habitatation
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0' N
Andhra Pradesh
Karnataka State
Kerala State
Tamil Nadu
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Bay of Bengal
Namakkal
Perambalur
Ariyalur
Coimbatore
Tiruppur
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Thanjavur
Thiruvarur
Nagapattinam
Dindigul
Pudukkottai
Palk Strait
Theni
Madurai
Sivaganga
Palk Bay
Virudhunagar
Ramanathapuram
Pamban Channel
Adam's Bridge
Thoothukkudi
Gulf of Mannar
Tirunelveli
Lakshadweep Sea
Kanniyakumari
Indian Ocean


TAMIL NADU STATE
NORMAL ANNUAL RAINFALL
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary/ Head Quarter
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0'N
Andhra Pradesh
Karnataka State
Kerala State
Tamil Nadu
Thiruvallur
Vellore
Krishnagiri
Kancheepuram
Tiruvannamalai
Viluppuram
Dharmapuri
Puducherry (UT)
Salem
Cuddalore
Erode
The Nilgiris
Namakkal
Perambalur
Ariyalur
Karur
Coimbatore
Tiruppur
Tiruchirappalli
Thanjavur
Nagapattinam
Thiruvarur
Dindigul
Pudukkottai
Sivaganga
Madurai
Theni
Virudhunagar
Ramanathapuram
Thoothukkudi
Tirunelveli
Kanniyakumari
Bay of Bengal
Palk Strait
Palk Bay
Gulf of Mannar
(Marine Bio-sphere Reserve)
Pamban Channel
Adam's Bridge
Lakshadweep Sea
Indian Ocean
250 Isohyte interval 250mm
Rain Gauge Station Location
Normal Rainfall in mm
(Source: NDC, IMD, Pune, 1951-2000 Normal)
<500
700
1000
1250
1250>


TAMIL NADU STATE
WIND & CYCLONE HAZARD ZONES
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
Basin Boundary
River
Reservoir
Surge Height 3.5m
CS-13; SCS-9
CS-10; SCS-0
CS-10; SCS-7
Surge Height 3.5m
CS-14; SCS-6
PMWS-64 m/s; Risk Factor = High
Surge Height 4.5m
Surge Height 5.5m
Surge Height 7m
CS-4; SCS-3
Surge Height 12m
CS-4; SCS-5
Surge Height 7m
Surge Height 7m
Surge Height 3m
Andhra Pradesh
Karnataka State
Kerala State
Tamil Nadu
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Namakkal
Perambalur
Ariyalur
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Coimbatore
Tiruppur
Thanjavur
Nagapattinam
Dindigul
Pudukkottai
Theni
Madurai
Sivaganga
Palk Bay
Virudhunagar
Ramanathapuram
Thoothukkudi
Gulf of Mannar
Adam's Bridge
Tirunelveli
Kanniyakumari
Lakshadweep Sea
Indian Ocean
Bay of Bengal
Cyclone / Wind Hazard Risk Zones
Source: BMTPC: Vulnerability Atlas; 2Ed.,and Cyclone Data (1877-2017), IMD
Very High Damage Risk Zone
(B) - (Vb = 50 m/s)
High Damage Risk Zone
(Vb = 47 m/s)
Moderate Damage Risk Zone
(B) (Vb = 39 m/s)
Low Damage Risk Zone
(Vb = 33 m/s)
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0' N


TAMIL NADU STATE
INLAND TRANSPORT NETWORK
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0' N
Andhra Pradesh
Karnataka State
Kerala State
Tamil Nadu
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Bay of Bengal
Namakkal
Perambalur
Ariyalur
Coimbatore
Tiruppur
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Thanjavur
Thiruvarur
Nagapattinam
Dindigul
Pudukkottai
Palk Strait
Theni
Madurai
Sivaganga
Palk Bay
Virudhunagar
Ramanathapuram
Pamban Channel
Adam's Bridge
Thoothukkudi
Gulf of Mannar
Tirunelveli
Lakshadweep Sea
Kanniyakumari
Indian Ocean
LEGEND
Transport System
National Highways
State Highways
District Roads
Railways



02 HAZARD, VULNERABILITY AND RISK ASSESSMENT

2.1 Risk Identification & Assessment

A systems based approach gives due emphasis on risk identification and assessment of the system as a whole, which is a pre-requisite for any significant intervention for prevention, mitigation, preparedness and response etc. The State is vulnerable to both natural and man-made hazards of different types with varying intensity. The major hazards being cyclonic storms and periodic droughts. The identification, assessment and mapping of the risks are undertaken taking into account the legacy data and geomorphological characters of the State.

Tamil Nadu covers an area of 13 Million hectares and has a coastline of 1,076 kms which is about 15% of the coastline of India. The State is vulnerable to disasters of different types with

varying intensity as indicated in the table below:

Water and Climate Related	Geophysical Related	Chemical and Industrial	Accidents Related	Biological Related
Drought, Thunder Storm Surge, Sea Erosion, Sea Water Incursion, Lightning, Flash Floods, Floods and Cyclones	Earthquake, Tsunami, Landslide/Debris flows/ mudslides	Industrial Fires, Gas and Chemical Leakages,Oil spills	Forest fires, Electrical fires, Urban and Village fires, Building Collapses, Festival/ Fair /Temple Stampedes, Road, Rail and Air based Accidents/ Boat capsizing, Fire Accident	Epidemics, Pest attacks, Food poisoning, Water Contamination and Cattle epidemics

2.2 The vulnerability of the State to the above disasters is narrated below

2.2.1 Drought Vulnerability

Low rainfall coupled with the erratic behaviour of the monsoon in the State makes Tamil Nadu the most vulnerable to drought. Drought can have a devastating impact and can affect a large population. Drought variability has a direct and significant impact on food production and the overall economy. Drought is more recurrent during June to September months in Tamil Nadu. Traditionally, the districts which are severely prone to drought hazard are Dharmapuri, Madurai, Coimbatore, Ramanathapuram, Salem, Tiruchirapalli, Thirunelveli and Kanyakumari. But during 2017, Tamil Nadu experienced the severest drought unheard so far that adversely affected the agricultural and drinking water sectors.

2.2.2 Coastal Vulnerability

There are 13 coastal Districts, 25 coastal blocks and 561 fishing villages in the coastal areas. The coastal ecosystems are now encountering problems ranging from pollution, siltation and coastal erosion to that of flooding, saltwater intrusion and storm surges. The Tamil Nadu coast comprises of the Coromandel Coast from Pulicat Lake in the north to Point Calimere in the south and the Gulf of Mannar, which extends up to the tip of Kanyakumari, which is the southernmost point of the Indian Peninsula. The Cyclones and the Tsunami of 2004 had a devastating impact along the coast.

2.2.3 Sea Erosion

High Erosion Zones along the Tamil Nadu coast include the districts of Kanyakumari, Thirunelveli, parts of Tuticorin, Ramanathapuram, Pudukkotai, Thanjavur, Thiruvarur, Nagapattinam,

Cuddalore, Villupuram, Kancheepuram, Chennai and Thiruvallur. The State has prepared shoreline change maps for each district. Sea erosion not only impacts the livelihood of fishermen but also adversely affects the housing, road infrastructure and ground water.

2.2.4 Sea Water Incursion

The coastal districts of Tamil Nadu are very much vulnerable to multiple disasters especially due to tidal waves and recurrent floods along the coastal areas. The lands are subjected to periodic inundation of tidal waters and the saline soils are the result of inundation of backwaters from sea. These lands are low lying and remain submerged under water during the monsoon. As a result, the fresh water aquifer is converted into a saline water aquifer due to sea water incursion and intrusion of sea water into the land. The Climate change and the resultant sea level rise, changing monsoon behaviour and increased groundwater demand have a significant influence on saltwater intrusion. Sea water incursion causes reduction in drinking & irrigation water supplies of potable and usable quality respectively and makes the valuable agricultural lands unfit for cultivation, adversely impacting the small and marginal farmers.

2.2.5 Cyclone / Heavy Rainfall Vulnerability

The geographical setting of Tamil Nadu makes the State vulnerable to natural disasters such as cyclones, floods and earthquake-induced tsunami. About 8% of the State is affected by five to six cyclones every year, of which two to three are severe. Cyclonic activities on the east coast are more severe than on the west coast and occur mainly during October-December. On an average, the State encounters one or two cyclonic events during the Northeast monsoon period. Even during the non-cyclonic phase, the State receives sudden and very heavy spells of incessant rains during the formation of low pressure/deep depressions in the Bay of Bengal. The low pressure/deep depressions so formed cause flooding and inundation in the vulnerable areas. Of late extreme weather events are resulting in extremely heavy rains way beyond the carrying capacity of the river systems and the drainage system, disrupting normalcy. Some of the cyclonic storms are accompanied by gale winds gushing even beyond 140 Kmph, wrecking havoc on the public infrastructure including power infrastructure and causing loss of lives and damages to housing and agricultural properties.

2.2.6 Flood Vulnerability

Tamil Nadu is also subjected to annual flooding, including flash floods, floods due to cloudbursts, monsoon floods of single and multiple events, cyclonic floods and those due to dam bursts or failure. Every year, number of people are affected, some succumbing to the floods, thousands are rendered temporarily homeless and several hectares of crops are damaged. Floods in the State are mainly caused during cyclones and heavy rains. The coastline of Tamil Nadu even at the time of depression experiences heavy flooding. For instance, in the years 1997 to 2005 even though there were no cyclonic storms, extremely heavy rainfall caused severe floods in most of the coastal areas and

affected the districts of Chennai, Kancheepuram, Thiruvallur, Cuddalore, Thanjavur, Nagapattinam, Thiruvarur, Pudukottai and Thoothukudi.

2.2.7 Storm Surge Vulnerability

Storm surge varies from 3 meters to 11 meters in the Tamil Nadu coast. The Southern parts of Thanjavur, Pudukkottai, Ramanathapuram, Thoothukudi, Thirunelveli and Kanyakumari have experienced storm surges exceeding 6m above the current sea level. The northern regions of Thanjavur, Cuddalore and Chennai have lower storm surge heights of around 3 meters. Storm surges are a major threat to the fishing community damaging their livelihood support and to small & marginal farmers by rendering agricultural lands unfit for cultivation.

2.2.8. Heat Wave Vulnerability

A Heat Wave is a period of abnormally high temperatures, more than the normal maximum temperature that occurs during the (Hot weather) summer season. Heat Waves typically occur between March and June. The extreme temperatures and resultant atmospheric conditions adversely affect people living in these regions as they cause physiological stress, sometimes resulting in death. Some of the districts in Tamil Nadu that have witnessed heat wave impacts are Vellore, Thiruvannamalai, Krishnagiri, Dharmapuri, Salem, Namakkal, Tiruppur, Coimbatore, Erode, Karur, Tiruchirapalli, Ariyalur, Perambalur, Sivagangai, Virudhunagar, Theni, Dindigul and Madurai.

2.2.9 Seismicity Vulnerability

Tamil Nadu is one of the 13 identified seismotectonic zones of Peninsular India. The East – West Cauvery fault Tirukkovilur – Pondicherry fault, Vaigai River fault and North-Southern trending Comorin – Point Calimere Fault and Rajapatnam – Devipatnam Fault are some of them which run close to the urban centers like Coimbatore, Madurai, Nagapattinam, Thanjavur and Pondicherry and thus make the State vulnerable to tremors and earthquakes geologically. Tamil Nadu experienced moderate earthquakes in the past earthquake history of 200 years as is evident from the published literature. Twelve earthquakes of M>5.0 are known to have occurred in the State so far. The latest Seismic zoning map of Bureau of Indian Standards classifies Tamil Nadu into two categories - Zone II and Zone III (representing an area of 73% and 27% respectively), which is under Low risk (upto magnitute 4.9) and Moderate risk (upto Magnitude 6.9) respectively including many districts in the State namely Chennai, Thiruvallur, Vellore, Coimbatore, Dharmapuri, Salem, Thirunelveli, Kanyakumari and the Nilgiris. Chennai, the State capital and the major cities Coimbatore and Salem fall under seismic zone III.

2.2.10 Landslide Vulnerability

Landslide is one of the major natural hazards that is commonly experienced in hilly terrains. The landslide hazard zonation atlas of India published by Building Materials and Technology Promotion Council (BMTPC), Government of India, categorized the Nilgiris district of Tamil Nadu State

as one of the severe to very high landslide hazard prone areas of India. Landslides occur during the seasonal rains in the Nilgiris Hill Range and some of the major ones that have occurred are the Runnymede landslide, the Glenmore landslide, the Coonoor landslide, the Karadipallam landslide, Megamalai landslide and the Marapalam landslide. Besides Nilgiris, other districts in the State that have had the problem of the landslide are Salem, Erode, Coimbatore, Vellore, Dindigul (Kodaikanal hills) and Theni.

2.2.11 Tsunami

An earthquake of magnitude 9.00 on the Richter scale struck the seabed off the Sumatra Coast, Indonesia at 6.28 AM on 26.12.2004. The resultant seismic giant sea wave (Tsunami) battered the coast of South India. These giant sea waves ravaged the coastline of Tamil Nadu ferociously on 26.12.2004 at 8.30 A.M. The people living in villages and towns all along the coastline of 13 Districts viz. Chennai, Kancheepuram, Thiruvallur, Villuppuram, Cuddalore were severely affected leading to loss of lives, livelihood and infrastructure.

2.2.12 Forest Fire

Forest Fire is a recurring phenomena in the State leading to disastrous proportions during the decade 2006-2015, 8649 fire incidents were detected within the geographical area of the State of Tamil Nadu. Of this, 3272 the fire incidents were detected within the Notified forests of the State. On an average, 327 fire incidents in 74 fire days per annum were detected during the period with maximum fire incidents during the year2009.

Fire Sensitive beats:

Active fire locations over the notified forests of Tamil Nadu during 2006-2015 were analysed for spatial and temporal patterns. During the decade, more than one fourth of annual average fire incidents had been detected in 15 forest divisions vizKodaikanal, Vellore, Theni, Mudumalai Tiger Reserve,Hosur, Sathyamangalam Tiger Reserve, Kanyakumari, Anamalai TigerReserve, Tirupattur, Nilgiris (N), Thiruvallur, Dindigul, Kallakurichi, and Megamalai Wild Life Sanctuary (WLS) divisions.

The Moderate Resolution Imaging Spectrometer (MODIS) and Visible Infrared Imaging Radiometer Suite (VIIRS) detected fire incidents, of 2006 to 2015, were overlaid with beat map of the State to assess the frequency of fire occurrence in different beats. As per analysis, at least one fire incident had been detected in 638 beats. Based on number of fire detections in the beats the sensitivity is classified into five classes' viz. Very Low, Low, Moderate, High and Very High.

NUMBER OF BEATS IN DIFFERENT FIRE SENSITIVE CLASS

(Based On 2006-2015 MODIS/VIIRS Data)

Sl. No	Sensitivity	Frequency	No. of Beats
1	Very Low	0 - 4	1105
2	Low	5 - 9	136
3	Moderate	10 - 14	57
4	High	15 - 19	20
5	Very High	20 & Above	21

2.2.12 Fire Risk and Explosives

Tamil Nadu is vulnerable to fire risk disasters

and some of the districts fall in the very high risk and high-risk categories. Districts have been analyzed based on fire risk ranking by specialized groups and the analysis reveals that six districts namely Chennai, Coimbatore, Dindigul, Kancheepuram, Madurai and Thiruvallur are under the 'very high risk' category, Cuddalore, Namakkal, Thanjavur, Tuticorin, Tiruchirapalli, Thirunelveli, Tiruppur, Vellore and Virudhunagar in the 'high risk' category. The analysis was borne out of assessing the population density, residential built-up area and Industrial areas in these districts. Forest fires are also a major problem in Nilgiris, Salem, Theni and Dharmapuri due to acute drought conditions, lightning and some times induced by human activities.

2.2.13 Chemical, Biological, Radiological and Nuclear (CBRN)

Tamil Nadu has a number of Industries which are vulnerable to natural as well as man-made disasters. There are 153 Major Accident Hazard (MAH) units in Tamil Nadu falling under this category because of the storage of highly inflammable petroleum products in large quantities. There are underground pipelines carrying petroleum products across the State apart from tankers and railways carrying chemicals which are potentially hazardous. The three major types of hazards possible with chemical emergencies are fires, explosions and toxic releases that could affect the population and the environment. Kancheepuram, Thiruvallur, Cuddalore, Madurai, Vellore, Thoothukudi, Thanjavur and Ramanathapuram districts have industries that are dealing with potentially hazardous materials and hence have the vulnerability factor.

2.2.14 Nuclear Plants Vulnerability

Tamil Nadu has two Nuclear power plants namely, Madras Atomic Power Station at Kalpakam two units of 220 MW each and the Koodankulam nuclear power station with a 1000 MW unit in Thirunelveli district. Kudankulam has one 1000 MW reactor and operations of the second 1000 MW reactor commenced in the year 2017.

2.2.15 Locational Vulnerability

Physical vulnerability relates to the physical location of the people, their proximity to the hazard zone and standards of safety maintained and relates to the technical capacity of buildings and structures to resist the forces acting upon them during a hazard event. During cyclones, large scale damage to non-engineered buildings, semi-engineered buildings, lifeline structures like lighting poles, transmission line structures are likely to arise. Damage also occurs due to increased density of houses, construction of houses in vulnerable areas, use of poor quality materials as substitutes and the like, which then leads to major building collapse and resulting collateral damage. Such disasters can happen in any district considering a large number of high-rise buildings coming up.

2.3 Hazard Vulnerability Risk Analysis

The Government of Tamil Nadu has initiated number of studies to assess the Hazard and Vulnerability Risk Analysis of (HVRA) various

Areas of Very High Vulnerability:	a. Where inundation of water was more than 5 feet, or b. Where rescue operations were carried out with the help of Central forces/State Disaster Response Force(SDRF), or c. Which were cut-off and became inaccessible, or d. Where loss of lives was reported or large-scale evacuation was carried out.
Areas of High Vulnerability	Where inundation of water was from 3 to 5 feet.
Areas of Medium Vulnerability	Where inundation of Water was from 2 to 3 feet.
Areas of Low Vulnerability	Where inundation of water was below 2 feet.

disasters.The HVRA study for Thiruvallur District has been completed by the Disaster Management Cell, Anna Institute of Management, Chennai during 2014. The HVRA study for Cuddalore District is under progress. The State has plans to take up HVRA studies based on systems approach in all other river basins covering the entire State.

2.4 Urban Flood Assessment

Risks emanating from recurring Urban floods are more pronounced in Chennai, Tuticorin, Cuddalore, Nagapattinam, Tambaram, Manali and other urban areas, will be analysed in depth through Unmanned Aerial Vehicle (UAV) aided aerial photogrammetric and Light Detection and Ranging (LiDAR) based surveys on a river basin approach. The study will cover the river basins in their entirety traversing rural and urban areas to arrive at structural and non structural interventions in a holistic manner to prevent/mitigate urban floods.

2.5 Comprehensive Flood & Cyclone Protection

The Government have sanctioned an amount of Rs.7.01 crores to carry out UAV based aerial photogrammetric studies over a period of 3 years of all the riverbasins in order to develop digital elevation models for comprehensive treatment of the river basins and arrive at appropriate flood and drought mitigation strategies. Government has sanctioned Rs.54.00 lakhs from State Disaster Response Fund (SDRF) for the preparation of Comprehensive Flood Protection Plan based on legacy data in 8 vulnerable Coastal Districts covering 13 river basins identified as flood prone. This plan will bring out, river basin wise interventions for mitigating the adverse impacts of Floods through systematic hydrological analysis and structural measures.

The State has done Hazard Vulnerability Risk Assessment of the most frequently recurring hazard i.e. flooding. The Mapping of vulnerable areas at firka level (with respect to Rural) and ward level (with respect to urban) has been prepared with vulnerability analysis for floods based on legacy data in AutoCAD format. Converting them into digital formats and uploading them in the respective district websites is under progress. Based on legacy data 4399 areas were identified as vulnerable areas

and they are classified as below table: -

2.6 Landslide Vulnerability Mapping

The Geo Technical Cell established by Government in The Nilgris District has studied the Landslide aspects exhaustively through Institute of Remote Sensing Anna University and potentially vulnerable Watersheds have been identified for treatment.

2.7. Storm Surge Model

In order to predict storm surges on real time basis, it is proposed to develop storm surge and Tsunami Modeling for Tamil Nadu with the help of IIT (Madras) Chennai. The real time simulation model will identify the areas that are likely to be inundated during the storm surges and provide effective visualization Models taking into account IMD forecast so as to strengthen early warning systems during the disaster phase and to develop during post disaster and pre-disaster phases in subsequent years.

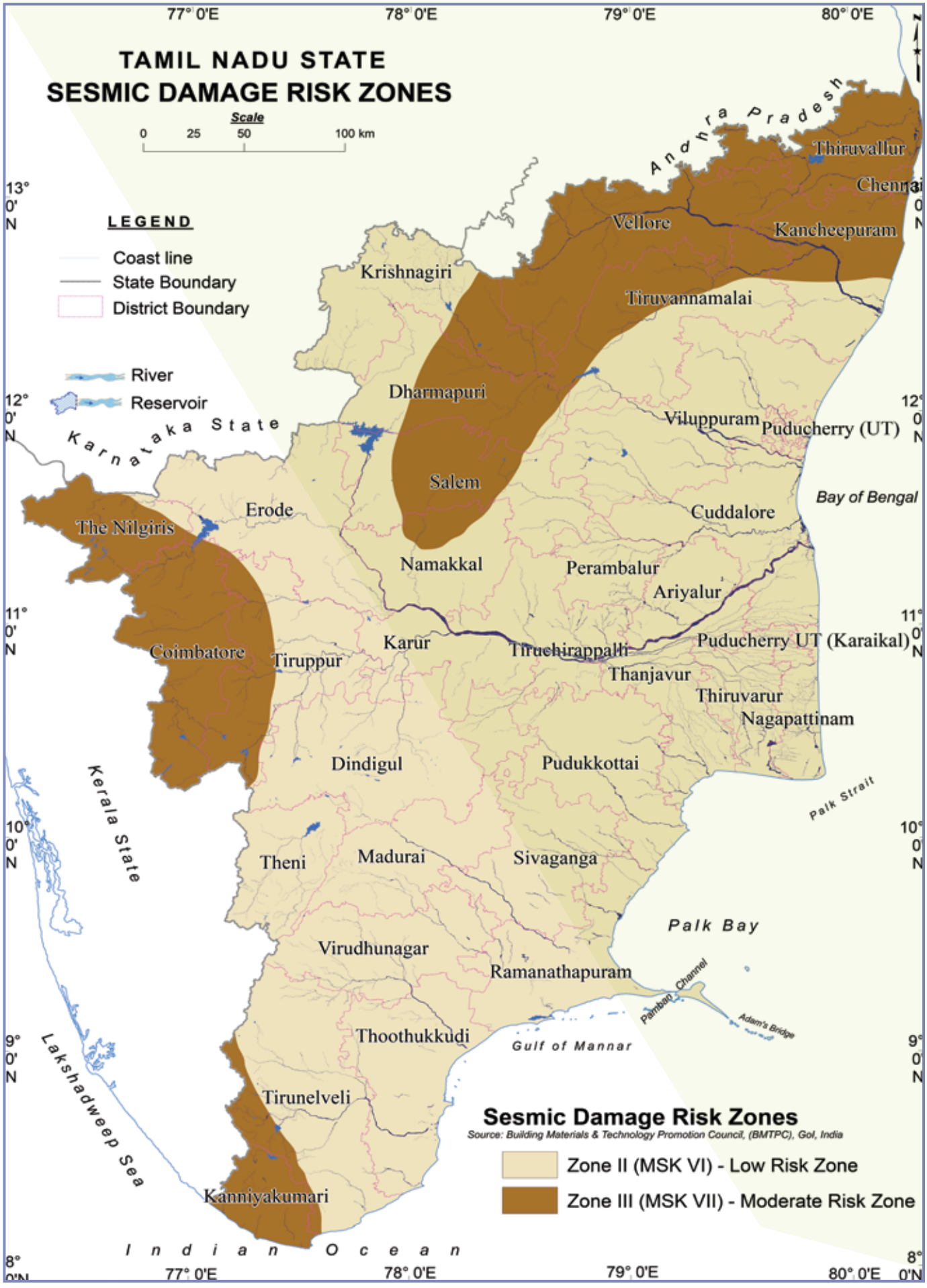
2.8 Development of IT enabled solutions for Disaster Management:

In order to analyze the data and organize relief it becomes necessary to simplify the process of Disaster Management. IT enabled services can be customized to deliver the functions like a) Creation of an interface in the Web with GIS and MIS system for storage & retrieval, b) Development of New Tools for information gathering and Dissemination relating to Disaster management and c) Create dynamic reporting for Data Analytics viz fore-casting and decision-making d) maintain the IT infrastructure of the entire Disaster Management functions.

2.9 Integrated Coastal Zone Vulnerable Areas Mapping

Integrated Coastal Zone Management (ICZM) is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It takes into account the full cycle of information collate, planning, decision making, management and monitoring and evaluation of implementation. ICZM refers to the integration of a wide variety of objectives depending on the stakeholder and also to the integration of the many instruments needed to meet these objectives. The key deliverables of the project are:

1) Land use mapping of the entire coastal stretch of Tamil Nadu,
2) Land capability assessment,
3) Coastal Vulnerability Mapping,
4) Sectoral Planning recommendation,
5) Special Area Management Plans.


TAMIL NADU STATE
SESMIC DAMAGE RISK ZONES
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0'N
Andhra Pradesh
Karnataka State
Kerala State
Tamil Nadu
Thiruvallur
Chennai
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Bay of Bengal
Namakkal
Perambalur
Ariyalur
Karur
Tiruchirappalli
Puducherry UT (Karaikal)
Coimbatore
Tiruppur
Thanjavur
Thiruvarur
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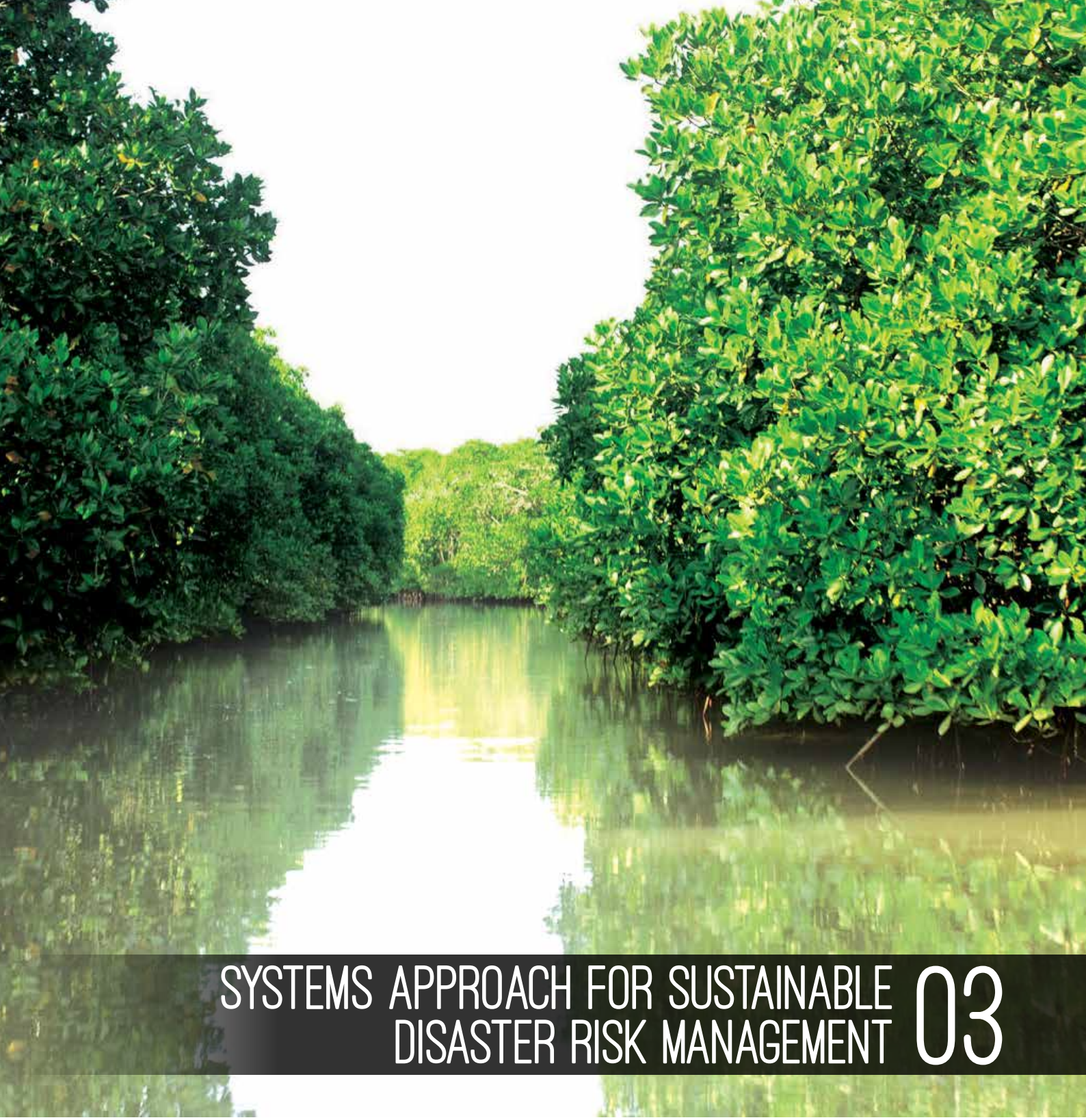
Dindigul
Pudukkottai
Palk Strait
Theni
Madurai
Sivaganga
Palk Bay
Virudhunagar
Ramanathapuram
Pamban Channel
Adam's Bridge
Thoothukkudi
Gulf of Mannar
Tirunelveli
Lakshadweep Sea
Kanniyakumari
Indian Ocean
Sesmic Damage Risk Zones
Source: Building Materials & Technology Promotion Council, (BMTPC), GoI, India
Zone II (MSK VI) - Low Risk Zone
Zone III (MSK VII) - Moderate Risk Zone



SYSTEMS APPROACH FOR SUSTAINABLE DISASTER RISK MANAGEMENT 03

Disaster Management gained international attention, in recent decades in view of the recurrence of different disasters that are debilitating the communities, inflicting widespread damages to both public and private assets besides causing large scale loss of lives. In order to address the risks caused due to various disasters, an International agreement was reached in the meeting held at Sendai, Japan in 2015.

The Sendai Framework was the first International agreement adopted within the context of the post-2015 development agenda. Two other major international agreements followed it in the same year: the Sustainable Development Goals 2015 – 2030 in September and the UNCOP21 Climate Change agreement to combat human-induced climate change in December. Disaster Risk Reduction is a common theme in these three global

agreements. The Paris Agreement of 2016 on global climate change points to the importance of averting, minimizing and addressing loss and damage associated with the adverse effects of climate change, including extreme weather events and slow onset events and the role of sustainable development in reducing the risk of loss and damage. Intrinsic to sustainable development is DRR and the building of resilience and resistance to disasters. Further, effective disaster risk management contributes to sustainable development.

The Sendai Framework provides the way forward for risk reduction strategies and priorities for the period ending in 2030. The Sendai framework has clearly set out 4 priorities for action and a set of 7 global targets with the major targets being "substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries." The State Disaster Management Plan is conceived with priorities and targets that are consistent with the priorities and global targets set by the Sendai Framework.

3.1 State Disaster Management Plan (SDMP) 2018-2030

The Disaster Management Act stipulates preparation of Annual State Disaster Management plans in order to meet the goals set out in Sendai Framework. The Government of India has come out with a National Disaster Management Plan for first time in 2016 and in the same year Government of Tamil Nadu has come out with a State disaster management plan to set out the priorities. The SDMP follows the Framework for covering all aspects of Disaster Management from Disaster Risk Reduction, Prevention & Mitigation and Preparedness & Response to Recovery and Reconstruction. The SDMP specifies the Roles and Responsibilities of all stakeholders in different phases of Disaster Management and spells out the goals and strategies of the Tamil Nadu Disaster Management Authority to address various risks faced by the State and to specify the measures that will be put in place in disaster risk reduction/ proofing and reduction over a period co-terminus with Sendai Framework period (2018-2030).

3.2 Vision

To build a safe and disaster resistant Tamil Nadu through systems approach, inclusive development and mainstreaming disaster risk concerns into the development ethos of the State.

3.3 Mission

To adopt systems approach for sustainable disaster risk reduction and enhance resilience of the community. The focus areas for risk reduction will be natural resources conservation on watershed basis, comprehensive management of river basins, sustainable management of ecologically fragile areas, sustainable agricultural development, mainstreaming of disaster into developmental plans, social inclusion and integrated development of the vulnerable areas.

3.4 Goals

1. Comprehensive Flood Protection through structural and non-structural interventions to reduce the risks and enhance resilience and resistance of the Community with special reference to Thiruvallur, Kancheepuram, Cuddalore, Nagapattinam, Thoothukudi, Ramanathapuram and Kanyakumari Districts.
2. Minimise the risk of urban floods with special focus on Greater Chennai Corporation and its neighbourhood.
3. Enhance the resilience of farmers to face the vagaries of monsoon and impacts of Climate Change with special reference to Delta Districts.
4. Recharge the aquifers in Blocks where Ground Water is currently overexploited/Critical/Semi-Critical categories and convert into Safe Category.
5. Restore and protect ecologically fragile Wet Land and Marsh Lands with Special Focus on Pallikaranai and Ennore Creek Areas and Gulf of Mannar.
6. Reclaim and Restore Areas affected by Sea Water Intrusion and prevent Sea Water Intrusion in Coastal Areas with special focus on Chennai, Thiruvallur and Cauvery Delta Districts.
7. Enhance BioShields to mitigate Floods and Storms in Coastal Districts
8. Restore and Strengthen Water bodies and enhance the capacity of the Water Bodies through Desiltation to mitigate floods and drought.
9. Promote Sustainable Agricultural practices in Rainfed Areas with special focus on Ramanathapuram, Dindigul, Perambalur, Sivagangai, Virudhunagar, Dharmapuri, Namakkal and Ariyalur Districts.
10. Reduce the risks in areas which are prone to specific Disasters like Land Slides, Forest Fire etc with a special focus on the Nilgris, Coimbatore, Erode, Theni, Krishnagiri, Vellore, Villupuram, Dindigul and Thiruvallur Districts.
11. Enhance Mulitistakeholder participation, especially community participation with social inclusion.
12. Strengthen Non-structural measures to reduce the risks due to Man- made and Natural Disasters.
13. Deliver climate resilient hydraulic infrastructure for irrigation and drainage to reduce inundation and flood damages, as well as Sea water incursion with special focus on Delta Districts.
14. Build the capacity to manage CBRN and other man-made disaster.

3.5 Systems Approach for Risk Management

Systems approach recognizes that the disturbances caused in the local ecosystems are due to factors that emanate in the ecosystems that are upstream due to their interconnectedness. Moreover no ecosystem can be free from the influences of other ecosystems due to environmental factors such as Cyclonic storms, extreme weather events be it excess or deficit rainfall etc. The Risk Reduction strategies can be successful only when mitigation measures are adopted holistically to provide a permanent solution. Therefore, the Government have decided to adopt systems approach in prevention and mitigation strategies for risk reduction so as to provide a holistic solution. As per this approach the problems confronting the coastal and non-coastal districts will be examined on the ecosystems basis. In case of floods and drought a River Basin System will be the unit for treatment rather than treating each district as an entity by itself. This approach is necessitated by the fact that in many districts the causative source for the risk lies in the upstream areas of the river system rather than due to inadequacies within that district. It is also imperative to focus on the river basin system in its entirety to address the risks that are faced as a consequence of floods, cyclonic storms, landslides and drought which are triggered due to the vagaries of Monsoon. The Systems approach looks at the causes and effects of the disaster in a holistic and integrated manner encompassing environmental, physical, social, economic and cultural aspects. Long term interventions based on systems approach will enhance resilience and minimize damages even if there is recurrence of extreme weather events and the mitigation measures will also protect the integrity of ecosystems.

The systems approach takes into account that systems are interrelated to each other requiring a holistic management unlike the linear cause and effect chains where one tends to address issues that emerge only from snapshots. Systems approach will address the basic questions of disasters such as why there is a risk, what is the type of risk, when the risk is likely to occur, where the risk is likely to occur, who all will be affected by the disaster and how to reduce the risks. The system approach stands out by the following characteristics

Understanding the big picture as against the local picture alone. Data analytics and aerial photogrammetric studies of river basins will provide the big picture that is required to address the disasters such as floods and drought.

Understanding the need for long term solutions to minimize risks, the strategy will strike a balance between short term and long term perspectives through build back better approaches in the preventive and mitigation measures.

Understanding the dynamic, complex and interdependent nature of different ecosystems viz. relation between fresh water and coastal ecosystems, the systems approach addresses the different ecosystems in a holistic manner. Special focus will be on special ecosystems such as wetland marshland and creek ecosystems to secure their ecosystem service of flood and drought mitigation.

Taking into account both measurable (structural) and non-measurable (non-structural) factors to enhance the resilience & resistance of the State on the one hand and community resilience & resistance on the other.

Understanding that we are only a small part of the overall system in which we are functioning and influencing the system as much as we are

influenced by the system, the holistic strategies will centre around protecting the ecosystems and their interconnecting subsystems.

In view of the prevailing risks and the vulnerabilities, the strategies proposed under this approach have been categorized under following major groups:

In order to achieve the priorities and goals set forth under the Sendai Framework, the systems approach will focus on some key areas such as 1) Natural Resources Management 2) Comprehensive Flood Risk Management through Integrated Development of River Basins 3) Sustainable Development of different ecosystems to secure the ecosystem services of Disaster Mitigation, 4) Sustainable Agriculture Development and 5) Social Inclusion, 6) Disaster resilient power transmission infrastructure.

REFORMS AGENDA

Paradigm shift to System Approach for Risk Reduction

KEY ELEMENTS OF SYSTEMS APPROACH

Basic Reforms

- Risk Assessment through Data Analytics, GIS Tools
- Systems Approach for Sustainable Risk Reduction
- Multi Stakeholders Engagement
- Mainstreaming of Risk concerns into Development Plans

Reforms Tools

- Strengthening Risk Governance for effective response
- Regulatory measures for prevention & risk reduction
- Mitigation measures to Build Back Better
- Mitigation fund & convergence for enhanced resource allocation

Reforms of Implementation

Compliance

a) Mainstreaming of Risk Concerns into Development Plans

b) Land Use & Building Regulations

Resourcing

a) Convergence
b) Mainstreaming
c) Mitigation fund
d) Flexi funds
e) Externally aided projects

The different programmes that have already been taken, that are being taken and that will be taken up in the coming years have been described in greater detail under the chapters – Prevention and Mitigation, Mainstreaming, Build Back Better and the Way Forward respectively. The gist of the major schemes under focus area is furnished in the table: -

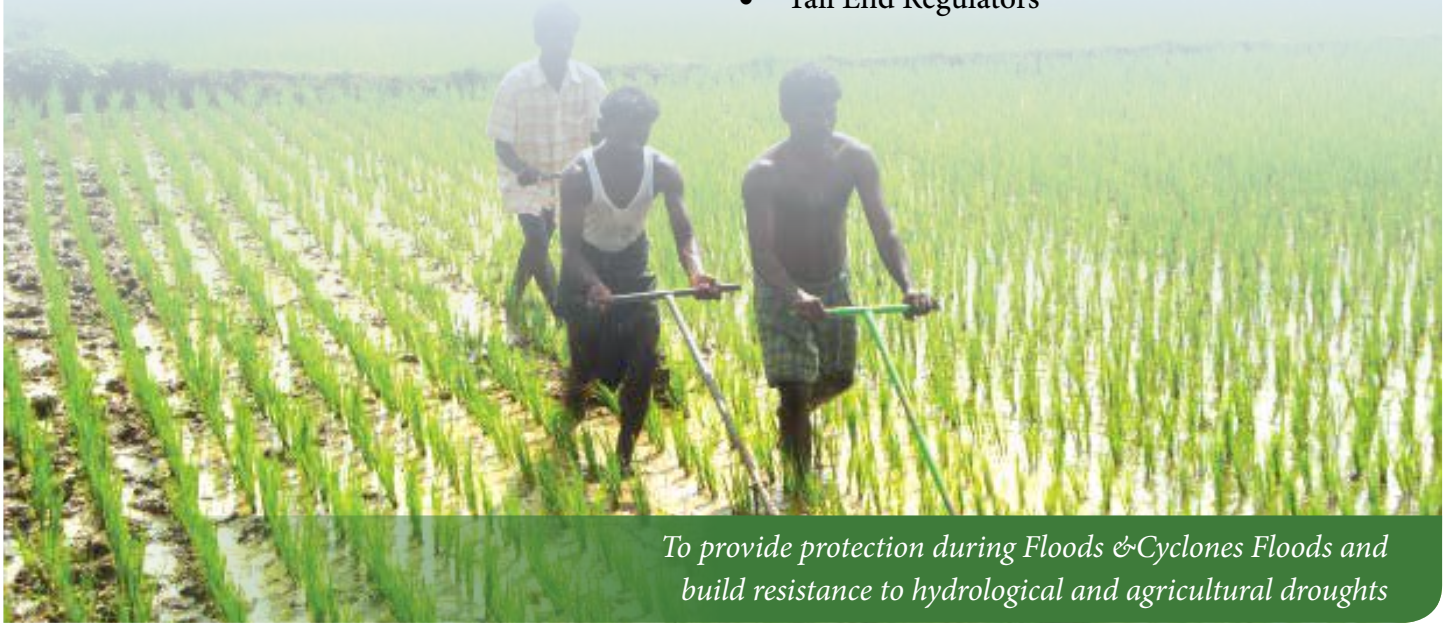
Natural Resources Conservation Schemes

- G.O.Ms No 50 (Industries) dated 24.4.2017
- Kudimaramathu
- MGNREGS- Improving Inflow Channels, Tree Planting, Watershed Development
- Watershed Development
- Special Area Development Programmes
- Integrated Tribal Development
- Micro Irrigation
- Rain Water Harvesting
- Artificial Recharging of Ground Water
- New Irrigation Projects
- Prevention of Sea Water Intrusion

To address Drought, Floods, Landslides, Heat waves and Climate Impact

Comprehensive Management of River Basins - Schemes

- IAMWARM / TNIAMP
- Kudimaramathu Works
- Desilting of Tanks under G.O 50.
- Clearing & Widening Drainage Carriers to Original Standards
- Check Dams across River Courses with necessary scour vents for recharging the Downstream stretches
- Construction of Regulators and barrages
- Riverine Reservoirs
- In stream Reservoirs
- Interlinking of Rivers
- Tail End Regulators



To provide protection during Floods &Cyclones Floods and build resistance to hydrological and agricultural droughts

Sustainable Management of Ecologically fragile areas Schemes

- Rain Water Harvesting
- Artificial recharging through check dams and recharge shafts
- Prevention of seawater intrusion
- Rejuvenation of failed Wells
- Eco restoration of marsh lands, estuaries & creeks.
- Conservation & Restoration of Creeks Marshlands and Wetlands
- River regrading works New Irrigation Projects
- Prevention of Sea Water Intrusion

Flood and Drought Mitigation and Livelihood Support

Sustainable Agricultural Development Schemes

Mission for Sustainable Dry Land Agriculture, Rain fed Area Development for Horticulture Clusters

To Combat Drought and Climate mitigation

To enhance Community Resilience

Inclusive development Schemes

- Social Security Schemes implemented by Revenue Department
- MGNREGS implemented by Rural Development Department
- Tamil Nadu Rural Transformation Project (TNRTP)
- National Rural Livelihood Mission (NRLM)
- Tamil Nadu State Rural Livelihood Mission (TNSRLM)
- Tamil Nadu Urban Livelihood Mission (TNULM)
- Tamil Nadu Skill Development Mission – Programmes
- Self Help Groups
- Fisheries Management for Sustainable Livelihoods (CDRRP)
- Economic Development of Adi Dravidar and Tribal Welfare
- Social Security Schemes for differently abled persons
- Schemes implemented by various Welfare Boards.

04 RISK GOVERNANCE – INSTITUTIONAL FRAMEWORK FOR DISASTER MANAGEMENT

4.1 Disaster Management Act 2005

The Disaster Management Act, 2005 (DM Act 2005) lays down institutional and coordination mechanism for effective Disaster Management (DM) at the national, State, district and local levels. As mandated by this Act, the Government of India (GOI) have created a multi-tiered institutional system consisting of the National Disaster Management Authority (NDMA) headed by the Prime Minister, the State Disaster Management Authorities (SDMAs) headed by the respective Chief Ministers and the District Disaster Management Authorities (DDMAs) headed by the District Collectors and co-chaired by Chairpersons of the local bodies. These bodies have been set up to facilitate a paradigm shift from the hitherto relief-centric approach to a more proactive, holistic and integrated approach of strengthening disaster preparedness, mitigation and emergency response.

4.2 Ministry of Home Affairs – Govt of India

The overall coordination of disaster management vests with the Ministry of Home Affairs (MHA). The Cabinet Committee on Security (CCS) and the National Crisis Management Committee (NCMC) are the key committees involved in the top-level decision-making with regard to disaster management.

4.3 National Disaster Management Institutional Mechanism

The DM Act of 2005 provides for the setting up of NDMA at national level and the SDMA at the State level. The extent of involvement of central agencies will depend on the type, scale and administrative spread of the disaster. If the situation requires the direct assistance from Government of India or the deployment of central agencies, it will provide all necessary support irrespective of the classification of the disaster.

4.4 National Disaster Management Authority (NDMA)

The Government of India established the NDMA in 2005, headed by the Hon'ble Prime Minister. Under the DM Act 2005, the NDMA, an apex body for disaster management, is having the responsibility for laying down the policies, plans and guidelines for disaster management for ensuring timely and effective response to disaster. NDMA is assisted by NEC in discharge of Executive functions. The guidelines of NDMA will assist the Central Ministries, Departments and States to formulate their respective DM plans. It approves the National Disaster Management Plans and DM plans of the Central Ministries / Departments. It will take such other measures, as it may consider necessary, for the prevention of disasters, or mitigation, or preparedness and capacity building, for dealing with a threatening disaster situation or disaster. Central Ministries / Departments and State Governments will extend necessary cooperation and assistance to NDMA for carrying out its mandate. It oversees the provision and application of funds for mitigation and preparedness measures.

4.5 State Level

The DM Act, 2005 also envisages specific roles to be played by the local bodies in disaster management. The Institutional Mechanism at the State and District level is furnished below: -

4.5.1 Tamil Nadu State Disaster Management Authority (TNSDMA)

The Tamil Nadu Government constituted the State Disaster Management Authority under the chairmanship of Hon'ble Chief Minister for monitoring the Disaster Management Activities in the State. The members of SDMA are:

Hon'ble Minister for Revenue and Disaster Management, Chief Secretary to Government, Secretary, Revenue and Disaster Management Department, Secretary, Finance Department, Secretary, Home Department, and Commissioner of Revenue Administration / State Relief Commissioner, Director, Centre for Disaster Management & Mitigation, Anna University, Chennai and Head of Department of Civil Engineering, Indian Institute of Technology, Madras. The State Government have included the Secretary Higher Education and Secretary School Education as members of the SDMA recently.

The State Disaster Management Authority (SDMA) is responsible for coordinating the response to disasters and to reduce risks. All measures for mitigation, preparedness, response and recovery are undertaken under the guidance

and supervision of the Authority. The SDMA approves the State Disaster Management Plan and District Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Authority.

4.5.2 State Executive Committee

The State Executive Committee has been constituted to assist the State Disaster Management Authority under the Chairmanship of the Chief Secretary and Secretaries of Finance, Revenue, Public Works, Highways and Home as members. The State Relief Commissioner is a Special invitee of the State Executive Committee. The State Executive Committee is responsible for implementing the State Disaster Management Plan and to advise the State Government on all financial matters in relation to Disaster Management. The SEC is empowered to sanction funds under SDRF to ensure immediate release of funds for carrying operations during disasters.

4.5.3 State Advisory Committee

The State Advisory Committee has been constituted under the Chairmanship of the Principal Secretary / Commissioner of Revenue Administration. The Secretary, Revenue is the co - chair. The Advisory Committee comprises of experts in various fields of Remote Sensing, Communication Networks, Weather Forecasting, Surface Transportation Engineering, Urban Drinking Water Supply and Sewerage, Public Health, Rural Drinking Water Supply, Ocean Sciences, Meteorology and Climate Change, Highways, Industrial Safety and Health, Public Health and Preventive Medicines, Petroleum and Explosives Safety, Forest Conservation and Forest Fires, Irrigation and Flood Management, Electrical Transmission, Water Resources Management and Environment, to advise on measures for disaster risk reduction.

4.5.4 Revenue Administration & Disaster Management Mitigation Department

The department is responsible for policy making and issuance of Government orders based on approvals accorded by Tamil Nadu State Disaster Management Authority and State Executive Committee and Commissioner of Revenue Administration.

4.5.5 State Relief Commissioner

The Commissioner of Revenue Administration is the State Relief Commissioner and implements the tasks assigned by the TNSDM Authority and State Executive Committee relating to the different phases of Disaster Management. The CRA/State Relief Commissioner plays a pivotal role and is responsible for preparedness, capacity building, relief and rehabilitation measures, formulation of policies relating to disaster management in the State. To assist the Commissioner of Revenue Administration, a special purpose vehicle Tamil Nadu State Disaster Management A.gency (TNSDMA)" has been created.

4.5.6 TNSDMA / TNDRRA

The (TNSDMA) is registered under Tamil Nadu Societies Registration Act on 09.01.2014. The Agency has a Governing Council and Executive Council. The Hon'ble Minister for Revenue is the Chairperson of the Governing Council and Chief Secretary to Government is the Vice-Chairperson. 14 Secretaries to Government are Members of the General Council and Commissioner of Revenue Administration / State Relief Commissioner is the Convener. The TNSDMA has been renamed has Tamil Nadu Disaster Risk Reduction Agency (TNDRRA) and herein after will be referred as TNDRRA.

Hon'ble Minister for Revenue is the Chairperson of the Governing Council and Chief Secretary to Government is the Vice-Chairperson. 14 Secretaries to Government are Members of the General Council and Commissioner of Revenue Administration / State Relief Commissioner is the Convener.

TNDRRA functions under the direct control of the Commissioner of Revenue Administration & State Relief Commissioner who is also the chairman of the Executive Council. The Commissioner (Disaster Management) is the Member Secretary and convener of the council.

4.5.7 Incident Response System

The management of response in disasters requires the Government, community, civil society and other stakeholders to carry out a large number of tasks. The activities involved in response management would depend on the nature and type of disaster.

It is pertinent to refer to the definitions of "Disaster", "Disaster Management" and "Types of Disasters" to understand what constitutes a disaster and prescribe an appropriate "Incident Response System"

The UNISDR (2009) defines disaster as "A serious disruption of the functioning of a community or a society involving widespread human, material, economic or environmental losses and impacts, which exceeds the ability of the affected community or society to cope using its own resources."

UNISDR considers disaster to be a result of the combination of many factors such as the exposure to hazards, the conditions of vulnerability that are present, and insufficient capacity or measures to reduce or cope with the potential negative consequences. Disaster impacts may include loss of life, injuries, disease and other negative effects on human physical, mental and social well-being, together with damage to property, destruction of assets, loss of services, social and economic disruption and environmental degradation.

The DM Act 2005 uses the following definition for disaster:

"Disaster" means a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or manmade 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:

The UNISDR defines disaster risk management as the systematic process of using administrative decisions, organization, operational skills and capacities to implement policies, strategies and coping capacities of the society and communities to lessen the impacts of natural hazards and related environmental and technological disasters. This comprises of all forms of activities, including structural and non-structural measures to avoid (prevention) or to limit (mitigation and preparedness) adverse effects of hazards. A definition for the term 'Disaster Management' is not included in the UNISDR's handbook of terminology. However, the proposed, but not yet adopted, 'Updated Terminology on Disaster Risk Reduction' of UNISDR has proposed the following definition for the term Disaster Management (UNISDR 2015b):

"The organization, planning and application of measures preparing for, responding to and, initial recovery from disasters." As per this definition, 'Disaster Management' focuses on creating and implementing preparedness and others plans to decrease the impact of disasters and build back better. Failure to create/apply a plan could result in damage to life, assets and lost revenue. However, it may not completely avert or eliminate the threats.

The term Disaster Management as used in the NPDM 2009 and the DM Act 2005 document

is comprehensive covering all aspects – disaster risk reduction, disaster risk management, disaster preparedness, disaster response, and post-disaster recovery. This document uses the term with the same meaning as defined in the DM Act 2005:

Types of Disasters:

Primarily disasters are triggered by natural hazards or human-induced or result from a combination of both. In particular, human-induced factors can greatly aggravate the adverse impacts of a natural disaster. Even at a larger scale, globally, the UN Inter-Governmental Panel on Climate Change (IPCC) has shown that human-induced climate change has significantly increased both the frequency and intensity of extreme weather events. While heavy rains, cyclones, or earthquakes are all natural, the impacts may, and are usually, worsened by many factors related to human activity. The extensive industrialization and urbanization increases both the probability of human-induced disasters, and the extent of potential damage to life and property from both natural and human-induced disasters. The human society is also vulnerable to Chemical, Biological, Radiological, and Nuclear (CBRN) disasters.

Levels of Disasters:

The disaster management and its planning at various tiers must take into account the vulnerability of disaster-affected area, and the capacity of the authorities to deal with the situation. Using this approach, the High-Power Committee on Disaster Management, in its report of 2001, categorized disaster situations into three 'levels': L1, L2, and L3. The period of normalcy, L0, should be utilized for disaster risk reduction.

Level-L1: The level of disaster that can be managed within the capabilities and resources at the District level. However, the state authorities will remain in readiness to provide assistance if needed.

Level-L2: This signifies the disaster situations that require assistance and active mobilization of resources at the state level and deployment of state level agencies for disaster management. The central agencies must remain vigilant for immediate deployment if required by the state.

Level-L3: This corresponds to a nearly catastrophic situation or a very large-scale disaster that overwhelms the State and District authorities. The categorization of disaster situations into levels L0 to L3 finds no mention in DM Act 2005.

The Government of Tamil Nadu is adopting Incident Response System (IRS) in the State to ensure the unification of efforts of all the stakeholders to ensure immediate response during disasters to protect people & their properties.

The Incident Response System provides a systematic, proactive approach guiding the concerned departments and agencies at all levels of Government, the private sector and Non-Governmental organizations to work seamlessly in disaster situations. For effective, efficient and comprehensive management of disasters in the State of Tamil Nadu, IRS is critical. The aim is not only to minimize loss of life and property but also strengthen and standardize the disaster response mechanism in the State.

Incident Response Systems (IRS) teams have been formed in all districts of Tamil Nadu. The National Institute of Disaster Management (NIDM) is training the team of officers on the various modules of IRS.They will be used as Master Trainers to train the other officials in the State and District.

Incident response System for Natural disasters:

The Incident Response System functions under the overall supervision of the Tamil Nadu State Disaster Management Authority the Chief Secretary to Government is the Responsible Officer and the Principal Secretary / Commissioner of Revenue Administration and State Relief Commissioner is

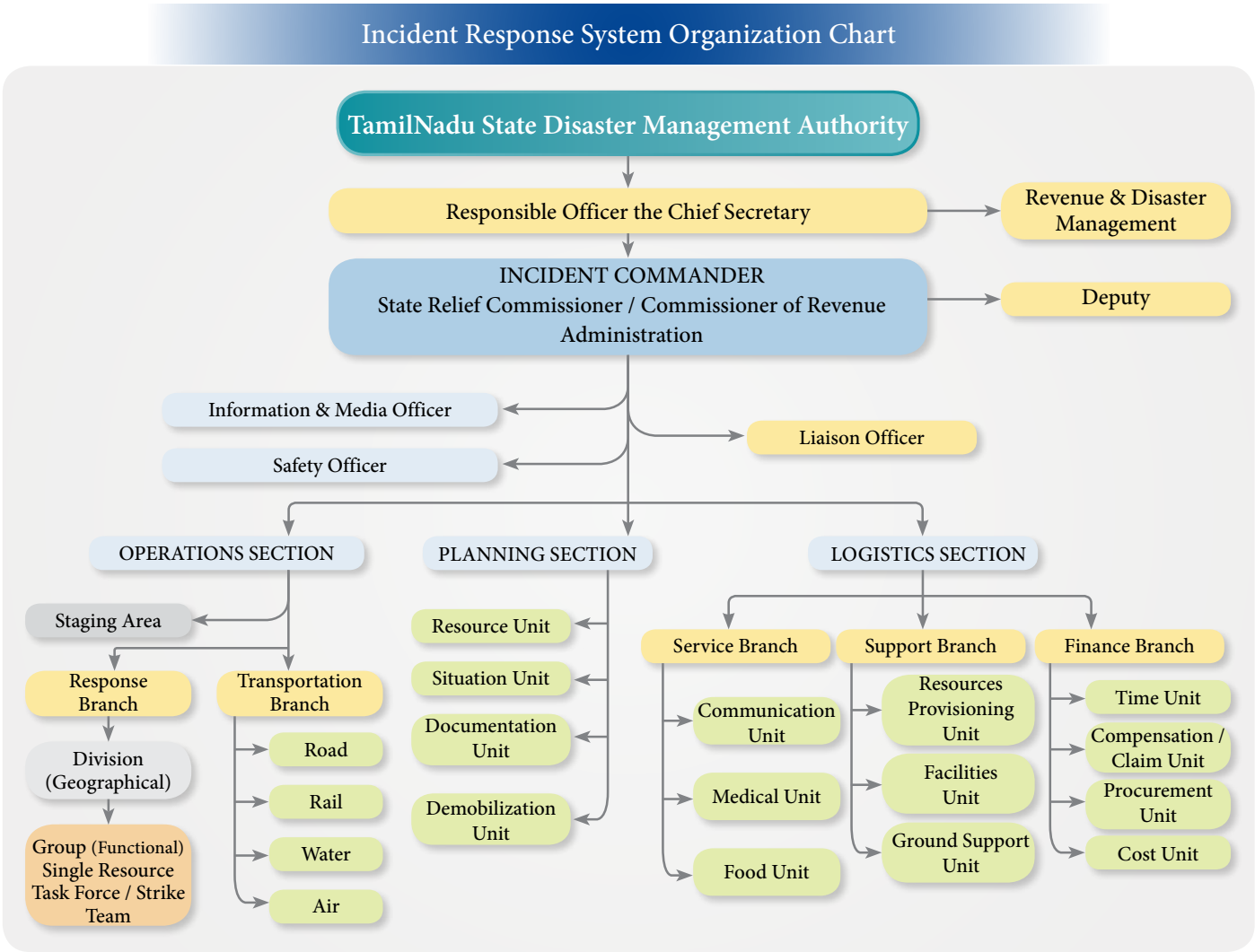
the Incident Commander. The District Collector is the Incident Commander at District level. The Incident Commander is assisted by the Commissioner of Disaster Management who is the Deputy Incident Commander at State level. The Operations, Planning and Logistic sections assist the Incident Commander in carrying out various measures during disaster.

Incident Response System for Manmade Disasters (Breakdown of Public Order, Terrorist Attack & Mutiny :

Crisis Management Plan

The Ministry of Home Affairs, Government of India have prescribed a Crisis Management plan for man-made disasters and it deals with the following crisis situations or potential crisis situations.

a) Breakdown or potential breakdown of Public Order This relates to Intelligence regarding serious



breakdown of law order or actual breakdown of law and order, simultaneously affecting large parts of a state or the country.

b) Terrorist Attack or intelligence, regarding imminent terror attack. This relates to the following situations:

i) Intelligence relating to major terrorist attack or actual terrorist attack including attack by Drone like flying objects at public places, vital installations, symbols of democracy and governance, historical monuments, places of worship, important government buildings, public transport, etc.

ii) Intelligence relating to or actual terrorist attack by use of nuclear / biological / chemical agents or weapons of mass destruction by terrorist outfits

iii) Intelligence relating to or actual incident of assassination or attempted assassination or kidnapping of Indian or foreign dignitary

iv) Terrorist situation connected with hostage taking which requires specialized handling (excluding Civil Aviation Sector)

c) Mutiny: This relates to major / large scale mutiny or desertions in Central Armed Police forces or state police forces or intelligence regarding such a possibility.

d) Migration / exodus / infiltration:

This relates to large scale exodus of people / refuges from a foreign country into India over a short period of time.

State Crisis Management Group

The State Crisis Management Group will be formed with:

1	Chief Secretary	Chairman
2	ACS (Home) / Home Secretary	Member
3	DGP	Member
4	ADG / IG, Special Branch	Member
5	State Relief Commissioner	Member

The Chief Secretary will be the Responsible officer and the DGP will be the Incident Commander. The Secretaries to Government Public, Home will provide support at the Government level. The role of the State Relief Commissioner will be to co-ordinate with the District Administration.

District Crisis Management Group

The District Magistrate / the District Collector / Commissioner of Police will head the District Crisis Management Group. It will have the following members:

i. Superintendent of Police

ii. A representative of IB

iii. Additional Collector /Additional District Magistrate.

iv. Joint Director Public Health

As per the above prescriptions of Govt of India, the Crisis Management Plan and the appropriate institutional mechanism at State and District level will be put in place.

Incident Response System for Epidemics, Disease outbreak, CBRN:

The Chief Secretary to Government will be the responsible officer assisted by the respective Secretary Health and Family Welfare Department at the Government Level. The State Relief Commissioner / Commissioner of Revenue

Administration will be the Incident Commander assisted by the Director of Public Health at the State Level. The District Collector will be incident Commander at the District Level assisted by the Joint Director of Public Health.

4.5.8 District Disaster Management Authority

The District Disaster Management Authority has been constituted under the Chairmanship of District Collector in all the Districts. The District Disaster Management Authority acts as the District planning coordinating and implementing body for disaster management and takes all measures in accordance with the guidelines laid down by the State Disaster Management Authority. The Members of District Disaster Management Authority are:

District Collector - Chairperson

District Revenue Officer – CEO of DDMA

Superintendent of Police (SP)

Personal Assistant (General)

Additional Collector Development

Joint Director (Health)

4.5.9 State Emergency Operation Centre (SEOC)

A State Emergency Operation Centre (SEOC) is functioning under the command of Commissioner of Revenue Administration & State Relief Commissioner. The SEOC is a communication centre for dissemination of all early warnings and alerts received from IMD, CWC, INCOIS and other agencies. During disaster period, the Centre will function round the clock by drafting the services of senior officers of the State and Central agencies for quick dissemination of alerts. The Centre is accessed by the people in distress by calling toll free number 1070. This Centre also collects information from forecasting nodal agencies for rainfall, cyclone, floods, drought and earthquake and disseminates the above information to District Administration and Line Departments, State Government and the Government of India.

The SEOC has State-of-the-art communication facilities and connectivity on the one hand up to the District and on the other is linked to the National Emergency Operations Centre (NEOC) and other Disaster Warning facilities (National & State).

The Officials from Revenue Administration, Police, Fire, NDRF, PWD, Chennai Corporation (in respect of Chennai) will be manning the SEOC under the direct supervision and control of the Commissioner of Revenue Administration and State Relief Commissioner during Disasters.

4.5.10 District Emergency Operation Centre (DEOC)

The District Emergency Operation Centre (DEOC) functions under the direct supervision of the District Collector. The DEOC acts as a communication centre at the district level for dissemination of information received from State Emergency Operation Centre to Taluk and Village level. During disaster period the centre functions round the clock by drafting the services of the Line Departments in the district for quick dissemination of alerts and collects information on the search, rescue, relief and rehabilitation operations from various quarters and updates the same to Commissioner of Revenue Administration & State Relief Commissioner. This centre is accessed by the public by calling toll free No. 1077. Separate control rooms have been established at the office of Revenue Divisional Officers in coastal and hill areas during the year 2017. Based on necessity, additional control rooms are established temporarily in the scene of occurrence.

4.5.11 Taluk/Block/Zone level Disaster Management Committee

A Disaster can be effectively handled only to the extent that adequate delegation has taken place and involvement of all wings of Government, are clear about their respective roles. A Taluk/ Block level disaster management committee is necessary and shall be formed under the direction of the District Collector. This Committee will monitor the development and implementation of taluk level disaster management plans.

4.5.12 Inter Departmental Zonal Teams for group of vulnerable areas

Inter departmental Zonal Teams are formed under the leadership of Revenue Authority. The team members are drawn from Police, Fire services, Rural Development, Forest, Agriculture Departments etc. Each team will closely monitor 5 to 7 vulnerable areas. 589 Inter departmental zonal teams were formed to monitor the 4,399 vulnerable areas during North East Monsoon 2017.

4.5.13 Village/Ward Level Disaster Management Committee

The coastal districts bear the brunt of the monsoon and hence to have a better community involvement in disaster management, Village/Ward level Committees are formed. This Committee of First Responders is perhaps the most important to be formed and the District Collector directly takes care to put in place a balanced committee with good representation. Every disaster requires total involvement and wholehearted cooperation of the village/ward level citizens. The Panchayat, VAO, local institutions, NGOs, youth clubs and the like will be encouraged by the administration to be involved in the event of an emergency. The first responders are trained to make the communities strong and vibrant in proactively tackling the disasters. Community participation at grass root level is enabled through enrolment of able bodied volunteers, with skills of swimming and climbing, as first responders (10 per vulnerable area). First responder teams are formed in Areas of very high and high vulnerability. The first responders are trained by Fire services / SDRF and Red Cross society. Mobile teams of First Responders and Snake Catchers at Block / Taluk / Sub-Divisional and District levels are formed for deployment based on need.

The First Responders play a key role in providing (first aid, search and rescue, extrication from damaged buildings, road clearance, fire fighting) raising awareness (about hazards, risks and disaster response)community drills (annual drills for disaster response in the community) equipping the community with minimum resources (first aid kit, extrication equipment, lifejackets, lifebuoys, rope etc.)

Sl.No.	Functions	Departments/Agencies
1	Activation of Trigger mechanism	SDMA , DDMA
2	Risk Communication	RADM&M dept., SEOC , DEOC, DIPR, Media and telecommunication networks
3	Evacuation of People	RADM&M, Urban and local bodies, Police, Home Guards, Fire and Rescue services, SDRF, NDRF, Armed Forces, Volunteers, "108" ambulance, community and others
4	Shelter arrangement for rescued people, Search and Rescue Operations	RADM&M, Urban and Local bodies.
5	Traffic control and diversions	Traffic Police , Home Guards , Volunteers
6	Cordoning off the disaster affected areas, Search and Rescue Operations	SDRF , NDRF, Police , Home Guards and Volunteers
7	Law and Order maintenance, Search and Rescue Operations	Police and Home Guards
8	Search and Rescue operation	Fire and Rescue Services, SDRF, NDRF, Police etc.,
9	Provision of First Aid / Trauma Care / Prevent Spread of Epidemic and Endemic diseases	Health department, Local bodies and RED Cross
10	Relief camps and basic amenities in shelters	RADM&M, Health Department & Local bodies
11	Identification of dead and injured	RADM&M, Police, Health department and local bodies
12	Arrangement of medical support for causalities	Health Department
13	Impact & Resource Assessment	RADM&M, Urban and local bodies, Experts
14	Clearance of disaster affected areas.	RD, PWD, Highways & Urban Local bodies
15	Preventive health camps	Health Department and local bodies
16	Need based Establishment of Temporary Shelters	RADM&M and local bodies
17	Mobilizing Resources for relief & restoration	RADM&M, Civil supplies and Consumer Protection Dept, RD&PR and Urban Local bodies
18	Clearance of debris / Solid waste	SDRF, F&RS, PWD, Highways Department and local bodies

Sl.No.	Functions	Departments/Agencies
19	Restoration of Communication & Road networks	PWD, High ways, Urban / Rural Local bodies, RD&PR, TANGEDCO
20	Provision of Water	TWAD,CMWSSB and local bodies
21	Restoration of Electricity	TANGEDCO
22	Resumption of Transportation	Road Transport and High ways
23	Food Arrangements	RADM&M , CS & CP Dept and local bodies
24	Provision of Relief supplies	RADM&M , CS & CP Dept, RD&PR and Urban Local bodies
25	Temporary mortuary / Dead body disposal	Health, RADM&M and local bodies
26	Evacuation and shelter arrangement for cattle/ Livestock	Animal Husbandry Department, Blue Cross, Local bodies and Volunteers
27	Carcass disposal	Animal Husbandry
28	Restoring normalcy	RADM&M, all line departments

The various departments of Government and the local bodies associated with the disaster management functions are presented below:-

4.6.1 Fire& Rescue Services Department

Fire and Rescue Services Department of the Government of Tamil Nadu is entrusted with the task of fire fighting and rescue operations in times of emergency. The Fire and Rescue Services Directorate plays a very vital role in the area of fire fighting and fire prevention. Apart from fire fighting, this department also undertakes rescue activities and helps people, marooned in floods and caught in the debris of fallen buildings, road and rail accidents and other natural and man-made disasters.

4.6.2 The State Disaster Response Force (TNDRF)

State Disaster Response Force (SDRF) has been constituted with a strength of 80 Police of Police, 3 Inspectors of Police, 6 Sub-Inspectors of Police and 70 Police Personnel from other ranks on OD basis from Armed Police, Chennai to TNCF. They have been trained in disaster management and rescue operations in consultation with National Disaster Response Force (NDRF). In order to strengthen the disaster response force, police personnel from Special Forces were trained in rescue and evacuation operations with the help of NDRF and SDRF. Totally 2500 police personnel at the rate of 70 in each coastal district were trained. The SDRF is trained on the lines of the NDRF to deal with any untoward situation. They are trained in disaster response techniques such as detection and location; Extrication and access; Fire Fighting; Medical and First Aid. The first responders in the district were in turn trained by trainers of Fire services / SDRF and Red Cross society.

The Government of Tamil Nadu has issued orders to establish the Tamil Nadu Disaster Response Force (TNDRF) on the lines of NDRF to

respond to both Natural and Manmade Disasters. Funds to the tune of Rs.15.00 Crore have been earmarked for procurement of equipment to TNDRF. The training for TNDRF will be done by NDRF.

4.6.4 Home Guards/Civil Defence

The Tamil Nadu Home Guards organization came into being in 1963 as per Tamil Nadu Home Guards Rules, 1963, as a voluntary citizens' force to assist the Police in the maintenance of Law and Order and for meeting emergencies like floods, fires, cyclones, etc. The Home Guards organization renders valuable assistance in the regulation of traffic, crowd control, maintenance of internal security, promotion of communal harmony, the spread of awareness on health, hygiene, drug abuse, AIDS and road safety, etc.

4.6.5 Emergency Management Contact Directory

An Emergency Management Contact Directory containing contact numbers of all nodal officials in disaster management at the national, State and District level - of the Government, private, NGOs and the community will be prepared and maintained. The Collector supervises and coordinates the preparation and regular updating of this directory at the district website. The DDMA develops a comprehensive resource inventory of NGO's, CBO's and organizations in disaster management and emergency response. Networking enables quick access to resources to minimize response time in emergencies. The system gives the location of specific equipment and resources as well as the controlling authority for that resource so that it can be mobilized for response in the shortest possible time.

The database will be made available at the district and State levels and can be used for all emergencies.

Similarly, an expert database comprising of trained experts in various disasters, volunteers, NGOs, retired Government servants, swimmers, rescuers etc. will be prepared by each district and sent to the TNSDMA.

The District Collector will maintain an updated list of professionals like doctors, paramedical, civil and construction engineers, architects and town planners and send it to the TNSDMA every year for updating of the State list.

4.7 National Institute of Disaster Management

As per the provisions of the Chapter-VII of the DM Act, Government of India constituted the National Institute of Disaster Management (NIDM) under an Act of Parliament with the goal of being the premier institute for capacity development for disaster management in India and the region. The vision of NIDM is to create a Disaster Resilient India by building the capacity at various levels for disaster prevention and preparedness. NIDM has been assigned nodal responsibilities for human resource development, capacity building, training, research, documentation and policy advocacy in the field of disaster management.

4.8 Armed Forces (AF)

The role of armed forces in disaster management is very important. The armed forces have historically played a major role in emergency support functions and this includes search and rescue operations, health and medical facilities and transportation - especially in the immediate aftermath of a disaster. Armed Forces are deployed often when the crisis situation is far beyond the State Government to manage and agencies need help due to the magnitude of the disaster.

4.9 National Disaster Response Force (NDRF)

For the purpose of a specialized response to a threatening disaster situation or a disaster that's happening, the National Disaster Management Act has mandated the constitution of a National Disaster Response Force (NDRF). These battalions are positioned at different needy locations across the Country. In Tamil Nadu, the NDRF is located at Arakonam, Vellore District and Chennai, which maintains a close liaison with the designated State Governments and are available in the event of any disaster situation.

4.10 Coast Guard

The Indian Coast Guard protects India's maritime interests and enforces maritime law, with jurisdiction over the territorial waters of India, including its contiguous zone and exclusive economic zone. The Coast Guard works in close cooperation with the Indian Navy, the Department of Fisheries, the Department of Revenue (Customs) and the Central and State police forces. There are currently 42 Coast Guard stations, which have been established along the coastline of the country. The State of Tamil Nadu comes under Eastern Region (E) CGHQ Chennai. The Coast Guard is the central co-ordinating Authority for managing Oil Spills as per the Coast Guard Act, 1978.

4.11 Nehru Yuva Kendra Sangathan (NYKS)

It is an autonomous body under the Ministry of Youth Affairs and Sports with a nation-wide presence. With the presence in nearly 500 districts, it is a large grass-root level youth organization. NYKS volunteers have traditionally been in the forefront of assisting the civil administration in times of disasters. The organization has been active in relief management and distribution. Their involvement will need to be harnessed and they should be a part of Mock drills.

4.12 Airport Authority of India (AAI)

When a major disaster strikes, airports are overwhelmed with receipt of tons of relief materials (like food, bottled water, medical supplies, clothes and tents, etc.) arriving from all over the world. This material is urgently needed to be in the field. In such cases, AAI may then appoint a senior officer at the airport for handling and distribution (which includes precise unloading, inventory, temporary storage, security and distribution) of relief material during the disaster situation. The State Relief Commissioner (CRA) will make necessary arrangements to dispatch the relief material during an emergency situation.

4.13 Indian Railways

Indian Railways is spread over a vast geographical length over 63,000 kms in India. In the event of a disaster, Southern Railways can assist in the rescue and relief operations. Railways are often preferred mode of transport, both for the movement of people and relief material in bulk. Railways will also have a disaster management plan that will involve coordination with the district or State administration. The more effective the networking mechanism is, the better will be the coordination in times of difficulty.

4.14 India Disaster Resource Network (IDRN)

India Disaster Resource Network (IDRN) is a web based information system for managing the inventory of the equipment, skilled human resources and critical supplies for emergency response in the entire country. This database is to enable assessment of the level of preparedness for specific disaster related vulnerabilities. It is a nationwide district level resource database. The designated user of each district of the State has been given a unique username and password through which they can perform data

entry, data updating on IDRN for resources available in their district.The IDRN network will enable quick access to resources to minimize response time in emergencies.

4.15 India Meteorological Department (IMD)

India Meteorological Department (IMD) monitors meteorological / weather information/ bulletins, warning, announcements and continuously communicates with disaster managers for preparedness. The meteorological department undertakes observations, communications, forecasting and weather information services. During the cyclone and flood seasons, the State Government keeps close contact with the Regional Meteorological Centre for weather related forecasts. Earthquakes occurring in the State which is of magnitude 3.0 and above on the Richter scale are also reported and bulletins issued by the IMD to the State Government.

4.16 Indian National Centre for Ocean Information Services (INCOIS), Hyderabad

Indian National Centre for Ocean Information Services (INCOIS) is a National agency of the Government of India, under Ministry of Earth Sciences. It provides the coastal and ocean information services and supports coastal zone management in the country.The ocean parameters envisaged for dissemination include the wind, wave, current, mixed layer depth, heat budget and maps on the coral reef, mangroves, shore line change and land use pattern. INCOIS has already put in place an early warning system for Tsunami through which it alerts the coastal States whenever an undersea earthquake of a higher magnitude capable of triggering a Tsunami is reported.

4.17 National Remote Sensing Centre (NRSC)

The National Remote Sensing Centre is an operational center under Department of Space, Govt. of India, for receiving and distributing the remote sensing data models such as optical and radar images for applications like Natural Resource Management, Disaster Management and Flood Management. Recently NRSC developed mobile apps for disaster management at the village level.

4.18 National Service Scheme (NSS)

NSS is the Social Service Unit at the College level and has a vibrant and easily approachable youth force which can reach a spot that is in close proximity to a college in an organized manner to take up challenges to provide preliminary urgent help, aid and awareness to the victims. As this group is educated, highly motivated and disciplined, they are trained in disaster response techniques such as detection and location; Extrication and access; Fire Fighting; Medical and First Aid.

4.19 National Cadet Corps (NCC)

There are 5 NCC Group Headquarters and 51 NCC units under the control of this Directorate for the State. 5 NCC Group Headquarters are located in Chennai (2), Coimbatore, Madurai and Tiruchirapalli. 51 NCC units are located in various places of Tamil Nadu. They will play an important role during search, rescue and evacuation.

4.20 Coastal Security Group

Tamil Nadu has a coastline of 1,076 km covering 591 fishing villages in 13 Coastal Districts. The Coastal Security Group was formed in 1994 by the Government of Tamil Nadu. The Personnel of the Coastal Security Group are working in liaison with the Navy, Coast Guard, Local Police, Fisheries Department, Customs and other Revenue Authorities in disaster related activities and had played a pivotal role in rescue and relief operations during floods and cyclones.

4.21 Indian Red Cross Society

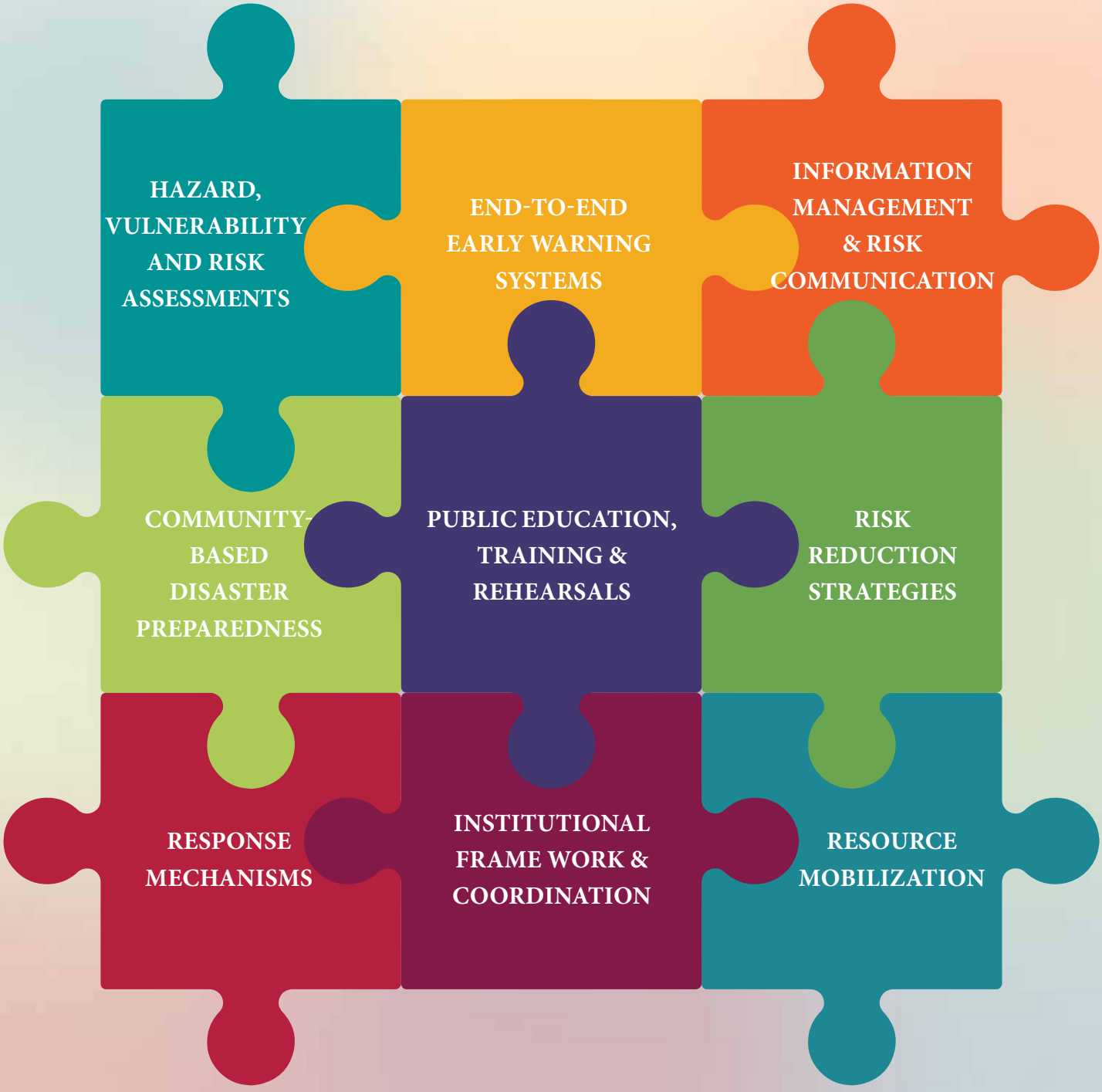
The Red Cross Society functions at the State and district levels. This is a movement for providing relief to the people when they are in dire need. As an organization that provides relief internationally to people in distress, it has credibility at the field level.

4.22 Industrial Associations

Industries play a pivotal role in protecting industrial areas as well as in supporting Emergency Disaster Response and Recovery in the event of any disaster. They have trained man power, technical equipment and infrastructure within Industries that can be used effectively if networked effectively. Industrial associations are active throughout the State. The corporate social responsibility funds available with public and private sector can be dovetailed for mitigation efforts.

4.23 Non-Governmental Organisations

NGOs play a key role in Disaster situations and go a long way in plugging the gaps during emergencies as they often have a good relationship with the local community. NGOs play a very important role in mobilizing communities and in initiating Disaster Risk Reduction activities.The strong linkages which NGOs have with grassroot communities will be effectively harnessed for creating greater public awareness on disaster risk and vulnerability, initiating appropriate strategies for strengthening the capacity of stakeholder groups to improve disaster preparedness, mitigation and improving the emergency response capacities of the stakeholders.



DISASTER PREPAREDNESS 05

5.1 Preparedness Measures

Disaster Management is highly complex requiring multiple strategies and multi-sectoral approaches. Preparedness is the most important aspect in all phases of Disaster Management. Preparedness strengthens efforts for preventing disasters, enhances ability for rescue and evacuation, enables inclusive coverage of vulnerable sections during relief operations, provides scope for rapid response for restoration and rehabilitation as well as provides opportunities for building back better and above all ensures unification of the efforts of multiple agencies and integration of the community participation in Governmental efforts.

Disaster preparedness refers to measures taken to prepare for and reduce the effects of disasters. Disaster preparedness is best viewed from a broad perspective and is more appropriately

conceived of as a goal, rather than as a specialized programme or stage that immediately precedes disaster response. Disaster preparedness is achieved partially through readiness measures that expedite emergency response, rehabilitation and recovery and result in rapid, timely and targeted assistance. It is also achieved through community-based approaches and activities that build the capacities of people and communities to cope with and minimize the effects of a disaster on their lives. A comprehensive disaster preparedness strategy would therefore include the following elements:

1	Hazard, vulnerability and risk assessments
2	End-to-end early warning systems
3	Information Management & Risk Communication
4	Community-Based disaster preparedness
5	Public education, training & rehearsals
6	Risk Reduction Strategies
7	Response mechanisms
8	Institutional Frame work & Coordination
9	Resource mobilization

Having realized the significance of preparedness in disaster management, a massive preparedness exercise was initiated from the month of September 2016 onwards to face the Northeast Monsoon which is usually associated with floods due to cyclonic storms, excessive downpour, cloudburst on one hand and drought on the other hand due to failure of monsoon. This strategy will be followed in the years to come.

5.2 Key features associated with the preparedness

As part of the preparedness measures the following general preparedness measures are adopted to face the eventualities such as floods, cyclonic storms, landslides that arise during North East Monsoon and special measures are put in place to face disasters such as Tsunami, Earthquakes and others.

5.2.1 Hazard, Vulnerability and Risk Assessments (HVRA)

All planning and implementation of disaster preparedness measures will be based on an assessment and prioritization of the hazards and risks that people face, as well as their ability or inability to cope with and withstand the effects of those hazards. This assessment was meant to

- Identify the characteristics, frequency and potential severity of the hazards a community faces
- Identify the particular geographical areas and communities that are most susceptible and vulnerable to those hazards.
- Identify the main sectors of a community (population, infrastructure, housing, services, etc.) that would be affected by a specific type of hazard and anticipate how they might be affected.

5.2.2 Identification of Vulnerable Areas:

Identification of vulnerable areas due to North East Monsoon activities was done throughout the State based on legacy data and 4399 areas have been identified and they are classified into 4 categories as detailed below.

- Areas of Very High vulnerability- 578
- Areas of High vulnerability- 892
- Areas of Medium Vulnerability-1206
- Areas of Low vulnerability-1723

5.2.3 Vulnerability Mapping

Maps have been prepared to depict the vulnerable areas in rural and urban areas. Each map incorporates not more than 3 vulnerable areas in a Firka (Rural areas) / Ward (Urban area).

Analysis of the vulnerability and its magnitude in the areas identified, along with details of escape route to the nearest relief center are all captured in the vulnerability map.

5.2.4 Early Warning and Dissemination Systems

Early warning and dissemination systems play a very important role in minimizing the risks to the community. Several Central agencies are responsible for forecasting and sharing the early warning messages. The following Central agencies are mandated to provide early warning messages for different natural hazards. These agencies are responsible for keeping track of developments in respect of specific hazards assigned to them and inform the designated authorities about the impending disasters.

5.3 Name of the Nodal Agencies for Disaster Early Warning dissemination

Disasters	Agencies
Cyclone/ Hydro-meteorological	India Meteorological Department
Earthquake	India Meteorological Department
Floods	Central Water Commission
Drought	Ministry of Agriculture
Landslides	Geological Survey of India
Tsunami	Indian National Centre for Ocean Information Services

The State Relief Commissioner / Commissioner of Revenue Administration coordinates with central agencies.

5.4 Floods

Floods are often a result of heavy rains associated with the natural course of surplus water flow being hindered by encroachments, unplanned development and the like. The Central Water Commission has developed a network of flood forecasting stations and it issues Daily Flood Bulletins during the Monsoon seasons for all the major river basins in the following categories:

- **Category IV: Low Flood stage** (Water level of the river is flowing between Warning Level and Danger Level)
- **Category III: Medium Flood** (Water Level below 0.50m. less than HFL and above Danger Level)
- **Category II: High Flood** (Water Level less than Highest Flood Level but still within 0.50m. of the HFL)
- **Category I: Unprecedented Flood** (Water Level equal and above Highest Flood Level (HFL)

Declaration of Stages of Flood

The standard stages of the flood situation are as follows:

- **Flood Alert**: Flooding is possible. Be prepared
- **Flood Warning** : Flood is expected require immediate action
- **Severe Flood Warning** : Danger to life and property
- **De Warning** : Flood warning /Flood alert is withdrawn

5.5 Tsunami

The Indian National Centre for Ocean Information Services (INCOIS) provides round-the-clock monitoring and warning services for the coastal population on tsunamis, storm surges and high waves through the in-house Indian Tsunami Early Warning Centre (ITEWC). When an earthquake occurs in a Tsunami generic source and if the magnitude is more than 6.5 and the depth is less than 100 km, INCOIS automatically starts issuing a real-time tsunami warning.

5.5.1 Nature of Advisories issued by INCOIS

Real-time tsunami warnings are issued by INCOIS by first announcing the area of warning, alert and watch based on travel time together with an estimate of the height of the tsunami calculated on pre-run numerical models of tsunami propagations. Based on the hazard - '*warning*', '*alert*' and '*watch*' are issued.

- **Area under Warning:** Area that is within 60 minutes from the tsunami generic sources and wave height expected is more than 2 meters.
- **Area under Alert:** Area within 60 minutes travel time of the tsunami and wave height is less than 2m and Area more than 60 minutes travel time of tsunami and the expected wave height is more than 2 m.
- **Area under Watch:** Areas that are outside the 60 minutes travel time of tsunami and are kept under watch when the wave height is expected to be less than 2 m.

INCOIS issues of over a period of four to five hours as many as six bulletins.

- **The First Bulletin (Type – I)** is issued before the lapse of 20 minutes of the earthquake when the seismic network detects an earthquake occurring in the Andaman Sumatra Subduction Zone (ASSZ). The First bulletin informs that an earthquake has occurred and the preliminary estimates of the location of the epicentre, magnitude, depth of focus and time are informed.
- **The Second Bulletin (Type – II)** is issued not later than 30 minutes of the earthquake in the subduction zone with a magnitude of > 6.3 and the depth of focus is less than 100 km detailing the areas under warning and threat.
- **The Third Bulletin (Type – II Supplementary)** is issued with updated earthquake parameters and revised information on tsunami wave height and accordingly the status of the threat is updated.
- **The Fourth Bulletin (Type III)** is issued when tsunami is confirmed. If the threat is upgraded to **warning** status evacuation will be started immediately.
- **The Fifth Bulletin (Type – III Supplementary)** is issued when the tsunami reaches the coast with hourly updates and also whenever real-time water level information are available.

  The Final-"ALL CLEAR" bulletin indicates withdrawal tsunami warning.

In addition, an early warning system for earthquake/tsunami in Indian Ocean is operational at Madras Atomic Power Station, Kalpakkam. This PC-based Earthquake Notification System (ENS) is installed in Control room of MAPS.

5.6 Cyclone

The cyclone warnings are issued by IMD in four stages.

- The **First Stage** warning known as **"PRE CYCLONE WATCH"** issued 72 hours in advance contains early warning about the development of a cyclonic disturbance and its likely intensification into a tropical cyclone..
- The **Second Stage** warning known as **"CYCLONE ALERT"** is issued at least 48 hrs. It contains information on the location and intensity of the storm, likely direction of its movement, intensification, coastal districts likely to experience adverse weather and advice to fishermen, general public, media and disaster managers.
- The **Third Stage** warning known as **"CYCLONE WARNING"** issued at least 24 hours in advance of the expected commencement of adverse weather over the coastal areas. Landfall point is forecast at this stage. These warnings are issued at 3 hourly interval giving the latest position of cyclone and its intensity, likely point and time of landfall, associated heavy rainfall, strong wind and storm surge along with their impact and advice to general public, media, fishermen and disaster managers.
- The **Fourth Stage** of warning known as **"POST LANDFALL OUTLOOK"** is issued at least 12 hours in advance of expected time of landfall. It gives likely direction of movement of the cyclone after its landfall and adverse weather likely to be experienced in the interior areas.

Different colour codes are used in the cyclone warning bulletins.

Stage of warning	Colour code
Cyclone Alert	Yellow.
Cyclone Warning	Orange.
Post landfall out look	Red.

5.7 Drought

Drought is still largely unpredictable and varies with regard to the time of occurrence, duration, intensity and extent of the area affected. It is a temporary condition caused by significantly less rainfall for an extended period of time. The severity of the drought can also be aggravated by other climatic factors such as high temperature, high wind and low humidity. Drought conditions can be predicted only by closely monitoring actual rainfall received and occurrence of dry spell during the monsoon periods. The guidelines for declaration of drought were revised in 2016.

1. **Meteorological drought:** When actual rainfall over an area is significantly less than the climatological mean.
2. **Hydrological drought:** When there is marked depletion of surface water causing very low stream flow and drying of lakes, reservoirs and rivers.
3. **Agricultural drought:** When inadequate soil moisture produces acute crop stress and affects productivity.
4. **Soil Moisture drought:** Inadequate soil moisture particularly in rain fed areas which may not support crop growth.
5. **Socio economic drought:** The reduction of availability of fund and income loss on account of crop failures endangering food and social security of the people in the affected areas.

6. **Famine:** When large scale collapse of access to food occurs which without intervention, can lead to mass starvation.
7. **Ecological drought:** When the productivity of a natural ecosystem fails significantly as a consequence of distress induced environmental damage.

5.8 Heat Waves

Heat-wave early warnings are designed to reduce the avoidable human health consequences from heat-waves through timely notification of prevention measures to vulnerable populations. Heat wave is considered only after maximum temperature of a station reaches at least 40° C for plains and at least 30° C for hilly regions. India Meteorological Department issues forecast on the level of Heat waves likely to prevail in the regions for 5 days at a time.

5.9 Landslides

The major landslides in Tamil Nadu occur mostly in the Nilgiris, parts of Eastern Ghats, Yelagiri and Shevaroy hills.

Geological Survey of India issues alerts and warnings about landslides

- **Category I:** Landslides that may occur over or in close vicinity of inhabited areas such as urban settlements or fairly large rural settlements wherein a landslide can result in loss of human lives and dwellings on a large scale.
- **Category II:** The landslides that may occur on the fringes of inhabited areas and result in limited loss of life and property.
- **Category III:** Landslides which are fairly large and affect infrastructural installations such as strategic and important highways and roads, rail routes, hydroelectric and irrigation projects.
- **Category IV:** Landslides of small dimensions that occur away from habitations and do not affect either humans or their possessions.

5.10 Earthquake

An Earthquake is a sudden event and gives hardly any time to react. Early warning or prediction of an earthquake is not easy. The protocol for Early warning and prediction of an earthquake is not presently available. India Meteorological Department (IMD) monitors seismic activity in and around the country and disseminates information to all the concerned agencies. In Tamil Nadu, three seismological network stations are located as noted below:

Locations of seismological monitoring centers

Location	Code	State	Latitude (Deg:Min)	Longitude (Deg:Min)	Altitude above MSL
Chennai	MDR	Tamil Nadu	13:04.08N	80:14.78E	15
Kodaikanal	KOD	Tamil Nadu	10:14.00N	77:28.00E	2345
Salem	SALM	Tamil Nadu	11:39.00N	78:12.00E	278

5.11 Chemical Industrial Disaster

NDMA guidelines on chemical disasters have defined Levels of Emergencies which are useful in communicating the level of response needed to be provided.

- **Level – 0:** A non-emergency period when mock drills, trainings, exercises and other preparedness activities for effective response should be done.
- **Level – 1:** The emergency will spill over to off-site (outside the factory) and within the capabilities of the district administration to deal with.
- **Level – 2:** The emergency will require assistance and help from the State government and within their capability.
- **Level – 3:** A National level disaster requiring major direct intervention of the Central Government.

5.12 Nuclear and Radiological Emergency Scenarios

There are two main centers of nuclear facilities in Tamil Nadu viz., Kalpakkam DAE Centre and Kudankulam Nuclear Power Project. The Department of Atomic Energy (DAE) has been identified as the nodal agency in the country for providing the necessary technical inputs to the national or local authorities for responding to any nuclear or radiological emergency in the public domain. In the event of any radiological or nuclear emergency in the public domain, the Crisis Management Group is immediately activated and will co-ordinate between the local authority in the affected area and the National Crisis Management Committee (NCMC).

Both the nuclear facilities have a detailed emergency preparedness and response plan for responding to radiation emergencies arising out of the nuclear facilities.

5.13 Line of Communication and Responsibility for the State

Nuclear disaster arising from nuclear facilities is a situation, where sufficient time will be available to take preventive measures to minimize impact in public domain. However, radiological disaster caused by accidents or malevolent actions in the public domain is a situation where the chances of receiving any early warning are very low. In such a situation where no early warning signals are available, the primary objective of the trigger mechanism shall be to mount immediate isolation.

5.13.1 The following procedures are followed in such situations

The field functionary at ground zero will inform the District Emergency Operation Centre (DEOC)/the Commissioner of Greater Chennai Corporation or the concerned District Collectors and the CRA/SEOC. Immediately thereafter, personnel from the AERC will determine the source of the radioactive emission and its strength. The Commissioner of Greater Chennai Corporation/ District Collector will inform the Commissioner of Revenue Administration for carrying out the required operations. The SEC will meet under the chairmanship of the Chief Secretary and chart the plan of action.

The TNSDMA shall inform the National Emergency Operation Center (NEOC) and coordinates with DAE-CMG and Bhabha Atomic Research Center (BARC) for specialized support team from the 22 ERCs.

Health Secretary will place medical and para-medical teams if required at the disposal of the Incident Commander.

The Chemical Biological Nuclear and Radiological team (CBRN) shall be formed and deployed to ground zero

5.14 Information Management & Risk Communication

Gathering, analysing and acting on timely and accurate information (hazard and early warning information), before during (disaster needs assessment) and after disasters (progress of post-disaster recovery) play a very important role in risk reduction as well as focused response in the areas falling in the disaster zone. Information is gathered on a 24x7 basis from the designated scientific institutions and is analysed for deciding the course of action.

5.15 Risk Communication

The Risk Communication is carried out through the State of Art, State EOC at Chennai in the O/o. Commissioner for Revenue Administration/ State Relief Commissioner at Chennai and the District EOCs in all 32 districts at the Collectorates. Government of Tamil Nadu have sanctioned 14 additional EOCs to be established in the Coastal and Hill Districts in the office of the Revenue Divisional Officers. 478 VHF mobile stations have been established in 32 districts in Tamil Nadu. Exclusive Video Conferencing facilities are being established in the office of the Commissioner for Revenue Administration/ State Relief Commissioner at Chennai and also in all District Collectorates. V-SAT communication facility is available at the SEOC to connect with Thiruvallur, Kancheepuram and Thirunelveli districts. Dissemination of information is also made through Electronic Print media and Social Media like Face Book, Twitter and WhatsApp Groups.

5.16 Community – Based Disaster preparedness

5.16.1 Community based Disaster Management:

The community is the first responder to any Disaster. The Community has its own traditional wisdom and local knowledge to withstand the impact of disasters. Harnessing leadership and voluntarism among the Community and developing a team of trained community volunteers through participatory approach for special tasks of early warning, Search, Rescue Transport Arrangements & Evacuation, First Aid, Shelter and Relief (Food, Water and Sanitation) are essential for successful Disaster Management. Involvement and participation of the communities will ensure a collective and coordinated action during emergencies. Volunteers from local community are being identified from NSS, NCC and Youth Groups with skills of swimming and climbing, as First Responders and teams of First Responder are formed in areas of vulnerability (for search, rescue and evacuation). It is also ensured that Women volunteers are also included in First Responders Teams and also in other Committees. The first responders are being trained by Fire & Rescue Department / SDRF or Red Cross society / Civil Societies. During the year 2017 the total no. of first responders identified and made part of the Response teams is 23,325 of which 6,740 are women responders.

5.16.2 Social Inclusion - Needs of Vulnerable Groups

When addressing the preparedness and relief requirements of the disaster victims, focus is being placed on the special needs of the vulnerable population that is, children, women, aged and the differently abled. Socio-cultural needs are being taken into account in disaster management planning.




The DDMAs pay special attention to 1) Ensure proper arrangements for vulnerable sections like differently abled, Senior Citizens Women and children etc. 2) Provide Warm and inner clothes and additional clothes to Children, sick, elders, women and widows. 3) Sanitary napkins for women / girls will be provided with disposable paper bags.4) ensure necessary basic arrangements for safe delivery by pregnant woman.5) ensure arrangements with Government / Private Hospitals so that required medical assistance will be available at short notice 6) provide milk powder etc for lactating mothers and 7) Wheel chairs to help aged, differently abled persons.

5.17 Public Awareness

Imparting Disaster Risk Knowledge and bringing attitudinal and behavioral changes to the early warning messages play a significant role in Risk Reduction especially in minimizing loss of lives. Considering the importance and the need for enhancing the knowledge levels of different stakeholders to tackle different disaster situations GoTN has been according very high priority in building the capacities of the community and other Stakeholders. In order to spread the awareness levels, all possible channels of communication such as print, electronic, social and traditional media are being used by GoTN.

5.17.1 Curriculum development on Disaster Risk Reduction for Schools

Post 2004 Tsunami, there was a paradigm shift in the policy for Disaster Management and one of the key drivers identified was community resilience to face disasters. It is imperative to enhance the awareness among school children about Disaster Management and prepare them to face the risks to enhance the overall resilience of the community. In order to prepare the future generation to face the disasters in a more confident and resilient manner and also make them part of Disaster Management the curriculum of 7th to 10th classes have been modified and lessons on Disaster Management have been incorporated. For 11th and 12th standard classes the concept of DRR in curriculum in the subject Tamil, English, Geography have been submitted to the State Government for approval. A draft syllabus has been included for a Diploma in Elementary Education in Social Science Text book.

The School Education Department organised a series of elocution, essay and drawing contests in more than 21,000 schools with the theme on Disaster Risk Reduction. 6099 High and Higher Secondary Government and Government aided schools teachers were trained in disaster management concepts who inturn will be building the awareness of school students.

5.17.2 Mock Drills

Search and Rescue Teams at State Levels are carrying out mock drills on various disasters situation annually. For floods/flash floods mock drills are carried before the monsoon period. For earthquakes, landslides etc., such drills are being done periodically. At the district and State levels, mock exercises are being carried out for assessing and evaluating preparedness of the State machinery and that of community.

5.17.3 Sensitizing Hospitals/Educational Institutions and Oil Companies

Realising the importance of sensitizing the private institutions to be equipped with mechanism for immediate response during disasters, series of meetings were held at District and State levels to sensitize the Hospital / Educational / Industrial organizations, communications service providers, Oil companies to be equipped with strategies at institutional levels and also to make back up arrangements to ensure lifesaving services unhindered especially in the hospitals.

5.18 Risk Reduction Strategies- Preventive & Mitigation Measures

Taking into account the damages caused in the past during different disasters the Government under takes immediate, short-term and long-term preventive and mitigation measures in the areas affected and areas identified as vulnerable to minimize risks. Some of the preventive and mitigation measures undertaken regularly as part of North East Monsoon preparedness are

Desiltation and clearance of water bodies and water ways for flood mitigation:

1. In order to mitigate the risk of Flood and Drought and to enhance the fertility of Agricultural land the Government ordered on 28.4.2017 desiltation of Dams, Reservoirs and Lakes and supply the tank silt free of cost to farmers. So far 5.46 crore cubic meters of silt was removed from 33,612 water bodies and around 6 lakh farmers have been benefitted. Removal of 5.46 Crore cu metre of tank silt has enhanced the storage capacity to the extent of 1.75 tmc.
2. Desilting of Water bodies and inlet Channels and river courses and water ways is accorded High priority under MGNREGS and other State schemes.
3. Blockages are removed under Bridges and culverts to ensure free flow of flood waters and prevent breaches and inundation of the neighbouring areas.
4. Desilting of storm water drains in the urban local bodies prior to monsoon is one of the key activity undertaken.
5. Major water bodies in Chennai City viz. Buckingham Canal, Velachery lake, Captain Cotton and B Canal in Kodungaiyur are desilted and weeds that clog the water ways are also removed.
6. Repair of storm water drains that have been damaged and construction of missing links and new storm water drains in the extension areas.

Structural interventions undertaken for flood mitigation in water bodies and water ways

A basin and sub-basin intervention approach is followed by the Public Works Department as part of the pre-monsoon activities to prevent flooding. The following types of works are carried out regularly.

- Widening and deepening of the river courses and their branch channels.
- Permanent flood protection works such as construction of retaining walls, strengthening the bunds, widening the river courses etc.,
- Dredging of the river mouths of Cooum, Adayar, Kosasthalyar and Kovalam, Gadilam etc.,

A comprehensive project has also been taken up for Construction/ Reconstruction / Rehabilitation of all the tail end regulators and improvement of the drains at a cost of Rs.960.66 Crores in Delta districts. This project aims to ensure flood protection and also prevent sea water intrusion.

Encroachment removal in Water bodies and water ways. A massive drive has been initiated to remove 825 encroachments in River Cooum and 4134 encroachments in River Adyar.

- In other areas 7050 encroachments were removed.
- Response & Relief Mechanisms

The Revenue Administration, Disaster Management and Mitigation Department (RADM&MD), is in the process of strengthening disaster management capacity in the State by providing access to essential facilities, creating support systems and building human capacities. To cope effectively with crisis and emergency situations, the department coordinates with the other State departments, policy makers and technical institutions which develop well-defined strategies to manage crisis and also to mitigate the risks caused by the same.

The Commissioner of Revenue Administration undertakes all activities relating to Disaster Management and Mitigation besides managing relief and rehabilitation activities of any disaster in the State. The Principal Secretary/ Commissioner of Revenue Administration is also the Relief Commissioner of the State.

At the district level, the District Collector has the responsibility for the overall management of disasters (The Commissioner of Greater Chennai Corporation will be responsible for the overall management of disasters in Chennai Corporation areas). All departments of the State Government, including the Police, Fire Services, Public Works, Irrigation, etc., work in a coordinated manner under the leadership of the District Collector during disasters, except in Metropolitan areas where the Municipal body plays a major role. NGOs are also involved in providing relief, rescue and rehabilitation in recent times.

5.19 Incident Response System

The management of response in disasters requires the Government, Community, civil society and other stakeholders to carry out a large number of tasks. The activities involved in response management would depend on the nature and type of disaster. The Government of Tamil Nadu is adopting Incident Response System (IRS) in the State to ensure the unification of efforts of all the stakeholders to ensure immediate response during disasters to protect people & their properties.

The Incident Response System provides a systematic, proactive approach guiding the concerned departments and agencies at all levels of Government, the private sector and Non-Governmental organizations to work seamlessly in disaster situations. For effective, efficient and comprehensive management of disasters in the State of Tamil Nadu, IRS is critical. The aim is not only to minimize loss of life and property but also strengthen and standardize the disaster response mechanism in the State.

The Chief Secretary to GoTN is the overall RESPONSIBLE OFFICER and is assisted by the Revenue and Disaster Management Department at the secretariat level and by the Commissioner of Revenue Administration / State Relief Commissioner who is the Incident Commander of the Incident Response System at the State level. The Commissioner, Disaster Management is the deputy Incident Commander. During Disasters all Line Departments function under the overall guidance of the Incident Commander. The District Collector is the Incident Commander at District level.

5.20 Inter Departmental Zonal Teams for Pre-Inspection and Monitoring

Constitution of Inter Departmental Zonal Teams have been formed to closely monitor the situation in designated areas covering 5 to 7 vulnerable areas on an average, in Areas of Very High and Areas of High Vulnerability and in other areas.

The Inter Department Zonal teams led by Revenue Authority comprises of representatives from Police, Fire services, Forest department, Agriculture, Rural Development Department, etc., Totally 498 teams were formed.

5.21 Pre-Positioning of Men

Prepositioning of men in the vulnerable areas will be done to ensure that rescue and evacuation operations are carried out swiftly and the affected or people likely to get affected are saved and possibility of loss of lives is averted. Meetings are held during pre-monsoon phase to ensure that there is perfect coordination with NDRF and Central Agencies besides keeping the SDRF on alert mode.

5.22 Pre-Positioning of Materials

Prepositioning of two months requirement of essential commodities in the vulnerable areas is done by the TN Civil Supplies Corporation to ensure that rescue and relief operations are in place even if the vulnerable area is isolated due to breaches and inundation. Green corridors in vulnerable areas are designated to facilitate rapid movement of rescue teams to undertake necessary operations.

5.23 Revenue Administration, Disaster Management and Mitigation Department

- To coordinate the preparedness functions of all line departments; It is also overall in charge of formulating and implementing the disaster management policies of the State.
- Ensure adequate resources are allocated for preparedness work for all departments.
- Main support department for District Disaster Management Authority.
- Quick mobilization of resources for relief and rehabilitation to the Disaster spot.
- Ensure basic facilities for personnel who work on disaster response.
- Prepare a list of potential shelters while clearly specifying their capacity and check their suitability for accommodating people.
- Prepare a detailed contingency plan for disposal of dead bodies and carcasses that will include adequate documentation.
- Constitute Village-level Preparedness Teams with the help of local bodies, local NGOs and revenue officials.
- Coordinate Village/Habitation level mock drills with the assistance of the Rural Development department and Police.
- Prepare and update inventory of manpower and resources database every quarter inclusive of Earthmoving equipment, Tipper Lorries, Power saws, Cranes, Boats and any other lifesaving equipment.
- Annually facilitate the DDMA to update the District Disaster Management Plan.
- Maintain, activate and monitor the District level Emergency Operations Centre (DEOC).
- Establish communications with State Emergency Operations Centre (SEOC) and all stakeholders at all levels for the purpose of receiving and sending warning and information exchange through district control room.
- Ensure collation of expense accounts for sanctions and audits and to ensure full accountability for funds utilized through the department.

The revised norms of assistance for sanction of relief to the victims of the natural calamities under State Disaster Response Fund and Minimum standards of relief are placed at Annexure-II & III.

5.24 State Disaster Response Force (SDRF) – Response mechanism

State Disaster Response Force (SDRF) has been constituted with a strength of 80 Police Personnel comprising 1 Deputy Superintendent of Police, 3 Inspectors of Police, 6 Sub-Inspectors of Police and 70 Police Personnel from other ranks on OD basis from Armed Police, Chennai to TNCF. They have been trained in disaster management and rescue operations in consultation with National Disaster Response Force (NDRF). In order to strengthen the disaster response force, police personnel from Special Forces were trained in rescue and evacuation operations with the help of NDRF and SDRF. Totally 2500 police personnel at the rate of 70 in each coastal district were trained. The SDRF is trained on the lines of the NDRF to deal with any untoward situation. They are trained in disaster response techniques such as detection and location; Extrication and access; Fire Fighting; Medical and First Aid. The first responders in the district were in turn trained by trainers of Fire services / SDRF and Red Cross society.

Taking into account the developments of 2015 Flood and severe Vardah Cyclone 2016, GoTN took a major policy decision to strengthen the SDRF by raising an exclusive battalion Tamil Nadu Disaster Response Force [TNDRF] to assist during natural and manmade disaster. It has also been decided to fund TNDRF to equip them with the State of the art Search Rescue & Evacuation equipment. It has also been decided to build the capacity of the Tamil Nadu Disaster Response Force [TNDRF] personnel at the State and National levels with the help of National Disaster Response Fund [NDRF] and Central Reserve Police Force [CRPF].

In addition to the exclusive role to be played by Tamil Nadu Disaster Response Force [TNDRF], the Fire Rescue Services Department plays a very critical role not only in quelling fires but also in protecting the community by undertaking Search Rescue and Evacuation operations. The other specialized agencies of Tamil Nadu police such as coastal security, Home Guards are also involved actively in the response efforts to minimize the loss of lives which is one of the major priorities under the Sendai Frame work.

5.25 Institutional Framework & Coordination

The Tamil Nadu State Disaster Management Authority headed by the Hon'ble Chief Minister provides the policy guidance for the Disaster Management functions. The TNSDMA periodically reviews the preparedness arrangements and provides advice for proper and timely implementation of various preparedness measures. The Co-ordination among the Departments, Central Agencies is ensured by the State Level Executive Committee headed by the Chief Secretary to Government. The Revenue, Disaster Management and Mitigation Department at the Government level is incharge of the Administrative Function. The Commissioner for Revenue Administration has been designated as the State Relief Commissioner. The DDMAs function under the control of the State Relief Commissioner/ Commissioner for Revenue Administration. The DDMAs headed by the District Collector ensure the Co-ordination at the District level and carryout the following preparatory functions.

5.26 Medical Preparedness

Identification of the hospitals, doctors and para-medics teams including mental health and psycho-social service provider at sub-divisional and district levels will be carried out by CMOs to deploy medical teams at short notice. Their names, addresses, telephone numbers, mobile numbers, email etc. will be available at the State District Emergency Operation Centres. The list will be updated half yearly. The stock of medicines, accessories and equipment for each of the identified teams at the district and sub-divisions would be decided in advance as per need and disaster.

5.27 Emergency Health Preparedness

Disasters may cause an unexpected number of deaths, injuries, or illness in the affected community, exceeding the management capacities of local health services and requiring external assistance. The disaster may disrupt the local health infrastructures such as hospitals, which will therefore not be able to respond to the emergency. Some disasters may have adverse effects on the environment and the population, increasing potential risk for communicable diseases and environmental hazards that will increase morbidity, mortality and diminished quality of life in the future.

5.28 Measures to prevent Infectious Diseases during disasters

The following basic responsibilities are being planned for:

1. Maintenance or restoration of safe water supply and temporary measures of rendering water safe for drinking and other essential uses.
2. Adequate food inspection especially, inspection of emergency kitchens and canteens
3. Regulation of sanitation in shelters and emergency camps.
4. Disposal of corpses and carcasses.
5. Maintenance or restoration of sanitation standards in the disposal of sewage and solid waste despite less or diminution of water – supply.
6. Control of pests, rodents and insects which carry disease, destroy, food or become serious nuisances.
7. Requirements for Health relief:
    - Disinfectants such as bleaching powder, chlorine liquid, Phenyl/cresol, Chloroscope for ensuring quantity of free chlorine and supplying safe potable and protected water.
    - Mobile water tankers, drums and cans for transporting drinking water.

The Health department ensures that all the Relief shelters whether temporary or permanent are frequently visited by medical professionals to prevent spread of epidemic diseases. The Rapid Response Teams at District/Block and Municipal levels formed by Health Department will be rushed immediately to the spot for necessary remedial action. As a precautionary measure medicines required for controlling spread of epidemic diseases are adequately stocked and made available on 24x7 basis. The health Department has introduced Ambulance Services which can be availed by dialling 108. The ambulance services under 108 schemes are well equipped to provide first aid to the affected community. Currently there are 763 numbers of 108 Ambulances rendering services during manmade and natural disasters.

5.29 Animal Care

Animals both domestic as well as the wild are exposed to the effects of natural and man-made disasters. The department of Animal & Husbandry devises appropriate measures to protect animals and finds means to shelter and feed them during disasters and their aftermath, through a community effort, to the extent possible. It is pertinent to note that many communities have shown compassion

to animals during disasters and these efforts need to be formalized in the preparedness plans including Carcass Disposal Management Plan by the Departments of Animal Husbandry at the State level.

5.30 Logistics & Transport:

The Disaster Management response operations require transport of food and other essential commodities, evacuated people to the relief centres etc. This also involves identification of Transport vehicles, boats, ambulances, etc. The DDMAs prepared an elaborate and comprehensive list of resource inventory for the use of inter-departmental zonal teams, medical professional, NDRF/SDRF, Police, Fire & Rescue Department who are involved in the search, Rescue & Evacuation operation.

5.31 Resource Mobilisation

a) State Disaster Response Fund (SDRF) :

The State Executive Committee is empowered to sanction funds under SDRF to ensure immediate release of funds for carrying operations during disasters. The SDRF is utilized for Capacity Building of Departments and Communities, Procurement of Search, Rescue & Evacuation equipment and to provide relief to the victims of the Disasters including the local Disasters like Gale wind, Thunder Storm and Lighting.

b) State Mitigation Fund:

The Government of Tamil Nadu has decided to constitute a State Mitigation Fund in order to take up with prevention and mitigation measures to reduce the Disaster Risks. An announcement has been made towards this effect by the Hon'ble Minster for Revenue in the Legislative Assembly. The State Mitigation Fund will be utilized to undertake Disaster Risk Reduction Measures by adopting system's approach.

In addition, to leverage the advantage of convergence of various schemes and maximize Risk Reduction effort, it has been decided to mainstream Risk Reduction concerns into developmental plans. A conscious policy decision has also been taken, that the philosophy of Build Back Better will be adopted while undertaking preventive and mitigation measures. The strategies are elaborated in a separate chapter.

06 DISASTER RESPONSE, RELIEF & REHABILITATION

6.1 Tamil Nadu is prone to major Disasters

Both natural and man-made -flood, Cyclone, Drought, Tsunami, Landslides, Earthquake, Fire, Industrial & Chemical accidents but is mainly affected repeatedly by the fury of flood, cyclonic storm and risks of drought and fire. Out of 32 districts in the State almost all of them are vulnerable to disasters caused by one hazard or another.

Disaster Response measures are built upon the precautionary actions taken up prior to and following, a disaster with an objective to reduce the loss of life and damages to the property, infrastructures and environment, besides, rescuing those who are affected or likely to be affected by a disaster. The Response process begins the moment it becomes apparent that a disaster is imminent and continues until the disaster is declared as over.

6.2 Well-designed Disaster Response System

The Tamil Nadu State Disaster Management Authority headed by the Hon'ble Chief Minister is responsible for the overall disaster management and the Chief Secretary to Government will be the Responsible officer. The Commissioner of Revenue Administration and the State Relief Commissioner, is the Incident Commander for controlling, monitoring and directing measures for organizing rescue, relief and rehabilitation. All other line departments render cooperation in all matters pertaining to the response and relief management. The State EOC, DEOCs and other additional control rooms at the State Capital and at the district level will be manned by Senior officers drafted for this purpose on 24x7 basis, during the disaster period.

The Commissioner of Revenue Administration/ State Relief Commissioner leads and provides the command and control of the operations ably assisted by the 32 District Disaster Management Authorities, various line departments at the State and district level, besides the other State and Central Agencies. Disaster Response includes all those activities that directly address the immediate needs, such as Search, Rescue, Evacuation, First Aid and Shelters, including the coordinated delivery of such efforts. The Government of Tamil Nadu has a well-established system of managing the Disasters of any form.

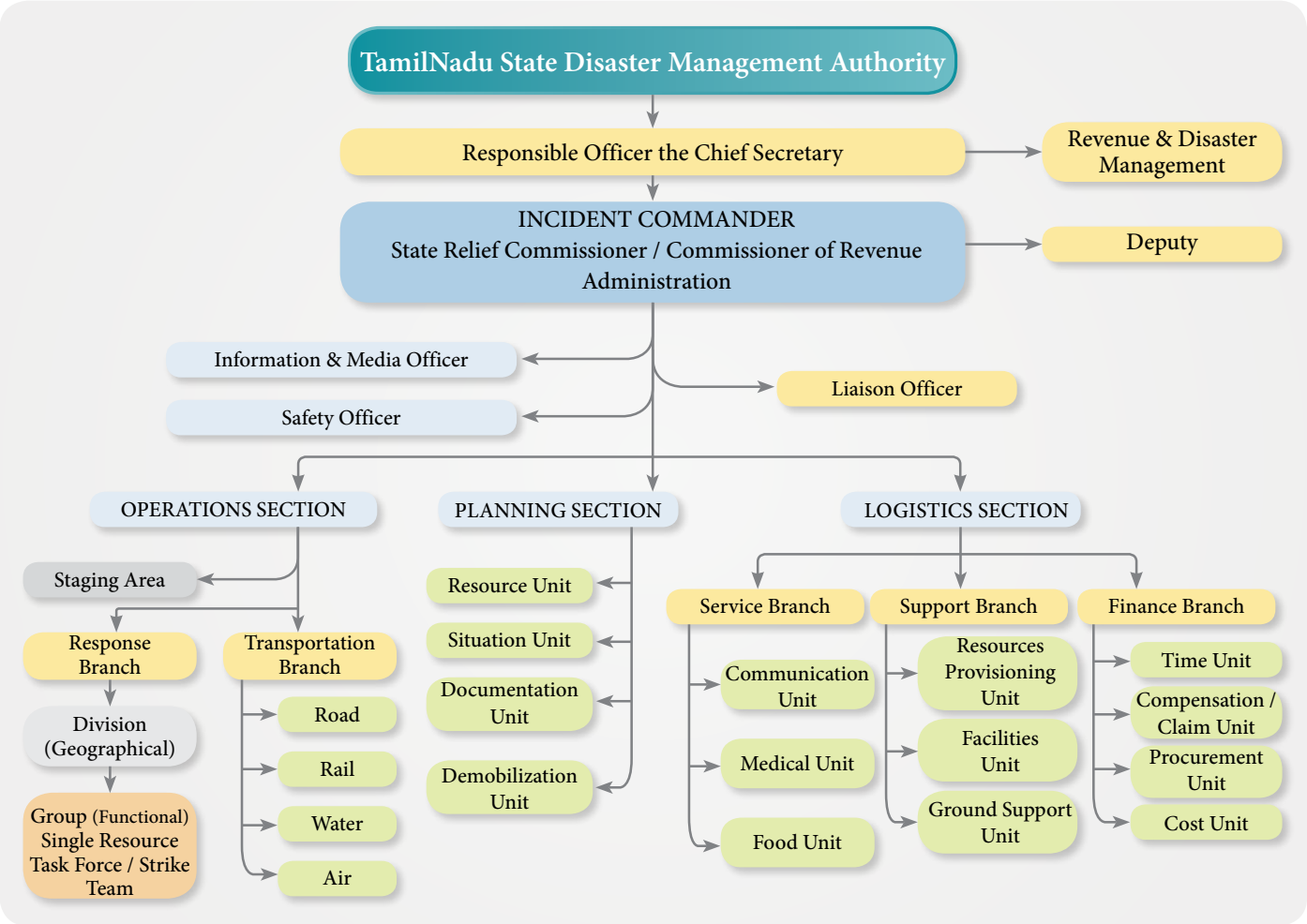
A responsibility matrix is provided in the Annexure 1 to illustrate how the various departments and Agencies of both State Government and Government of India and others coordinate and deliver the functions and synergize the outcomes.

6.3 Tamil Nadu Disaster Response Force

The Government of Tamil Nadu has issued orders for establishing the Tamil Nadu Disaster Response Force (TNDRF) on the lines of NDRF to respond to both Natural and Manmade Disasters. The TNDRF will be raised by conversion of one of the existing battalions. The Personnel will be trained by NDRF & other agencies to function exclusively as disaster response force & located at Avadi. The TNDRF personnel will be preemptively deployed at short notice & the familiarity of the terrain, culture & language will enable them to reach out to the community much faster & effectively. Funds to the tune of Rs 15.00 Crore are earmarked for procurement of State of the art equipment to strengthen TNDRF to undertake search, rescue & evacuation operations during different types of disasters. Establishing green corridors to facilitate quick movement of the rescue teams and relief materials.

6.4 Incident Response System

Incident Response System Organization Chart



The management of response in disasters requires the Government, community, civil society and other stakeholders to carry out a large number of tasks. The activities involved in response management would depend on the nature and type of disaster. The Government of Tamil Nadu is adopting Incident Response System (IRS) in the State to ensure the unification of efforts of all the stakeholders to ensure immediate response during disasters to protect people & their properties.

The Incident Response System provides a systematic, proactive approach guiding the concerned departments and agencies at all levels of Government, the private sector and Non-Governmental organizations to work seamlessly in disaster situations. For effective, efficient and comprehensive management of disasters in the State of Tamil Nadu, IRS is critical. The aim is not only to minimize loss of life and property but also strengthen and standardize the disaster response mechanism in the State.

Incidence Response Systems (IRS) teams have been formed in all districts of Tamil Nadu. The National Institute of Disaster Management (NIDM) is training the team of officers on the various modules of IRS.They will be used as Master Trainers to train the other officials in the State and District. The well-orchestrated Disaster Management System already functioning in the State will adapt to the Incidence Response System.

6.5 Coordination with GOI, NDRF,

Armed Forces

The Chief Secretary to Government convenes a Pre Monsoon Preparedness Meeting every year, inviting the officials of NDRF & Central Forces in which the preparedness is reviewed and co-ordination between central and State officials is being established. During major disasters the State and central co-ordination meeting is also conducted regularly. The preemptive deployment of NDRF and TNDRF is done by the Commissioner for Revenue Administration/State Relief Commissioner.

The services of Central Forces are requisitioned by the Secretary to Government, Public Department and the CRA in consultation with District Collectors decides the exact location of deployment. The Collector nominates Senior Revenue Officials (DRO / RDO) exclusively, for making arrangements of accommodation, food etc& to co-ordinate with central agencies like Military, NDRF, etc. at the District Level.

6.6 Search, Rescue and Evacuation Operations

The vulnerability maps provide details of escape routes, relief centres, transportation arrangements, details of Interdepartmental teams, Contact details of first responders which is much needed for Search, Evacuation and Rescue operations.

Maps have also been uploaded in all districts and Greater Chennai Corporation Web sites. They are also made available to the respective Inter Departmental Zonal Teams. The Team of First Responders made in charge of designated vulnerable areas are adequately familiarized and trained.

6.7 Fire Services & other State level agencies

The Fire & Rescue Services Department plays a significant role in Search, Rescue and Evacuation operations during different disasters. In order to augment their existing fleet of fire tenders & other equipment, Government have announced additional financial support during 2017-18 to the Fire and Rescue Services Department. The Tamil Nadu Special Police, Coastal Security Group & others will also assist in Search, Rescue and Evacuation operations on need basis.

6.8 Emergency Medical Response

The Emergency Medical Response is provided by the Health Department through the Government Hospitals spread throughout the State. The District Disaster Management Authority ensures a) Adequate stocks of essential medicines and life-saving drugs b) Scheduled visit of Doctors and Para medical staff to the Relief Centres. Ambulance services are augmented to render necessary assistance during disasters and 840 ambulances are in operation under the 108 Emergency Ambulance Service. 78 Four Wheel Drive Ambulances are in operation in difficult terrains. First Responder Bike Ambulance Service has been introduced in Chennai Corporation with 38 two wheelers from 2016. Further, Bike Ambulance Service has been extended to 16 more districts. Ambulatory services will be further strengthened in the State in a phased manner.

6.9 Emergency Support Functions

The District Disaster Management Authority holds periodical meetings with concerned line departments to foresee emergency situations and puts in place, a system to deliver emergency support functions. Inter Departmental Zonal Committee comprising of multi departmental officials oversee the pre arrangements and monitor the functions of various systems such as Restoration of Electricity, Water supply and Sanitation system, Telecommunication, Road and Transportation Network, Supply chain of food and other essential items etc during disasters. Food being the quite essential commodity, the Tamil Nadu Civil Supplies Corporation keeps two months stock of food items

especially in vulnerable areas at any given point of time. The public are also advised repeatedly to keep stock of Food, Water essential medicines and house hold items readily available.

6.10 Disaster Relief and Rehabilitation

As and when a disaster strikes or an early warning is issued the first priority is to ensure that the affected or likely to be affected, are evacuated/rescued from the danger zone to pre-identified Relief Shelters. Evacuation to relief shelters ensures that valuable lives along with their most valuable assets are protected. Once people are shifted to the Relief Shelters, the Government extends, relief measures which play a critical role in providing much needed succour to those affected during the disaster and are temporarily accommodated in the relief centres. The Government of Tamil Nadu follows the minimum standard prescribed by NDMA to provide relief to those accommodated in the relief centres.

The objective of Disaster Relief and Rehabilitation is to provide immediate relief and rehabilitation to the affected Community. The focus of the relief strategies adopted in Tamil Nadu is to ensure that those evacuated and shifted to the relief centres are provided with food and other basic necessities as well as ensuring that their health is taken care. The special needs of Women, Children, Aged and differently abled are given distinctive attention. The security of Women and Children, rebuilding their emotional equilibrium are also part of the priorities of the Government.

6.11 Multi-Purpose Evacuation Shelters / Cyclone shelters / other relief centres

They have facilities like kitchens, water storage and toilets for men & women thus providing a safe and hygienic shelter. To accommodate livestock, separate infrastructure has been created. These structures are planned as multipurpose utility buildings and can be used for activities like classrooms, community function hall, meeting rooms for SHGs, community meetings, vocational trainings and other such community activities on a regular basis, making this infrastructure a vital part of the development of the communities.

- In multipurpose Evacuation Shelters (MPES) recently completed under CDRRP, provision for cooking food, adequate and safe water supply, as well as proper sanitation as per NDMA guidelines, Generators with fuel for power back up, etc. are provided in all the relief shelters.
- In areas where permanent structures are not available, to avoid delay in setting up of temporary centres and exorbitant billing of essential supplies, MoU will be entered with manufacturers / suppliers for supply of factory made fast track pre-fabricated shelters / tents / toilets / mobile toilets and urinals which can be dismantled and taken back by the supplier after the deactivation of the camp.
- 3.5 Sq. m of covered area per person with basic lighting facilities are provided to the inmates of relief centres as far as possible. In mountainous areas and in those areas where no other public building is available, minimum covered area will be less.
- High Mast lights (wherever possible), emergency lamps, search lights and candles are arranged in sufficient quantity.
- Special care is taken for the safety and privacy of inmates, especially women, widows and children as their needs are distinct in nature.

6.12 Temporary and Intermediary Shelters

In case of devastating disasters, when the period of stay in temporary shelters is likely to be long and uncertain, or where extreme weather conditions can be life-threatening, construction of intermediary shelters are undertaken as was done during post tsunami in 2004.

In 2004, when Tsunami necessitated relocation of people from their normal place of living; every effort was made by the Government to provide the most suitable site for proving alternative accommodation from the available options. People, whose principal residence was damaged or destroyed badly by the disaster, were provided temporary accommodation.

6.13 Management of Relief Centres

Provision of basic shelter, food, water and health care are essential services that are extended to the people in the relief centres. While providing relief other issues, such as privacy, safety, security and specific gender needs are also addressed in these shelters. The National Disaster Management Authority has framed guidelines for providing Minimum Standards of Relief to the victims of disasters. As a measure of adopting the above guidelines, the District Collectors have been mandated to follow the above said NDMA guidelines vide this office letter NEM Circular No.N.C.1 (4) / 3137 / 2017, dated 8-9-2017.

- In addition to the 121 MPES, that have been constructed in coastal districts, 3172 public buildings like schools, Anganwadi centres, Cyclone shelters, community centres, marriage halls etc., have been identified which can be used as Relief Shelters for accommodating the people affected by any natural calamity in Tamil Nadu.
- Special arrangements are made for differently-abled persons, old and medically serious and patients with chronic disease as their needs are also distinct in nature.
- All the electrical installations are checked for safety.

The Guidelines for providing Minimum Standards of Relief to the victims of disasters issued by NDMA relating to food & nutrition, Drinking Water and sanitation are being adopted in the State.

6.14 Minimum Standard of Relief (Food and Nutrition)

- Milk and other dairy products are provided to the children and lactating mothers.
- Steps are taken to ensure that hygiene is maintained in the camp kitchens.
- It is ensured that Men and women are supplied food that provides a minimum of 2,400 Kcal per day and children / infants a minimum of 1,700 Kcal per day.
- The date of manufacture and the date of expiry on the packaged food items are verified before distribution.
- The community and camp kitchens have adequate facility for large number of people.

6.15 Drinking Water, Dewatering and Sanitation

Supply of clean drinking water to disaster affected areas is extremely essential to prevent any incidence of water borne diseases. The minimum standards prescribed by the State for supply of drinking water to people affected by disasters are adhered to in the relief centres. 3 litres of safe drinking water per person per day is provided to the inmates of the centres.

Providing proper sanitation facilities to men, women and children and ensuring privacy concerns is an important challenge met in the relief centres. The minimum standards prescribed by the NDMA have been adopted by the State for providing sanitation services to people affected by disasters.

In respect of Sanitation, the following standards are maintained in the Relief centres

- 1 toilet per 30 persons.
- Separate toilet and bathing facilities for women and children.

- 15 litres of water per person for toilet / bathing requirements.
- Dignity Kits for women are provided with sanitary napkins and disposable paper bags with proper labelling.
- Necessary arrangements are put in place for clearing the solid waste and for keeping the premises clean.

6.16 Relief Logistics and Supply Chain Management

The Tamil Nadu Civil Supplies Corporation (TNCSC) transports essential commodities of two months requirement to inaccessible and vulnerable / highly vulnerable and its nearby areas, as part of preparedness measures.

6.17 Health and Mental Health Care

Health care of disaster affected pregnant women and lactating mothers, neo-natal, aged and terminally ill and those suffering from chronic diseases receive utmost priority as they suffer from double jeopardy. The District Collectors have been directed to follow the above said NDMA guidelines vide this office letter No.N.C.1 (4) / 5779 / 2016, dated 28.10.2016.

6.17.1 Emergency Preparedness for Health Response

- Mobile Medical Teams visit the relief centres to attend the affected people. All precautionary Steps are taken to avoid spread of communicable diseases.
- Necessary basic arrangements are made for pregnant women for safe delivery.
- Arrangements are made well in advance to ensure the availability of Doctors / Para Medical Staff from Government / Private Hospitals with sufficient quantity of essential medicines to attend to the health needs and concerns of the affected people in relief centres.
- Referral and transportation of the affected people for further treatment / hospitalization etc., are arranged, wherever necessary by the medical team.
- Advance contingency plans for management of multiple casualties shall be derived.

The Social Welfare Department with technical support from mental health wing provides the support for diagnosis and treatment of mental care of affected people who suffer from Post-Traumatic Stress Disorder (PTSD). The past experience in Tsunami revealed that the State has handled the issue with a systematic approach.

In respect of Relief for Widows and Orphans,

- Special care to be given to widows and orphans, who are separated from their families.
- Widow Certificate to those widowed during disaster is issued within 15 days of disaster. Similar certificate to the children Orphaned by disaster is issued.
- For Relief to be given to Orphaned children, guidelines and G.O. issued by Government of Tamil Nadu will be followed scrupulously. Interest received should be given to the child / guardian every month for his / her proper upkeep.
- Ex-gratia assistance for loss of life, assistance on account of damage to houses is given immediately as per the norms approved in G.O.Ms.No.380, Revenue Department, dated 27.10.2015 or any orders / guidelines issued subsequent to the publication of this plan.

6.18 Veterinary Care

Veterinary care for disaster affected livestock and animals, including wild animals and arrangements for their evacuation, shelter, fodder / feed etc. are important for rehabilitation of animals. In respect of Veterinary care the DDMAs have been advised to instruct the Joint/Deputy Director,

Veterinary Services to ensure the availability of adequate stocks of veterinary medicine in Veterinary Hospitals and to ensure availability of essential drugs. The availability of adequate stock of fodder will be reviewed regularly. In the event of any emergency, the availability of stocks of fodder identified well in advance before the onset of monsoon will be transported to the needy places.

6.19 Recovery and Rehabilitation:

a) Psycho-Social Support

Once the response process is in place, the recovery process is activated by resorting to the following actions

- Providing and erecting temporary housing for the victims of the disaster who are displaced.
- Facilitating and providing claims and grants as per the relief manual.
- Providing counselling to the victims
- Providing and facilitating medical support to the victims requiring long term care.
- Clearing and disposing off the debris created as a result of collapse of physical infrastructure and elements.
- Initiating the process of reconstruction by adopting improvised technologies for safe construction and with participation of the communities.

The Department of Social Welfare, Government of Tamil Nadu, will take extensive steps for bringing the affected villagers out of the trauma and depression. For these measures, counselling centres were organized in all the villages during Tsunami 2004. The department had conducted Training of Trainers (TOT) Programme for 100 master trainers and 500 CLWS in Viluppuram and Cuddalore Districts. The Social Welfare Department had trained VHN, SHN, Block Extension Educators, EO (SW), CDPO and Supervisors of Health for counseling purpose. The services of retired teachers, 75 Volunteers from Nehru Yuva Kendra and SHGs were also utilized for the psychosocial support.

The department also organized drawing, Yoga and Music competitions for the affected children. Mental Health services have a vital role to play in bringing the community out of trauma and rehabilitating them back.

Psychosocial Counselling and support was provided for 14,305 traumatized victims on an immediate basis by the District Administration at Cuddalore with the support of experts from Government and Non-Governmental Organisations. Also, the Anganwadi workers were trained to provide counselling services to the rural women in trauma. Institutes like NIMHANS, Medicines sans Frontiers, Schizophrenic research centre. Institute of Mental Health, Chennai organized centres for the affected people and gave Psychiatric counselling for the needy people.

b) Livelihood Support

People affected by disasters, more often than not, lose their livelihood. Relief employment under MNREGA is one of the several avenues for providing alternate source of livelihood to the affected people. During the year 2016-17, as a measure to mitigate the effects of drought situation and to improve livelihood of the rural mass, the number of days of employment provided to a family was increased from 100 to 150 days. As part of the coastal disaster risk reduction and tsunami rehabilitation strategies Government has launched special programmes for enhancing livelihood opportunities for the vulnerable poor.

c) Coordination with Non- State Actors for Relief Efforts

When a natural calamity of extremely severe in terms of intensity and extent strikes, lot of Non-State Actors such as national, international agencies and even foreign nationals pour in relief material

and assistance. Special arrangements are made to coordinate with multiple agencies to ensure that the relief so obtained reaches all the needy in the most transparent manner.

d) Institutional Mechanism

The Commissioner of Revenue Administration undertakes all activities relating to Disaster Management and Mitigation besides managing relief and rehabilitation activities of any disaster in the State. The Principal Secretary/ Commissioner of Revenue Administration is also the Relief Commissioner of the State.

At the district level, the District Collector has the responsibility for the overall management of disasters (*The Commissioner of Greater Chennai Corporation will be responsible for the overall management of disasters in Chennai Corporation areas*). All departments of the State Government, including the Police, Fire and Rescue services, Urban and Rural Local Bodies, Health Public Works, Irrigation, etc., work in a coordinated manner under the leadership of the District Collector during disasters, except in Metropolitan areas where the Municipal body plays a major role. NGOs are also involved in providing relief, rescue and rehabilitation in recent times.

DISASTER PREVENTION & MITIGATION 07

7.1 Taking into account the hazards to which Tamil Nadu is exposed

The GoTN have been initiating several measures as part of its prevention and mitigation strategies. The preventive measures aim at risk avoidance, wherever it is feasible, taking into account social cultural and economic practices of the communities that are highly vulnerable to the hazards. For instance a conscious effort was made to relocate the houses of the fisherman community between beyond 200 m to 1000 m from the high tide line so as to make these housing colonies risk proof to Tsunami, Cyclones and storm surges. Even the houses of those families who were unwilling to relocate have been repaired and reconstructed in-situ with multi hazard resistant specification.

The integrated strategies adopted on watershed basis by GoTN aim to prevent exposure of the communities to the risks of drought and landslides. The River Grading/ Stream Training works in several locations have prevented the exposure of the communities to floods. However, due to the construction of several habitations in low-lying areas & flood plains as well as the geographic location of the State, prevention of disaster risks in entirety is extremely difficult. The problem gets accentuated due to the extreme weather events on the one hand and dependence of the State on upstream States for release of its rightful share of river waters. Therefore the Government has been according highest priority to fund, mitigation measures to lessen / limit the adverse impacts of hazards and disasters.

7.2 The preventive and mitigation measures undertaken fall under two broad categories.

STRUCTURAL MEASURES	NON STRUCTURAL MEASURES
Housing • Disaster Resistant Housing, • Multi-Purpose Evacuation Shelters	**Economic measures** • Diversification of Economic Activity • Subsides, • Credit Waiver
Water resources • Restoration of River drainage systems • River Grading/Stream Training, Flood Routing • Clearing inflow channels	**Risk Transfer** Insurance, Credit & Tax Policies
Infrastructures • Roads, • Bridges • Drinking water, • Power, • Communication, • Education, • Heritage, • Tourism	**Societal Measures** • Public Information Campaigns, • Non formal Education • Community Involvement

Ecosystem restoration	Physical Planning Measures
• Raising Shelter Belts along Coast, • Afforestation, • Restoring fragile interface Ecosystems viz., creeks, marshlands, wetlands etc. • Enhance Ecosystems' Health	• Land use Planning, • Safety in Designs • Retrofitting
	Safety Audit Disaster Resilient Public Infrastructure (Buildings Roads, Bridges, Water Bodies & Reservoir)
	Management & Institutional Measures (Educational Training – School/College Disaster Research Strengthening Technical Expertise, Strengthening of local Authorities)

7.3 Structural Measures

A wide range of structural measures are being contemplated covering most of the sectors viz., Housing, Irrigation, Agriculture, Public Infrastructure, Power, Public buildings etc. The major measures implemented are detailed below:-

7.3.1 Disaster Resistant Housing- Multi-Hazard Resistant Houses

Government of Tamil Nadu have always been in the forefront in creating durable assets for the poor and over the years has been replacing huts with concrete houses. Taking into account the devastating destruction caused by Tsunami, as part of the Tsunami Rehabilitation measures, the houses for the poor who lost their houses were designed as Multi-Hazard Resistant with cyclone and earthquake proof features. All the houses were provided with rainwater-harvesting structures. Fly ash bricks were used in construction, which are stronger and eco-friendlier than common red bricks. Most of the houses were relocated 200 to 1000 metres from the high tideline to prevent exposure of the communities to Tsunami.

All the houses were provided with a staircase which served as a safety provision for people to run to a higher level in case of another calamity. As a precautionary step, bio-shields in major re-settlements and also near all the existing habitations were taken up. The habitations were developed with adequate space to enable easy evacuation at times of emergencies. The reconstructed houses after post Tsunami have withstood the fury of Thane cyclone (which was historical) and the recurrent floods including the most severe in recent time in December 2015. The houses were not only safe but due to the provision of the staircase there was an additional space to move to a higher level in case of inundation due to flood.

The Manual for Disaster Resistant Construction Practices and Cyclone Resistant Building Architecture prepared under UNDP Disaster Risk Management has been made available to different departments responsible for construction of Housing and other public infrastructure.

7.3.2 Multi-Purpose Evacuation Shelters:

During the response and rehabilitation of the community to Tsunami, it was found that the existing number of cyclone shelters in Tamil Nadu along the coast were insufficient to accommodate

the vulnerable population in coastal areas. Based on a study of the location, catchment area population, community needs, 121 Multipurpose Evacuation shelters have been constructed with statutory CRZ clearances. To accommodate livestock also separate facilities have been provided. These shelters are multipurpose utility buildings and can be used for activities like class rooms, community functions, meeting rooms for SHGs, community meetings, vocational trainings and other such other activities, making this infrastructure a vital part of the development of the communities.

7.3.3 Flood Control & Drought Mitigation Measures

The structural measures under the broad water resources segment to combat Flood and Drought are complimentary to each other. The Flood control measures include, River Grading, River/Stream training, construction of new as well as Rehabilitation of Reservoirs, Dams, Anaicuts, Check Dams, Instream Reservoirs, Riverine Reservoirs, Tail end Regulators etc Flood routing through diversion Canals/Channels and creating new storage facilities to store excess runoff. These structures are constructed on a priority basis in the river basins known for recurring floods.

7.3.4 Removal of Encroachments

The problems of flooding in several locations is due to the structural anthropogenic interventions which obliterate the existence width of the water ways, constrict the water ways and I some locations eve block the water ways. The structural interventions are due to the authorized construction of public buildings in the ester years as well as due to illegal encroachments by people of different strata. Removable of the encroachments and the relocation of the authorized structure plays a very important role in maintaining the integrity of the water ways and minimise the risks due to floods. The Government of Tamil Nadu will launch a special drive to remove the encroachments on a priority basis in all water bodies and water ways.

In cases were the matter is subjudice necessary clearances will be obtained from the Hon'ble courts.

After securing clearance from the judiciary, a massive drive has been launched to remove the encroachments in Adayar, Kosathalaiyar Coovam, Kovalam and other river basins. The district administration will be according high priority for removal of the encroachments in the water ways and water bodies.

7.3.5 Augmenting Storage Capacities of Water Bodies

The failure of monsoon during 2016 has dealt a severe blow to the agricultural economy and the allied sectors in the State. Tamil Nadu has witnessed the severest drought ever known or recorded in history. The last known instance of severe drought was during 1876.

In response to the extremely severe drought, the Government of Tamil Nadu inter alia has brought in a major policy change in the management of mineral resources linked to the water bodies in the State. Accordingly the rule 12 (2) and 12 12 (2-A) (a) of the Tamil Nadu Minor Minerals Concession Rules, 1959 have been amended. The new policy enunciated in GO Ms. No. 50 Industries (MMC1) Department dated 27-4-2017 has enabled the farmers to remove the tank silt, free of cost for application on their fields. Within a period of six months 5.4 Crore cubic metre of tank silt has been removed from 33000 tanks benefitting nearly 5 lakh farmers who have applied the tank silt on their fields. The massive desiltation exercise throughout the State, (except in the districts of

Chennai, Thiruvallur and Kancheepuram) has enhanced the water holding capacity of these water bodies by about 1.8 TMC. In addition the removal of tank silt will accelerate the ground water recharge rates &increase the agricultural production as well as enhance the drinking water availability in the State. The application of silt in agricultural field enhances soil health and moisture levels as well as water retention capacity and increases productivity and production at a reduced cost of cultivation due to reduction in consumption of chemical fertilisers. This continuing exercise of massive desiltation will aid in flood mitigation on one hand and ensure drought proofing on the other.

7.3.6 Kudimaramathu

The State Government revived the ancient system of Kudimaramathu -maintenance of water bodies with community participation. The local community will contribute 10% of the project cost and take up works of desilting of tanks and channels. An allocation of Rs 100 Cores was provided in 2016-17 and is enhanced to Rs.300 Crore during 2017-18. The Kudimaramathu scheme paves the way for the people's participation and creates a sense of ownership in the Community besides serving the purpose of Flood Control, Drought Mitigation and Ground Water recharge and improved *on farm* water management.

7.3.7 Integrated Watershed Management project

This scheme aims to promote balanced use of Natural Resources through Watershed approach. The various soil moisture conservation and water harvesting strategies of the Integrated Watershed Management project serve the purpose of drought proofing rain fed agriculture, provide irrigation during critical periods of crop growth thus preventing crop failure and also facilitate recharge of ground water. Integrated Watershed Management project is being implemented at a cost of Rs.781.731 crores in 26 districts through 24 DWDAs covering 2770 watersheds.

7.3.8 Mission on Sustainable Dry Land Agriculture (MSDA)

The Mission for Sustainable Dryland Agriculture is a major initiative towards drought proofing of the Rainfed areas of Tamil Nadu. The Mission on Sustainable Dryland Agriculture (MSDA), focuses on improving the production and productivity of millets, pulses, oilseeds and cotton in an extent of around 25 Lakh Acres of dryland in a phased manner from 2016-17 to 2019-20 with a funding support of Rs.802.90 Crore. The programme implemented on a cluster approach focuses on capacity building, developing water harvesting structures, adopting new agronomical interventions, mechanisation besides value addition technologies to fetch remunerative returns to the dry land farmers. The synergistic benefits of the integrated measures will enhance the resilience of the poor farmers to withstand drought.

7.3.9 Road Infrastructure

Proper maintenance of all National State Highways and Rural Roads Clearing blockages under culverts bridges including 1000 meters upstream and downstream to enable free flow of flood waters. The Government has also decided to increase the vent ways to cover the full width of the River/Stream and convert the existing pipe culverts to Box Type Culverts and also construct elevated bridges at appropriate locations as part of its prevention and mitigation strategies.

7.4 Drinking Water

The extremely severe hydrological drought which impacted the drinking water supply throughout the State, was managed by the State Government with minimal inconvenience to the public by the adoption of a multipronged structural interventions which included creation of new sources, repair & restoration of the existing sources, replacement of distribution lines and micro management of drinking water distribution up to thehousehold level. During the pre-disaster phase, noticing that deficit during South West Monsoon was 20% and taking into account forecast of normal Northeast Monsoon 2016, advance action was taken to desiltwater bodies, construct checkdams, recharge structures, conversion of defunct borewells into recharge structures rainwater harvesting structures to augment drinking water resources in areas prone to water stress. In addition new sources were also developed such as Infiltration wells, ring wells, deep bore wells during the disaster phase.

7.5 Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

The core objectives of this scheme is to provide not less than one hundred days of unskilled manual work as a guaranteed employment in a financial year to every household in rural areas. This was enhanced to a minimum of 150 days during the unprecedented drought of 2017. The scheme is judiciously used to build assets that lend support to water conservation, rain water harvesting, afforestation and holistic Natural Resources Conservation. On the other hand it aims to provide employment to the rural people and thereby enable them to meet their livelihood needs. Establishing Bioshields through afforestation in identified Government / Common Lands, Village Panchayat lands, avenue plantation are expected to reduce the impact of the Heat Waves and also reduce the Carbon Foot Print of the State.

7.6 Safety of Lifeline Infrastructures

The structural interventions required for safety against Floods, Cyclone and extreme weather events and disasters like earthquake and landslide are arrived after the safety audit by respective organisastions. The lifeline infrastructures include, Dams, reservoirs, Water Bodies, Educational Infrastructures, Hospitals, Vertinary Care Centers, Power and Communication facilities, Heritage & Tourist Infrastructures.

7.7 Dam Safety Project

The GoTN has taken up the Rehabilitation of 89 Dams under the control of Water Resources and Department and 38 Dams under the control of TANGEDCO in a phased manner through an exclusive Dam Rehabilitation and Improvement Project.

7.8 Restoration and Protection of Diverse Ecosystems

Eco Protection and Eco Restoration of Marsh Lands, Wetlands Creeks and estuaries are being undertaken to enable flood protection and ensure livelihood of communities traditionally dependent on them. Massive tree plantation programmes in Rural & Urban areas in addition to the augmentation and conservation efforts in the protected and reserved areas.

7.9 Land Slides

Prevention & Mitigation of the adverse impacts of landslides is achieved by the following structural measures in the identified watersheds

- Prevention of Soil Erosion through engineering and vegetative measures
- Improvement of drainage systems of the entire watershed through River/Stream training, strengthening of embankments, to facilitate free flow of runoff.
- Stabilization of Slopes through Bio Engineering Methods
- Construction of Revetments to protect landslides along Highways and Roads

7.10 Structural Measures for Mitigating Earthquakes

Structural measures implemented to considerably reduce the impact of earthquake are:

- Properly designed, engineered and constructed structures — residential, service or infrastructure — built on well tested soil and adapting to suitable adjustments in design.
- Retrofitting in old structures so that short-comings in construction could be externally strengthened to a considerable extent to withstand the convulsions caused by Earthquake.

7.11 Non Structural Measures

The Structural measures can be effectively translated on field only with appropriate Non-Structural measures such as policies, guidelines and standards, community participation, regulatory mechanism, prescribed from time to time in accordance with the changing patterns of disasters. The non-structural measures being implemented for prevention and mitigation are detailed below:

7.11.1 Economic Measures

Tamil Nadu, which is a multi-hazard risk prone State is highly vulnerable to the cyclonic storms, down pours during Northeast Monsoon on the one hand and the vagaries of the monsoon impacting the fortunes of the farming community on the other. In addition, the deficit rainfall adversely affects the drinking water resources impacting essential supplies to the community particularly those in the drought prone districts of the State. In order to mitigate these risks, Government of Tamil Nadu invokes economic incentives and alternate strategies to enhance the resilience of the highly vulnerable sections of the society.

Fishermen bear the highest brunt of the disaster risks which threaten their lives, housing as well as economic wellbeing. In order to reduce the impact of these risks, the Government of Tamil Nadu have decided to provide multi hazard resistant houses free of cost and provide grants during lean season and prohibited periods of fishing. In addition the Government has been taking several measures to enhance their livelihood opportunities comprising of skill upgradation and value addition to their existing fishing centric income generating activities and imparting skills for diversification of livelihood opportunities.

Agriculture is the other main sector which bears the brunt of the risks due to vagaries of monsoon and its consequent risks of floods and drought. The problem of the farmers is accentuated in the areas irrigated from the rivers that originate outside the State due to issues involved in timely releases of water from the upper riparian States and the seasonal rivers of the State being at the mercy of the monsoonal rains.

In order to mitigate the plight of the farmers Government is providing incentives to the farmers of Cauvery delta during Kuruvai & Samba Seasons to shift from water intensive crops to less water consuming crops and extends 100 percent financial assistance for installation of Micro Irrigation

Systems throughout the State in order to conserve water and utilise the resources judicially to protect the interests of the farmers.

7.11.2 Risk Transfer

Risk transfer plays a significant role in withstanding the economic losses caused due to various disasters. For long, the risk transfer instruments did not address the concerns of the primary sector, which is highly impacted during disasters. The Prime Minister's Fasal Beema Yojana (PMFBY) introduced by Government of India addresses the concerns of the highly vulnerable farming community. Government of Tamil Nadu is implementing this scheme from 2016 and has ensured maximum number of farmers covered under the scheme during the year 2016.

About 15.37 lakh farmers have been enrolled and 31.85 Lakh Acre has been insured under the scheme. The Central and State Government have contributed Rs.428 Crore each toward their share as subvention. Due to the earnest efforts taken by the State Government, the Insurance Companies have released a sum of Rs.2420 Crore to 15.37 farmers till date who were affected due to the severest drought caused by deficit rainfall during 2016.

7.12 Societal Measures

7.12.1 Public awareness and Mass campaigns.

Imparting Disaster Risk Knowledge and bringing attitudinal and behavioural changes to the early warning messages play a significant role in Risk Reduction especially in minimising loss of lives. Considering the importance of the need for enhancing the knowledge levels of different stakeholders, to tackle different disaster situations GoTN have been according very high priority in building the capacities of the community and other stakeholders. In order to spread the awareness at various levels, all possible channels of communication such as print, electronic, social and traditional media are being used by GoTN.

In order to prepare the future generation to face the disasters in a more confident and resilient manner and also make them part of disaster management the curriculum of classes 7th to 10th have been modified and lessons on Disaster Management have been incorporated.

Special campaigns are being organised for different disasters to involve communities particularly children and other vulnerable sections. Schools, Colleges, NCC, NSS, Social defence, SHGs, NGOs, CBOs, traders associations, Builders associations, contractors, masons, local body representatives, religious and social organisations, academic institutions and professionals are being involved to make Tamil Nadu a disaster resilient State. In addition, the farming community is being encouraged to diversifytheir crops to minimize the water requirement and is also being encouraged to adopt Micro Irrigation Practices to conserve water and enhance resilience to face drought.

7.12.2 Community Based Disaster Management

The community is the first responder to any Disaster. The Community has its own traditional wisdom and local knowledge to withstand the impact of disasters. Harnessing leadership and volunteerism among the Community and developing a team of trained community volunteers through participatory approach for special tasks of early warning, Search, Rescue Transport Arrangements& Evacuation, First Aid, Shelter and Relief (Food, Water and Sanitation) are essential for successful Disaster Management. Involvement and participation of the communities will ensure a collective and coordinated action during emergencies. The Capacity Building of

Community is being ensured at grass root level through enrolment of able bodied volunteers. The volunteers from local community are being identified from NSS, NCC and Youth Groups with skills of swimming and climbing, as First Responders (at least 10 per vulnerable area) and First Responder teams are formed in areas of vulnerability (for search, rescue and evacuation).It is also ensured that Women volunteers are included in First Responders Teams and also in other Committees. The first responders are being trained by Fire & Rescue Department / SDRF or Red Cross society / Civil Societies. During the year 2017, the total no. of first responders identified and made part of the Response teams were 23,325 of which 6,740 are women responders.

7.12.3 Social Safety Nets

Various social protection nets are provided by Government of Tamil Nadu under both State Government schemes and externally aided special Projects (with World Bank, ADB and IFAD funding) like Emergency Tsunami Reconstruction Project (ETRP), Tsunami Emergency Assistance Programme (TEAP), Rajiv Gandhi Rehabilitation Programme (RGRP) and Post Tsunami Sustainable Livelihood Project (PTSLP) which have been implemented in response to the tsunami 2004.

7.12.4 Social Security Schemes

The following schemes provide social security protection to the vulnerable groups

- Old Age Pension Scheme
- Widow Pension Scheme (WPS)
- Differently Abled Pension Scheme (DAP)
- Destitute Widows Pension Scheme (DWP)
- Destitute/ Deserted Wives Pension Scheme (DDWP)
- Pension to Un-married, Poor, Incapacitated Women of age 50 years and above (UWP)
- Accident Relief Scheme
- Enhanced Relief to Disaster affected people
- Chief Minister's Uzhavar Pathukappu Thittam
- Mahatma Gandhi National Rural Employment guarantee scheme
- Deendayal Anthodia Yojana -National Urban Livelihood Mission (DAY-NULM)
- Tamil Nadu PudhuVaazhvu Project (Funded jointly by World Bank and GoTN)
- Self Help Groups (Micro Credit & Livelihood)
- Amma Canteens (Food Security for urban Poor)
- Priceless kits to pregnant women and lactating mothers.
- Priceless educational kits, bicycle etc to the school children.

These schemes provide Safety nets to the poor and in-turn their vulnerability during disasters and post disasters phases.

7.13 Management & Institutional Measures

7.13.1 Capacity Building

Capacity Building of the Institutions involved in the Disaster Response and Management and more importantly disaster risk reduction, is an important component of non-structural measures. Tamil Nadu is implementing community based Disaster Risk Management programme under Coastal Disaster Risk Reduction project in 561 habitations to involve the community in disaster management. State Institute of Rural Development is building the capacity of the community in these habitations. In addition, the First Responders

identified in the vulnerable areas are being trained every year to build their capacity. The First Responders Team at Village level is nurtured, trained and institutionalized. AAPDA MITRA a scheme funded by Government of India is being implemented to enhance the capacity of first responders in Greater Chennai Corporation to handle Urban Floods.

7.13.2 Capacity Building of Government Agencies

The Revenue Administration, Disaster Management & Mitigation Department is primarily responsible for disaster management in the State and is ably supported by several departments, the main departments being Police, SDRF, Fire & Rescue Services, Coastal Security, Fisheries, PWD, Highways, Agriculture, Horticulture, Animal Husbandry, Health, Election Board, Municipal Administration and other departments. In order to enhance the skills of the personnel engaged in Disaster Risk Reduction and those involved in different phases of disasters, GoTN have been according priority for Capacity Building Programme which are being organised with the help of NIDM, NDRF & SDRF, Fire services, Anna Institute of Management, Revenue Department and other Government agencies at District / State and National Levels.

The capacity of NGOs is also tapped to train the Personnel from different departments in Search, rescue & Evacuation Operations as well as other issues of Disaster Management, RED Cross Society, Sathya Sai Trust and other bodies. In addition, Government and Private educational institutions are also building the capacities of employees through special programmes. Government of Tamil Nadu is committed to build the capacity of its employees to build a pool of highly committed and competent teams right from the gross root level up to top management to address the concerns of the community in facing disasters, evolve strategies to prevent and mitigate risks and in implementation of prevention, mitigation and build back better projects.

7.13.3 Research and Technology Transfer

Mainstreaming Research and Development to alleviate ill effects of disaster mitigation/ reduction has become a necessity in the context of complexities of climate change.

R&D in management of earthquakes, floods, droughts, climate change, industrial, nuclear disasters and other disasters will ensure risk identification at the early stage in a holistic manner and minimize risks by suitably integrating mitigation measures into the development model.

7.13.4 Physical Planning Measures

It is not uncommon to note that the risks due to disasters being exacerbated due to inadequate understanding of the topography while under taking projects for housing, commercial, industrial and public infrastructure. Construction of public & private facilities in water bodies&water ways, change in land use pattern from agriculture to residential and industrial purposes, building public infrastructure on water ways due to the rapid urbanization to name a few have compounded the intensity of several disasters. Many of these issues will be addressed through regulations and prevent serious risks that exist today. GoTN is undertaking physical planning measures to minimise the risks as noted below:

a. Regulatory Mechanisms and Redesigning

As part of mainstreaming of risk concerns into developmental plans, GoTN consciously decided to re-examine the designs & codes relating Buildings, Irrigation Structures, drinking water

supply systems, Power Infrastructure, Bridges & Culverts in National and State highways & Rural Roads are being redesigned to reduce risks that arise due to flooding. For instance in order to ensure that the gushing water during the flood, seamlessly flows through the culverts & Bridges, the existing piped culverts are being converted into box type RCC structures & low level brides and cause ways are beingconverted into slightly elevated structures providing adequate space for flood waters to flow even during extreme weather events. Redesigning of these structures will prevent inundation of the surroundings areas which is happening currently now due to inadequate no. of vent ways and inadequate capacity of the piped culverts. In the power sector cables are being laid underground and junction boxes are being located on 1 to 2 feet tall support structures.

b. National Building Code Standards

Development Control Rules for CMDA provide for, regulating the constructions with reference to zone, location, height, number of floors, size of buildings, setback spaces to be left around and the use of the building and land. Building rules under the Local Bodies Acts provide for regulation of location of buildings, foundations, plinths, superstructures-walls, floors and rooms, licensing of surveyors and inspection of municipal engineers at various stages of constructions, wind load/ pressure, reinforced cement concrete and framed structures, construction materials, etc. Structural safety and soundness are being regulated under the building rules under the Local Body Acts.

The special provisions contained in the Building Rules under the Chennai City Municipal Corporation Act, Building Rules under the T.N. District Municipalities Act and Building Rules under T.N. Panchayats Act respectively, regulate structural design of buildings to reduce risks due to natural hazards viz. earth quake, cyclone, flood flow or inundation, tsunami, etc. The Public Works Departments adopts the NBC standards for guiding the construction of buildings.

c. Guidelines for Planning, design and construction of Multi Hazard Resistant buildings

Disaster prevention involves engineering intervention in buildings and structures to make them strong enough to withstand natural hazard so that the exposure of the society to hazard situation could be avoided or minimized. Public Works department buildings organization is committed to Plan, design, construct and maintain the Public Buildings and monitor the stability of the public buildings.

Every building shall be so Planned, Designed, Constructed, equipped, maintained and operated so as to provide not only adequate comfort to the occupants but also to take meticulous care to avoid undue danger to the life and safety of the occupants from Fire, Earthquake, Tsunami, Cyclone, Flood and other hazards. The Public Works Department has brought comprehensive guidelines including, but not limited to, the above features.

The public buildings are constructed based on the Codes published by the Bureau of Indian standards including the National Building code 2016.

d. Building stability

A Hazard Safety Cell (HSC) under the direct supervision and control of the Engineer-in-Chief of the State PWD as an advisory body was established for proper enforcement of the buildings code in all future constructions, thereby ensuring the safety of buildings and structures from all hazards such as earthquakes/ cyclones etc.,

e. Structural stability of the public building

The Structural stability of the public buildings is ensured through the Tamil Nadu Public Building Licensing Act 1965 and Rules 1966. The Public Buildings have to renew their licenses periodically. These licenses are issued / renewed after inspection of the buildings and satisfying structural stability certified by the PWD.

f. Road Safety Audit

Safety status in the roads upgraded under Tamil Nadu Road Sector Project has been reviewed to identify safety related problems, deficiencies and shortcomings for suggesting remedial measures. The suggestions from the Road Safety Audit, for 724 Km of roads recently in 2015 are implemented. Efforts are being taken to extend the road safety audit to select stretches every year.

g. Fire Safety Audit

A Multi Departmental Committee under the head of the District Officer of Fire Services Department conducts inspection in all cinema theatres in the Districts once in a year and forwards its report to the licensing authorities for taking appropriate action.

The Revenue Department also conducts fire-safety audits in Government buildings to ensure fire-safety. Apart from this, other buildings are also inspected under various Acts and Rules from fire-safety point of view.

h. Industrial safety Audit

The Major Accident Hazard (MAH) control activities in Tamil Nadu are monitored by Chief Inspector of Factories, Chennai.

- Risk Assessment and mapping of hazardous industries is done by the Department of Industrial Safety.
- Risk mitigation is done in MAH Units with preparation ofthe "On-Site Emergency Plan" and these plans get approval from the Chief Inspector of Factories.
- Factories Inspectors conduct one day Training Program on Industrial safety every month for Plant Operators and Supervisors in factories, as part of their field level activities.
- Factories Inspectorate in Tamil Nadu is having a **State Level Safety Audit Cell**. Chief Inspector of Factories is the Chairman of the Cell. Experts in the field of Safety, Health and Environment are members in the Safety Audit Cell.
- 53 MAH Units have been identified for conducting statutory Safety Audit in their facilities by External Auditor every year and to submit the Audit Reports to Chief Inspector of Factories under "Manufacture, Storage and Import of Hazardous Chemicals Rules,1989" (MSIHC Rules).

i. School Safety Policy

The National Disaster Management Authority has formulated the National Disaster Management Guidelines on School Safety Policy in February 2016. The Hon'ble Supreme Court has directed the School Safety Guidelines issued by NDMA have to be implemented in letter and spirit.

The School Education department as well as the DDMAs have been advised to follow the guidelines given in the School Safety Policy. Some of the major roles and responsibilities of DDMA as per the School Safety Policy are

- Collaborate with and involve education authorities in DM Planning, policies, processes and in developing minimum standards for school safety before, during and after emergencies. This will be done by co-opting the

District Education Officer and / other officials / NGOs / Private agencies as part of the DDMA.

- DDMAs will make sure that school safety is given due attention in the DDMPs, DDMAs will collaborate with and provide training inputs to Department of Education for training of School Safety Focal Point teachers and School Management Committee members to lead school safety efforts in their respective schools.
- Ensure that all school buildings whether government or private, comply with the building codes and directives of the Hon'ble Supreme Court of India in relation to safety of children.
- Facilitate specialised training in schools for teachers and peer educators.
- Include issues of school safety – in the District Disaster Management Plans.
- Conduct periodic mock drills at the district level activity involving schools.

j. Multi Hazard Resistant Designs in Housing

The State is striving to mitigate loss of life and property by adopting Multi Hazard resistant designs and specifications in the type design of Tsunami Houses and other social housing schemes for economically weaker sections. Manual for Disaster Resistant Construction Practices and Cyclone Resistant Building Architecture prepared under UNDP Disaster Risk Management Programme has been made available to the Departments.

08 BUILD BACK BETTER

8.1 Tamil Nadu is prone to frequent and severe cyclonic storms

Interspersed with periodic droughts subjecting the vulnerable section of the community to extreme hardship. The Tsunami that struck in December 2004, Thane Cyclone -2011, Neelam-2012, unprecedented floods of 2015 followed by very severe cyclone storm Vardah-2016 and severest drought in 2017 (due to the extremely severe deficit rainfall in all the seasons of 2016) had left the urban infrastructure, drainage system, power & road infrastructure trade and commerce in tatters on the one hand and impacted the livelihoods in the primary sector including those small and marginal farmers on the other.

Tamil Nadu is one of the few States that addresses the long-term concerns of the Community by not only building resilient infrastructures but also by improving access to services, imparting new skills, strengthening livelihood security and expanding services with well-coordinated actions as part of the Build Back Better strategies. The process of "Building Back Better" starts with the commitment to deliver the best with the available resources and also by accessing international funding & implementing the Projects within specified time limits. The Build Back Better strategies adopted by Tamil Nadu instil confidence in the communities which were psychologically traumatized and economically devaStated due to unprecedented disasters. The activities and measures initiated under build back better strategies focus on prevention and mitigation of disaster risks.

As a part of build back better strategies and experience gained during the past disasters, Government of Tamil Nadu undertook need assessment in a post-disaster scenario, taking into account not only the damages that have been caused to the infrastructure, losses incurred by the community but also design interventions needed through a detailed assessment carried out by different agencies encompassing Housing, Industry, Public Infrastructure, Health, Agriculture and – other sectors.

Based on the needs assessment, projects are undertaken with a special focus on risk-proofing the housing infrastructure of the vulnerable sections and enhancing livelihood opportunities and resilience of the community. In addition, the infrastructure of different sectors is built back better. The core philosophy principle of Building Back Better is deeply ingrained in all the project designs and interventions.

8.2 The completed Major Projects

In the recent past and on-going for the purpose of rehabilitation and reconstruction of Housing, Public Infrastructures, Livelihood systems to enhance the resilience of the community and also for Disaster Risk Reduction are detailed below:-

8.2.1 Tsunami Rehabilitation

The Government of Tamil Nadu implemented a number of projects one after the other to rehabilitate the Tsunami affected areas. The Emergency Tsunami Rehabilitation Project (ETRP), Tsunami Emergency Assistance Programme (TEAP),Vulnerable Reduction to Coastal Communities (VRCC) Rajiv Gandhi Rehabilitation Package Aided by Government of India and currently the Coastal Disaster Risk Reduction Project (CDRRP) have addressed various aspects such as Housing, Livelihood, of the Tsunami affected areas and the community Shelters, Fisheries infrastructures, Reclamation of agricultural lands, Reconstruction of Public Infrastructures, Community Based Disaster Risk Management etc.

Multi-Hazard Resistant Houses

All the houses were designed as Multi-Hazard Resistant, with cyclone and earthquake proof features. The plinth area of each house was 325 sq ft with a hall, bedroom, kitchen and toilet and met the expectations of the community. All the houses were provided with rainwater-harvesting structures. Fly ash bricks were used in construction, which is stronger and eco-friendlier than the common red bricks. In bigger settlements, Common Effluent Treatment Plants were established. Pattas for the houses were given in the joint name of husband and wife.

All the houses were provided with a staircase which served many purposes, like a safety provision to run to a higher level in case of another calamity, an open space to dry their fish, etc. It will also be very useful to them when they construct the first floor in future. The habitations were developed with adequate space to enable easy evacuation at times of emergencies, with amenities of permanent nature and with suitable rainwater harvesting. As a precautionary step against future natural calamities, bio-shields in major re-settlements and near all the existing habitations were taken up.

The reconstructed houses post Tsunami have withstood the fury of Thane cyclone (which was historical) and the floods of December 2015. The houses were safe and the provision of the staircase had created additional space to move to the higher level in case of inundation due to flood. This bears testimony to the Build Back Better policy which the Govt of Tamil Nadu have been following consistently.

Livelihood support for the fishermen:

Fishing is the most obvious activity along the coast and is the major livelihood of the Tsunami affected coastal communities. About 90% of the population in these coastal villages are engaged in fishing and fisheries related activities and the remaining 10 percent are engaged in

agriculture, livestock and microenterprise. The destruction and damages of livelihood assets, equipment and infrastructure due to tsunami has impacted the livelihood of the fishermen in particular and the coastal community in general. Multipronged strategies were adopted to restore the livelihood opportunities, which inter alia includes asset replacement, skill up-gradation, new skill development, alternate employment opportunities to diversify into non-fisheries activities to tide over off season and low catches. The assistance also included support for procurement of equipment to enhance shelf life. The livelihood programme provided options to broaden their livelihood base to non-fisheries alternatives with specialized technical assistance, provision of low cost equipment and long-term support to impart value addition and market access with existing fisheries and non-fisheries livelihoods. Stronger linkages have been developed with other, more comprehensive rural livelihood schemes such as National Rural Livelihood Mission, National Fishery Development Board (NFDB) and Vazhnthu Kaatuvom, to bring the benefits of these programs to coastal fishing communities.

Strengthening Fisheries Infrastructure

The fisheries sector and the communities dependent on fishing are the most vulnerable to natural disasters, climate change and the degradation of the marine environment. The Fisheries sector provides livelihood, not only to a large community of fisher-folk engaged directly in fishing activity, but also to a much large population engaged in selling, transporting, processing and other fisheries related activities. The above projects had a special focus on strengthening the fisheries infrastructure. Reconstruction and Modernisation of Fishing Harbours, New Ports and Jetties, Fish Landing Centres, Stabilisation/opening of Bar-mouth, paved the way for vibrant fishery activities. Modern facilities were also provided for easy handling and drying of fish. Auction hall, Net mending shed, Administrative Building and Radio Communication Building have also been provided.

Reclamation of Agricultural Lands

The farmers also suffered a massive set back due to the devastation of the tsunami. Submergence of land by sea water led to the top soil being eroded and an alarming increase in salinity making the lands unfit for cultivation. The treatment package sanctioned by the Government included application of soil ameliorants like gypsum for reclamation of salt affected soils, raising salt tolerant crops with appropriate land management and agronomic practices. As a result, the lands affected by Tsunami waves were reclaimed. In order to lend support during the period of reclamation farmers were provided with subsistence allowance and post reclamation insurance coverage to cover future risks.

Reconstruction of Public Infrastructure

The wrath of the tsunami was severely inflicted upon the public infrastructure. Besides causing severe damage to Roads & Bridges irreparable damage was caused to Government buildings, Water and Sanitation facilities as well. The Government, with the assistance of Asian Development Bank and World Bank, reconstructed the damaged public infrastructure. The major infrastructure that was Built Back Better includes the Multi-Purpose Evacuation Shelters. While rebuilding damaged infrastructure, new critical infrastructure that had been missing earlier were also thoughtfully built. This included community halls, Public Distribution systems (PDS), activity centres for fishermen, upgrading water supply, roads and sanitation systems, Cyclone Resilient Electrical Network and restoration and rehabilitation of damaged school buildings.

Multi-Purpose Evacuation Shelters:

At the time of reconstruction phase of ETRP, it was found that the existing number of cyclone shelters in Tamil Nadu along the coast were found insufficient to accommodate the vulnerable populations in coastal areas. Based on need assessment, catchment area population & community

needs, 121 Multipurpose Evacuation shelters have been constructed after obtaining statutory CRZ clearances. They have Community Halls of 1000, 2000 and 3000 people capacity, School buildings of 500 & 1000 capacity and Public Health Centre (PHC) of 500 people capacity. They have facilities like kitchens, adequate drinking water storage facilities and gender segregated toilets, so as to ensure a safe and hygienic shelter. To accommodate livestock, separate facilities have been provided. These shelters are multipurpose utility buildings and can be used for activities like class rooms, community function hall, meeting rooms for SHGs, community meetings, vocational trainings and other such community activities on a regular basis, making this infrastructure a vital part of the development of the communities. The management of the Multipurpose Evacuation Shelter is entrusted to the village level shelter management committees, which was not the case earlier. Through this mechanism the community is empowered in shelter management.

8.2.2 Flood Control & Drought Mitigation

a. Augmenting Storage Capacities of Water Bodies

In response to the extremely severe drought, the Government of Tamil Nadu inter alia has brought in a major policy change in the management of mineral resources linked to the water bodies in the State. Accordingly the rule 12 (2) and 12 12 (2-A) (a) of the Tamil Nadu Minor Minerals Concession Rules, 1959 have been amended. The new policy enunciated in **GO Ms. No. 50 Industries (MMC1) Department dated 27-4-2017** has enabled the farmers remove the tank silt, free of cost for application on their fields. Within a period of six months 5.4 Crore cubic metre of tank silt has been removed from 33000 tanks benefitting nearly 5lakh farmers who have applied the tank silt on their fields. The massive desiltation exercise throughout the State, (except in the districts of Chennai, Thiruvallur and Kancheepuram) has enhanced the water holding capacity of these water bodies by about 1.8 TMC. In addition the removal of tank silt will accelerate the ground water recharge rates &increase the agricultural production as well as enhance the drinking water availability in the State. The application of silt in agricultural field enhances soil health and moisture levels as well as water retention capacity and increases productivity and production at a reduced cost of cultivation due to reduction in consumption of chemical fertilisers. This continuing exercise of massive desiltation will aid in flood mitigation on one hand and ensure drought proofing on the other. **The desilting programme will be continued and extended to cover all the remaining water bodies.**

b. Kudimaramathu:-

The Kudimaramathu scheme in which PWD tanks are strengthened & desilted paves the way for the people's participation and creates a sense of ownership in the community besides serving the purpose of Flood Control, Drought Mitigation and Ground Water recharge and improved on-farm water management. An allocation of Rs 100 Cores was provided for the scheme in 2016-17 and is enhanced to Rs.300 Crore during 2017-18.

8.2.3 Integrated Watershed Management project

This scheme aims to promote balanced use of Natural Resources through Watershed approach. The various soil moisture conservation and water harvesting strategies of the Integrated Watershed Management project serve the purpose of drought proofing rain-fed agriculture, provide irrigation during critical periods of crop growth thus preventing crop failure and also facilitate recharge of groundwater. Integrated Watershed Management project is being implemented at a cost of Rs.781.731 crores in 26 districts through 24 DWDAs covering 2770 watersheds. The IWDP will be dovetailed with the MGNREGS in the years to come and is expected to improve the soil moisture regime, runoff management, water harvesting and land use.

8.2.4 Mission on Sustainable Dry Land Farming

The Mission on Sustainable Dry Land

Agriculture (MSDA), focuses on improving the production and productivity of millets, pulses, oilseeds and cotton in an extent of around 25 Lakh Acre of dryland in a phased manner from 2016-17 to 2019-20, for which an amount of Rs.802.90 Crore has been sanctioned. The programme is being implemented on a cluster approach with participation of farmers and the major activities include construction of water harvesting structures, adoption of new agronomical interventions, value addition to fetch remunerative returns to the dry land farmers. It is proposed to establish 1000 dry land clusters of 1000 Ha. each, during the project period of four years with Primary Agricultural Credit Cooperative Societies as the focal unit for each cluster. Cluster-wise Crop area has been identified and the Cluster Development Team and Block Level Team have been formed to take up the following activities:-

- Financial assistance will be extended to the entry point activities like creation of water harvesting structures viz., Farm ponds, Percolation ponds, community ponds and check dams.
- Financial assistance for Land development activities viz., summer ploughing.
- Agronomical assistance at 50% subsidy will be extended for distribution of short duration, drought-resistant seeds of Pulses, Millets, Oilseeds and Cotton.

Each nodal Primary Agricultural Cooperative Credit Societies will extend credit for setting up Micro Enterprises such as Mini Dhal Mill, Oil expellers and Millet processing units. Financial assistance will also be extended to Farmer Producers Organisation or Farmers Club for establishing Mini Dhal Mills, Oil Expellers, Millet Processing Units, sales outlets, packaging and branding of products, so as to enhance the livelihood opportunities of the small and marginal farmers.

Unemployed rural youth will be encouraged by providing assistance with 80% subsidy per cluster for creating custom hiring centres.

8.2.5 Climate Change Adaptation Programme with ADB assistance in Vennar Sub Basin

The Vennar Sub Basin of Cauvery delta suffers from high levels of water stress, recurrent flooding and increasing risks of climate change. The Climate Change Adaptation Programme with ADB assistance in Vennar Sub Basin addresses to reduce complex climate impact with the rehabilitation of irrigation and drainage system for safe disposal of floodwaters and prevents seawater ingress by replacement of dilapidated tail-end regulators. The Climate Change Adaptation Programme in Cauvery Delta is under implementation at a cost of Rs.1,560 crore, out of which the assistance of Rs. 1,092 crore is from Asian Development Bank (ADB) and the State Share of Rs.468 crore.

8.2.6 Mahatma Gandhi National Rural Employment Guarantee Scheme (MGNREGS)

The core objective of this scheme is to provide not less than one hundred days of unskilled manual work as a guaranteed employment in a financial year to every household in rural areas. This was enhanced to a minimum of 150 days during the unprecedented drought of 2017. The scheme is judiciously used to build assets that lend support to water conservation, rain water harvesting afforestation and holistic Natural Resources Conservation. On the other hand it provides employment to the rural people and meets their livelihood. Establishing Bioshields through afforestation in identified Government/ Common Lands, Village Panchayat lands, avenue plantation on either side of the roads is expected to reduce the impact of the Heat Waves and also reduce the Carbon Foot Print of the State.

8.2.7 Disaster resilient power transmission infrastructure

Conversion of overhead lines into underground cables under Coastal Disaster Risk Reduction Project (CDRRP).

The coastal belt of Tamil Nadu experiences extensive damage during natural calamities such

as the tsunami and cyclones like Thane and Nilam. Cuddalore and Nagapattinam districts suffer major damages during such cyclonic storms. The electrical infrastructure gets badly affected resulting in a breakdown of electricity, causes injury and even death and hampers search and rescue as well as relief operations. Re-establishing of infrastructure is not only time consuming, but also expensive. In an effort to build back better the TANGEDCO has taken up Conversion of the HT and LT overhead power lines into underground cables in cyclone-prone coastal towns of Cuddalore, Nagapattinam and Velankanni with funding assistance to the tune of Rs. 360 Crores (66.30 Million US$) from the World Bank. The component also includes related works such as restoration/ shifting of services and provision of service connections.

Schemes under execution in greater Chennai

The Greater Chennai Corporation areas are subjected to urban flooding and inundation during Northeast Monsoon periods and during cyclonic storms. The existing electricity distribution system and transformers in low lying areas get inundated and result in disruption of power supply, snapping of electrical cables and electrocution etc. In order to prevent such recurring problems, the following three interventions have been taken up by TANGEDCO.

1.Cyclone resilient Greater Chennai

TANGEDCO will convert the overhead lines into underground cables in areas of Greater Chennai Corporation at a cost of Rs.2,549 crores funded by Power Finance Corporation. Under this scheme, it is proposed to convert 33,307.81 km of LT overhead lines and 2004.89 km of HT overhead lines to underground cables. On completion of the scheme in 2020-21, the power infrastructure in Greater Chennai Corporation areas covered under the project will be much less susceptible to disasters.

2.ConversionofexistingDistributionTransformers structures to Ring Main Units (RMUs) in Chennai suburban areas

To ensure the safety & prevent accidents and to reduce the downtime of supply interruptions and to improve livability standard, TANGEDCO will replace the existing 17,535 distribution transformers structures into RMU in Chennai suburban areas at an estimated cost of Rs.1,750 crores, funded by Rural Electrification Corporation (REC). The tender has been opened and is under scrutiny. Works are expected to be completed by 2019-20.

3. Replacement of Pillar Box to HRC(High Rupturing Capacity) 6-way Pillar Box in Chennai Region

In order to minimise power interruptions due to natural calamities, it is proposed to replace the existing 38,844 pillar boxes by High Rupturing Capacity (HRC) 6-way pillar boxes in Chennai region at an estimated cost of Rs.270 crores funded by Rural Electrification Corporation (REC). The Worksare expected to be completed by 2019-20.

These measures will not only prevent the economic losses to the critical power infrastructure but also will eliminate the process of restoring the disrupted power supply by deploying thousands of men working in extremely difficult ground conditions.

09 MAINSTREAMING DISASTER RISK REDUCTION INTO DEVELOPMENTAL PLANNING

Risk reduction is a major challenge that requires multisectoral interventions and significant funding. However, the multitude of schemes currently implemented in different sectors have not imbibed disaster risk concerns which arise due to natural causes and anthropogenic intervention at global and local scale. Risks due to disasters are exacerbated due to lack of holistic approach in developmental planning and project implementation. It is essential to mainstream risk concerns into developmental plans so as to have a multi-pronged strategy to address the risks that are caused both due to natural and manmade causes.

9.1 The Legal Context

The Disaster Management (DM) Act 2005 mandated the DDMA to "lay down guidelines to be followed by the departments of the State Governments for the purposes of integration of measures for prevention of disasters and mitigation in their development plans and projects and provide necessary technical assistance. The State Government needs to "review the development plans and projects of the different departments of the State and ensure that prevention and mitigation measures are integrated therein", as per Section 38 (2) (e) of the Act. The State Government is further to ensure integration of measures to reduce or mitigate the vulnerability of different parts of the State to different disasters in the State development plan {38 (2) (f}.

9.2 Purpose of Mainstreaming

Mainstreaming Disaster Management into the development planning process has the following purposes

1. To make certain that all the development programmes and projects that originate from or funded by the Government will have a consideration for reducing the risks.
2. To make certain that all the development programmes and projects that originate from or are funded by the Government do not inadvertently increase vulnerability to disaster in all sectors: social, physical, economic and environment.
3. To make certain that all the disaster relief and rehabilitation programmes and projects that originate or are funded by the Government are designed to contribute to development aims and to reduce future disaster risk.
4. To make certain that area specific plan (prone to disasters) are prepared so as to enable the convergence of all future development programmes and projects to reduce the risks.

9.3 Do No Harm Approach

The objectives of Disaster Prevention will be realized through "Do No Harm Approach". The development plans incorporates elements of impact assessment, risk reduction and adoption of the 'Do No Harm' approach. Measures such as urban planning and zoning, updating of building codes their enforcement, adoption of disaster resilient housing designs flood proofing, the establishment of early warning systems, generating community awareness, creating technical competence and promoting disaster resistant technologies are some of the priority areas considered under the State Disaster Management Plan.

9.4 Mainstreaming Risk concerns-a way of disaster management

'Mainstreaming Disaster Risk Reduction' means completely institutionalizing Disaster Risk Reduction within the development and recovery agenda. 'Mainstreaming DRR', is a logical corollary to the systems approach and it means completely institutionalizing DRR within the developmental planning and projects. Accordingly, the following processes will ensure institutionalization of disaster risk reduction

On-going schemes and projects of the Ministries and Departments of GoI and GoTN, as well as of all Government agencies and Institutions, including Public Sector Undertakings, will be selectively audited by designated Government agencies for ensuring that they have addressed the disaster risk

and vulnerability profiles of the local areas where such schemes and activities are being undertaken.

At conceptualization or funding stage itself, the developmental schemes will be designed with consideration of any potentially hazardous impact associated with it and will incorporate measures for mitigation of the same.

All the developmental schemes will be pragmatic, incorporating the awareness of local disaster risks and vulnerabilities and ensuring that the schemes have addressed these concerns and included specific provisions for mitigating such concerns.

9.5 Guiding Principles for Mainstreaming

a) Risk Resistant Communities

The mainstreaming efforts will centre around anticipation of disaster and planning and executing disaster risk reduction strategies in order to promote community resilience through enhancement of their livelihood opportunities, health, protecting their culture & heritage and socio economic assets. As part of the community involvement and promoting leadership among youth, approximately 23,325 able-bodied youngsters have been enrolled as first responders including 6,740 number of women. These First Responders are trained in search, rescue and evacuation operations involving governmental & non-governmental agencies. The systems approach will accord highest priority to community involvement, capacity building in risk management and protecting the integrity of ecosystems to enhance their resilience. The ability of the communities to resist risks will be developed by mainstreaming risk resistant skills in the capacity building programmes and incorporating in the curriculum of schools and colleges.

b) Integrated Development of Vulnerable Areas

Besides focusing on treatment of the entire river basin for risk reduction, the main focus of mainstreaming disaster risk concerns into developmental plans will be on the integrated development of vulnerable areas so as to reduce the existing disaster risks and prevent the emerging and new challenges. The development of the vulnerable areas will be achieved through main streaming disaster risk concerns into the individual schemes and convergence of both structural & non-structural measures. In addition, all risk reduction strategies will accord primacy to social and financial inclusive growth. The approach besides preventing & reducing hazard exposure to vulnerability & disaster will also ensure the resistance of the State to risks through robust preparedness, preventive and mitigation strategies.

c) Restoration & sustainable management of ecosystems

The mainstreaming of risk concerns into development plans will be planned on a river ecosystem basis, so as to secure advantage of various ecosystem services rendered by the River Ecosystems and other ecosystems that interface between the rivers and the Coastal ecosystems. Special focus will be laid on restoration and protection of fragile and vulnerable interface ecosystems such as creeks, marsh lands and wet lands. In order to achieve the above objective, Government has constituted a Wetland Authority at the State and district level and has initiated special purpose vehicles to river restoration projects like the CRRT and studies have been initiated for comprehensive Development of Adyar, Kosathalayar and Kovalm so as to minimize the risks of urban floods in Chennai and its peri urban areas falling in Kancheepuram and Thiruvallur District.

9.6 Mainstreaming of Disaster Prevention & Mitigation Strategies into Developmental Planning for Risk Reduction

Mainstreaming

Disaster Risks		State Development Plans/Strategies		Risk Reduction
Flood Cyclone	→	Policies Regulation	→	Reduction in Number of Vulnerable Ares Reduction in Degree of Vulnerability
Drought		Budget		Reduced loss of lives
Tsunami Landslide	→	Sector Plans Programmes	→	Reduced loss of property Enhanced Livelihood opportunities
Earthquake CBRN	→	Projects	→	Risk Resistant Communities Risk Resistant State

9.7 Major Areas identified for mainstreaming risk concerns into developmental plans

During the period 2017-2030 GoTN will focus on major thrust areas for mainstreaming risk concerns into development plans taking into account risk reduction as an essential investment to promote sustainable and inclusive development. The major thrust areas identified are

1. Natural Resources Conservation
2. Comprehensive River Basin development
3. Restoration & Sustainable Management of Ecosystems
4. Sustainable Agricultural Development
5. Social Inclusion

The State Government has been implementing a multitude of projects and programmes in the above thrust areas which hitherto were being implemented with sectoral priorities and with less priority on Disaster Risk Concerns in the planning and implementation stages. In order to leverage the risk reduction potential of these programme the risk concerns will be mainstreamed into the project components and they will be implemented with a focus to reduce the disaster risks of the vulnerable areas identified in the districts. These schemes will also be integrated with the special projects which are targeted to reduce the risks in the vulnerable areas. The convergence and mainstreaming risk concerns into these major thrust areas will enhance the resilience of the community and the State in facing different disasters. The mainstreaming and convergence also incorporate the principle of Build Back Better to risk proof the community from major disasters to a great extent.

The major focus of the mainstreaming of risk concern strategies will be on Natural Resources Conservation, Sustainable Management of the Ecosystems and Restoration and Protection of fragile ecosystems. The strategies also encompass structural interventions based on aerial photogrammetric studies to promote comprehensive flood protection in each river basin. In order to enhance the resilience of the farming community to face the vagaries of monsoon and impacts of climate change, sustainable agricultural practices will be followed on a mission mode with special focus on rain fed agriculture. Mainstreaming of risk reduction strategies will be incorporated in relevant schemes to promote recharging of the ground water, aquifer through Integrated Watershed Management approaches, Comprehensive Rain Water Harvesting at the household, community and institutional levels. Addressing the problems of sea water incursion in the vulnerable coastal areas will be one of the major focus through establishment of tail end regulators, construction of Bed Dams and injection of fresh water in the tail end areas of the drainage systems which drain into the estuaries under the MGNREGS, State schemes as well as special risk reduction schemes including funding by the Private Sector.

The preventive mitigation strategies will be mainstreamed by establishing special cells to carry out in depth analysis of floods, drought, landslides and other natural disasters. It is also contemplated to establish a GIS cell in the Office of the State Relief Commissioner so as to develop site specific strategies for mitigation and to reduce the risks. Big data analytics viz. to analyse the legacy data in order to to arrive at the descriptive, predictive and prescriptive analytics will be relied upon for strengthening prevention & Mitigation strategies.

The main streaming will accord priority for carrying out works in vulnerable areas under five Major Themes viz

1. Sustainable Agricultural Development,
2. Natural Resources Conservation
3. Comprehensive Flood Protection
4. Sustainable Management of Ecologically fragile area
5. Inclusive Development

Natural Resources Conservation Schemes • **G.O.Ms No 50 (Industries)** • **Kudimaramathu** • MGNREGS-ImprovingInflowChannels, Tree Planting, Watershed Development • Watershed Development • Special Area Development Programmes • Integrated Tribal Development • Micro Irrigation • Rain Water Harvesting • Artificial Recharging of Ground Water • New Irrigation Projects • Prevention of Sea Water Incursion	To address Drought, Floods, Landslides, Heat waves and Climate Impact

Comprehensive Management of River Basins - Schemes • IAMWARM / TNIAMP • Kudimaramathu Works • Desilting of Tanks under G.O 50. • Clearing &Widening Drainage Carriers to Original Standards • Check Dams across River Courses with necessary scour vents for recharging the Downstream stretches • Construction of Regulators and barrages • Riverine Reservoirs • Instream Reservoirs • Interlinking of Rivers • Tail End Regulators	Flood protection and augumentation of aquifers during Incessant Rains &Cyclones through Structural interventions like a) improving Storage Capacity of Water Bodies b) Moderate flood flows by constructing link canals and diversion canals . c)River Training works d) Construction of new reservoirs / Dams / Anaicuts etc. e) Desiltation under G.O.Ms.No.50 etc.
Sustainable Agricultural Development Schemes Mission for Sustainable Dry Land Agriculture, Rain fed Area Development for Horticulture Clusters	To Combat Drought and Climate mitigation
Sustainable Management of Ecologically fragile areas Schemes • Rain Water Harvesting • Artificial recharging through check dams and recharge shafts • Prevention of sea water intrusion • Rejuvenation of failed Wells • Eco restoration of marsh lands, estuaries and creeks. • Conservation & Restoration of Creeks Marsh lands and Wetlands • River grading works	Flood and drought Mitigation and Livelihood Support

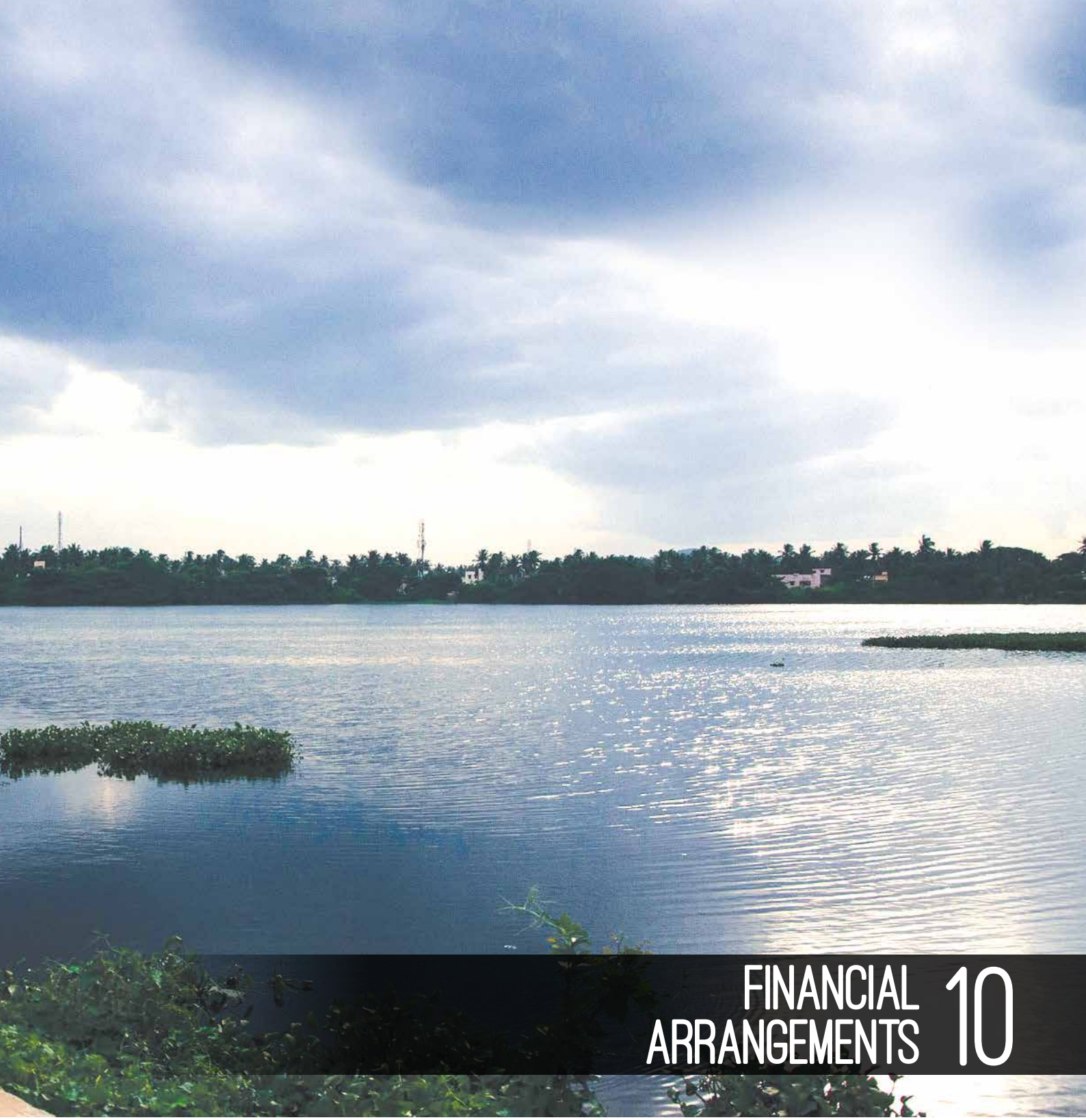
Inclusive development **Schemes** Social Security Schemes Capacity building of the vulnerable sections Livelihood schemes	Community resillence
• Social Security Schemes implemented by Revenue Department • MGNREGS implemented by Rural Development Department • Tamil Nadu Rural Transformation Project (TNRTP) • National Rural Livelihood Mission (NRLM) • Tamil Nadu State Rural Livelihood Mission (TNSRLM) • Tamil Nadu Urban Livelihood Mission (TNULM) • Tamil Nadu Skill Development Mission – Programmes • Self Help Groups • Fisheries Management for Sustainable Livelihoods (CDRRP) • Economic Development of Adi Dravidar and Tribal Welfare • Social Security Schemes for differently abled persons • Schemes implemented by various Welfare Boards.	To enhance Community Resilience

9.8 Institutional Mechanism

The mainstreaming concerns of disaster into development plans will be taken up by the District Disaster Management Agency at the district level and by the Commissioner for Revenue Administration & the State Relief Commissioner at the State level to ensure participation of relevant stakeholders and engagement of all State institutions. The overall direction of mainstreaming of risk concerns into development will be provided by the Tamil Nadu State Disaster Management Authority under the chairmanship of Hon'ble Chief Minister.

9.9 State Disaster Risk Mitigation Fund

A firm commitment has been made by Government of Tamil Nadu by making an announcement on the floor of the State Assembly by Hon'ble Minister for Revenue and Disaster Management during the 2017 - 2018 budget session for creation of State Disaster Mitigation Fund.



10 FINANCIAL ARRANGEMENTS

10.1 Approach

With the change of paradigm shift in DM from the relief-centric to proactive approach of prevention, preparedness, mitigation, response, relief, rehabilitation and reconstruction, the effort would be made to mainstream and integrate disaster risk reduction and emergency response in the development process, plans and programmes of the Government at all levels. This would be done by involving all the stakeholders including Government Organizations, research and academic institutions, private sector, industries, Civil Society Organization and community. SDMA and DDMA will ensure mainstreaming of disaster risk reduction in the development agenda of all existing and new developmental programmes and projects which shall incorporate disaster resilient specifications

in design and construction. Due weightage will be given to these factors while allocating resources.

As per the section (49) of the Disaster Management Act, 2005, every department of the State government shall make provisions in their annual budget for carrying out the activities and programmes set out in their disaster management plans. The planning department will be advised to make necessary budget allocation for meeting the disaster management requirement.

10.2 Fourteenth Finance Commission

The Fourteenth Finance Commission (FFC) has acknowledged the present arrangements as regards financing of Disaster Management with reference to the National Calamity Contingency Fund and the Calamity Relief Fund and the funds envisaged in the Disaster Management Act, 2005 (Act 53 of 2005) and has recommended that up to 10 percent of the funds available under the SDRF can be used by a State for occurrences which State considers to be 'Disasters' within its local context and which are not in the notified list of disasters of the Ministry of Home Affairs. The FFC has also recommend to expedite the development and scientific validation of the Hazard, Vulnerability and Risk Profiles of States.

As per Commission's recommendation, the contribution to the SDR Fund should be shared between the Centre and States in the ratio of 75:25 for general category States .

10.3 Responsibilities of the State Departments and Agencies

It is mandatory and incumbent on departments to identify specific budget heads to cover activities identified as disaster management specific to the departments.

All State Government Departments, Boards, Corporations, PRIs and ULBS will prepare their DM plans, including the financial projections to support these plans. The necessary financial allocations will be made as part of their annual budgetary allocations and ongoing programmes. They will also identify mitigation projects and project them for funding in consultation with the SDMA/DDMA to the appropriate funding agency. The guidelines issued by the NDMA vis-a-vis various disasters may be consulted while preparing mitigation projects.

10.4 State Government Funding

As Stated in the section (48) of the DM Act 2005, the State Government shall establish for the purposes of the Act the following funds:

1. **State Disaster Response Fund:** This fund will be constituted and made available to theSEC for meeting the expenses for emergency response, relief and rehabilitation.
2. **District Disaster Response fund:** This fund will be constituted and made available to theDistrict Disaster Management Authority for meeting the expenses for emergency response, relief and rehabilitation.
3. **State Disaster Mitigation Fund:** This fund will be constituted and made available to theSEC for meeting the expenses on mitigation activities.
4. **District Disaster Mitigation Fund:** This fund will be constituted and made available tothe District Disaster Management Authority for meeting the expenses on mitigation activities.

State Disaster Response Fund

The SDRF fund in constituted jointly by GOI and State Government in the ratio of 75:25. The following allocation is made for the period 2015-16 to 2019-2020 .

STATE DISASTER RESPONSE FUND						
Rs. In Crores						
FINANCIAL YEAR	CENTRAL CONTRIBUTION	State CONTRIBUTION	TOTAL	TOTAL EXPENDITURE	NDRF RELEASE	BALANCE MET FROM State FUNDS
2015-16	509.25	169.75	679.00	2984.65	1000.00	1305.65
2016-17	534.75	178.25	713.00	2494.77	1813.66	681.11
2017-18	561.00	187.00	748.00	* 512.59	218.76	
2018-19	589.50	196.50	786.00			
2019-20	618.75	206.25	825.00			

* PROVISIONAL FIGURE AS ON DATE

NATIONAL DISASTER RESPONSE FUND				
Rs. In Crores				
FINANCIAL YEAR	CALAMITY	FINANCIAL ASSISTANCE APPROVED BY HLC	BALANCE OF SDRF ADJUSTED FOR INSTANT DISASTER/ CALAMITY	BALANCE AMOUNT RELEASED FROM NDRF
2015-16	FLOOD 2015	1737.65	371.98	1365.67
2016-17	CYCLONE "VARDAH"2016	264.11	45.35	218.76
	DROUGHT 2016	1748.28	300.29	1447.99
2017-18	CYCLONE "OCKHI" 2017	0.00	0.00	133.00
2018-19				
2019-20				

10.5 Central Government Funding

The National Disaster Response Fund (NDRF) have been made available to the National Executive Committee (NEC) to be applied towards meeting the expenses for emergency response, relief and rehabilitation in accordance with the guidelines laid down by the Central Government in consulation with the National Authority.

- Project funds from Government of India
- State special funds
- State Development fund
- Departmental specific project funds
- Project fund/ soft loans from International agencies

The DM Act 2005 has mandated upon the Government to ensure that the funds are provided by the Ministries and Departments within their budgetary allocations for the purpose of disaster management. The Act has stressed upon the need for mainstreaming of the Disaster Risk Management

by way of making definite budgetary arrangements for the purpose by the respective Ministries and Departments within their overall agenda.

The Finance Ministry, Government of India, in their Guidelines for Flexi Funds within Centrally Sponsored Schemes (CSS) (copy enclosed) dated 06-09-2016 have also Stated that the Flexi Fund component within Centrally Sponsored Schemes can be used to undertake mitigation/restoration activities in case of natural calamities.

Long Term Disaster Mitigation includes Disaster Risk Reduction and Climate Change Reversal activities by creating new infrastructure as well as regular maintenance of the existing and the newly created infrastructure for sustainable risk reduction.

Considering the above points, it has been decided to approach Long term Disaster Mitigation with the following strategy.

i) Flexi Fund component within Centrally Sponsored Schemes. It can be used to undertake mitigation/restoration activities for risk reduction in accordance with the Guidelines framed by Finance Ministry Government of India for utilization of Flexi Funds within Centrally Sponsored Schemes (CSS).

In respect of the above, the State Relief Commissioner will identify disaster risk reduction needs of vulnerable areas and send it to Secretaries of the respective administrative departments to enable them to channelize funds for addressing the disaster risk concerns within the scope of individual projects/programmes.

ii) Long term Disaster Risk Reduction through project-based funding by the State Government

a. The Government of Tamil Nadu will allocate funds to the State Relief Commissioner and Commissioner of Revenue Administration for preparation of detailed project reports aimed at Disaster Risk Reduction.

b. The projects will be recommended and placed by the State Relief Commissioner and Commissioner of Revenue Administration before the State Executive Committee for being funded by the State Government.

c. The SEC will also decide to pose select projects for External Assistance.

iii) The funds provided annually for Northeast Monsoon preparedness to various departments.

a. The funds will be placed at the disposal of the State Relief Commissioner and Commissioner of Revenue Administration.

b. The departments will send the proposals for mitigation of disaster risk reduction to the SRC& CRA.

c. The SRC&CRA will allocate funds to different departments based on the proposals received

WAY FORWARD 11

Disaster Risk Management is highly complex requiring multipronged strategies by the Governments as well as by other stakeholders. Successful risk reduction strategies require a thorough understanding of the various disaster risks, robust disaster risk governance, thorough preparedness, effective response and build back better strategies. The Disaster Risk Management to build resistant communities as well as transform an area vulnerable to disasters into disaster resilient areas, require significant investments in disaster risk reduction from government as well as private sector and the community. The various measures that are under implementation as well as planned to be taken up in the immediate future are detailed below, relating the various measures being implemented to the different priorities set forth in the Sendai Framework.

PRIORITY - I

Understanding Disaster Risks

Risk Assessment, Risk Mapping, Alert Systems and Risk Communication play a very important role in understanding the risks caused by different disasters. Better understanding of the risks strengthen the efforts of different stake holders to be better prepared to avoid the risks and in cases where avoidance is not feasible, mitigation measures can be targeted with precision to reduce the impacts of the risks as well as enhance the resistance of the community to risks. Government of Tamil Nadu has been according highest priority to strengthen the capacity of different stakeholders for understanding the risks.

11.1 Risk Assessment and Mapping

Risk Assessment and mapping play a very critical role in enhancing preparedness during pre-disaster phase, strengthening response measures during the disaster phase as well as in undertaking preventive and mitigation measures during post disaster phase. The current Risk Assessment efforts will be strengthened with GIS based tools, advanced 3D models generating systems and Big Data analytics along with digital mapping of vulnerable areas as detailed below.

11.1.1 Real Time Flood Forecasting and Spatial Decision Support System for Adyar, Cooum, Kosasthalaiyar Rivers and Kovalam Basins

In order to address the recurrent Urban floods in Chennai and its peri-urban areas, the Government of Tamil Nadu will be undertaking a study and implement a "Real Time Flood Forecasting and Spatial Decision Support System for Greater Chennai Corporation and the river basin areas of Adyar, Cooum, Kosasthalaiyar Rivers and Kovalam" to forecast flooding and help prepare various stakeholders and Government agencies involved in risk reduction as well as prepare the community. The entire basins of Kovalam, Adyar, Cooum and Kosasthalayar will be studied for their hydrology along with street flooding patterns in urban local bodies such as GCC, Tambaram, Pallavaram, Sembakkam, Pammal, Anakaputur, Poonamalle, Avadi, *Ambattur,* Thiruvallur and Thirverkadu Municipalities.

Real-time Telemetry / GPRS network of stations such as Automatic Weather / Automatic Rain Gauge stations, Online lake inflow and outflow meters, River flow level meters will be installed in the entire basin areas of Cooum (489.32 Sq.km), Adyar (1162.46 Sq.km), Kosasthalayar (1949.32 Sq.km) and Kovalam (472.75 Sq.km) etc. The project envisages over 100 Automatic weather station (AWS) / Automatic Rain Gauge (ARG) as per the National Disaster Management guidelines of 1 in every 4.0 sq.km within the Greater Chennai Corporation. The estimated cost for this hardware as well as setting up of Control Rooms will be around Rs.15.00 to 20.00 crores, which is proposed to be funded under World Bank assisted Tamil Nadu Sustainable Urban Development Project (TNSUDP). The project will be completed within a period of 30 months.

11.1.2 Real Time Flood Forecasting and Spatial Decision Support System for other River Basins in Coastal and Non-Coastal Districts

Similar studies will also be carried out in Cuddalore, Nagapattinam and Thoothukudi Districts in the first phase and in other river basins during the second phase. Real-time Telemetry / GPRS network of stations such as Automatic Weather / Automatic Rain Gauge stations, Online lake inflow and outflow meters, River flow level meters will be installed in the entire river basin areas

so as to get real-time information of the rainfall as well as stream flows for strengthening preparedness measures and response measures. The data will also be analysed to evolve appropriate preventive and mitigation measures.

11.1.3 Mapping of Flood Prone River Basins by Unmanned Aerial Vehicle

Tamil Nadu Government in association with Anna University has launched an Unmanned Aerial Vehicle (UAV) for Photogrammetric mapping of flood affected districts at a cost of Rs.7.01 crore. UAV will perform efficient surveys for disaster-prone or physically inaccessible areas by providing aerial images and accurate pictures of the water courses in the River Basins. In addition separate studies involving LIDAR systems will generate Digital Evaluation Models of the major rivers of the State Viz., Cauveri, Adayar, Kosathaliyar, Cooum and Kovalam. These studies will be carried out by PWD and Greater Chennai Coporation.

Tamil Nadu State which spreads over 130058 sq.km is having 17 river basins comprising 38 main rivers with their tributaries confluence into sea. These river basins are further divided into 127 sub basins depending upon the drainage pattern within the basin. The Unmanned Aerial Vehicle (UAV) will make an aerial survey to undertake Aerial Photogrammetric mapping of 10,000 Sq.Km. of river basins along with 0.5km to 1km areas on either side of the main river course and its tributaries and distributaries in the districts which are detailed below:

Sl. No.	Name of the Districts	River Basin
1	Thiruvallur & Greater Chennai Corporation	Araniyar, Kosasthalaiyar and its tributaries, Cooum in Chennai
2	Kancheepuram & Greater Chennai Corporation	Adayar, Kovalam in Chennai, Palar and its tributaries in Palar, Ongur in Varahanadhi.
3	Villupuram & Kancheepuram	Ongur, Varaganathi in Varahanadhi, Pennaiyar, Gadilam in Pennaiyar, Manimuktha, Gomuki and Vellar in Vellar
4	Cuddalore	Pennaiyar, Gadilam in Pennaiyar, Paravanar and it, tributaries in Vellar Coleroon in Cauvery
5	Nagapattinam, Thiruvarur & Pudukottai, Thanjavur, Trichy & Karur	Coleroon Cauvery and it's distributaries in Cauvery
9	Madurai, Theni & Dindigul	Vaigai and its distributaries in Vaigai Gridhamalnadhi in Gundar
10	Ramanathapuram & Sivagangaii	Vaigai in Vaigai, Kottakaraiyar (Manimuttar)
11	Virudhunagar	Gundar and its tributaries in Gundar, Vaippar and its tributaries in Vaippar

Sl. No.	Name of the Districts	River Basin
12	Thoothukudi	Korampallam Aaru (Kallar) in Kallar Thamarabarani in Tambarabarani.
13	Thirunelveli	Thamarabarani and it's tributaries in Tambarabarani, Nambiyar and it's distributaries, Hanumanadhi in Nambiar
14	Kanyakumari	Kodaiyar, Palaiyar, Valliyar in Kodaiyar
15	Vellore	Palar and tributaries in Palar Kosathalaiyar and its tributaries in Kosathalaiyar
16	Thiruvannamalai	Palar, Cheyyar and tributaries in Palar Pennaiyar and its tributaries in Pennaiyar
17	Dharmapuri	Pennaiyar, Chinnar and tributaries in Pennaiyar, Cauvery and its tributaries in Cauvery
18	Krishnagiri	Pennaiyar and its tributaries in Pennaiyar
19	Salem	Sarabanga, Thirumanimuthar and tributaries in Cauvery, Kariyakoil and Anaimedu in Vellar
20	Namakkal	Cauvery, Sarabanga and its tributaries in Cauvery
21	Erode	Cauvery, Bhavani and tributaries in Cauvery
22	Coimbatore	Noyyal and its tributaries in Cauvery Aliyar, Palar and tributaries is PAP
23	The Nilgiris	Tributaries of Cauvery
24	Thiruppur	Amaravathi in Cauvery basin, Palar and its tributaries in PAP
25	Karur	Cauvery, Amaravathi and tributaries of Cauvery
26	Dindigul	Kodaganar and its tributaries in Cauvery

Sl. No.	Name of the Districts	River Basin
27	Perambalur	Cauvery and tributaries in Cauvery
28	Ariyalur	Cauvery and tributaries in Cauvery Vellar and its tributaries in Vellar
29	Pudukottai	South Vellar, Agniyar and tributaries in Agniyar basin Cauvery's tributaries

The study will provide inputs for identifying the location of dams, missing links of canals and ensure possible opportunities for interlinking of watercourses. Using UAV, the images captured will be pre-processed, stitched and converted into useful maps for the understanding of river basins and watercourses to initiate flood and drought mitigation measures.

11.1.4 Storm Surge Model

Tamil Nadu has a long Coastline of 1076 KM. Historical records show that Cyclones were often accompanied by very intense & heavy precipitation exceeding 40-50 cm in a day or about 10cm or more per hour in some places. The Cyclones accompanied by high storm surges inundate low lying areas of the coastal regions causing heavy floods, erosion of beaches and embankments, damage to vegetation and reduction of soil fertility. Storm Surges also pollute drinking water sources resulting in the shortage of drinking water and causing water borne diseases.

In order to predict storm surges on real-time basis, it is proposed to develop storm surge and Tsunami Modelling for Tamil Nadu with the help of IIT (Madras) Chennai. The real-time simulation model will identify the areas that are likely to be inundated during the storm surges and provide effective visualization Models taking into account IMD forecast so as to strengthen early warning and response systems during the disaster phase and develop mitigation strategies during post-disaster and pre-disaster phases in subsequent years. The storm surge model will also assist in the development of appropriate structures to reduce risks and non-structural measures to avoid the risks, reduce the risks as well as enhance resistance of the community and the State to storm surges.

11.1.5 Integrated Coastal Zone Management plan for Tamil Nadu

Integrated Coastal Zone Management (ICZM) is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It takes into account the full cycle of information collation, planning, decision making, management and monitoring and evaluation of implementation. ICZM refers to the integration of a wide variety of objectives depending on the stakeholder and also to the integration of the many instruments needed to meet these objectives. The key deliverables of the project are:

Land use mapping of the entire coastal stretch of Tamil Nadu:

The land use features are mapped from the merged product of CARTOSAT - I and RESOURCESAT (IRS P6 LISS IV) data duly supported by ground truth and Cadastral maps

(at 1: 5,000 scale) from Survey and Land Records Department of Government of Tamil Nadu. The land use classification followed the Coastal Land use classification scheme developed by Space Application Center (SAC), Ahmedabad and Ministry of Environment, Government of India.

Coastal Vulnerability Mapping

The combination of the wave and storm surge often inundate the coastal zone, especially when the coastal area is low lying. The conditions worsen under tsunami conditions. Wave and hydrodynamic modelling were carried out to arrive at highest water level which may be expected at the various locations along the coastline of Tamil Nadu. The MIKE 21 SW model has been used for wave transformations studies under the fair weather as well as cyclonic conditions. The flood of 30 to 40 years of data will be used to identify 'flood level' and that was superimposed on the digital elevation data of the coast to find out the degree of inundation/ flooding under such adverse condition. Based on these flood levels coastal vulnerability maps are prepared.

Special Area Management Plans

The Special Area Management Plan (SAMP) is a model case study to address the issues of economy, ecology and coastal erosion with special concern to the increased risk to life and property from coastal storms, high tidal waves, tsunami, floods etc. The case studies have been taken up in (i) Cuddalore town and adjacent areas in Cuddalore District (socio-economic); (ii) Tarangambadi (erosion) in Nagapattinam District and (iii) Manakudi (ecology) in Kanyakumari District.

The ICZM Plan will be prepared based on the above assessments, which aim to achieve a holistic management of Tamil Nadu Coast through better coordination of the developmental activities along the coastal stretch to enhance socio-economic improvement of its population while sustaining its natural resources and the environment healthy to meet the requirements of future generations. The Integrated Coastal Zone Management Plan (ICZMP) will serve the objective of protection and judicious use of natural resources in a sustainable manner. It includes the preparation of Integrated Coastal Zone vulnerability maps for the entire coast of Tamil Nadu.

11.1.6 Tamil Nadu System for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking (TN -SMART)

The Government of Tamil Nadu will put in place a System for Multi-Hazard Potential Impact Assessment and Emergency Response Tracking (SMART). The TN SMART is being developed in collaboration with the Regional Integrated Multi-Hazard Early Warning System for Africa and Asia (RIMES) an Inter-Governmental Organization registered with the United Nations based in Bangkok. This system will be integrated with the other systems being developed with the help of GIS technology. TN SMART will offer following services to strengthen risk governance.

- A dynamic risk assessment system to assess the potential impacts of the weather forecast issued by India Meteorology Department.
- An ensemble forecasting platform comprising of forecast products from various global and regional center for reference purposes.
- A robust verification mechanism (meta-analysis) platform to critically evaluate the performance of all the forecast products and

forecast based impact scenarios, a "real-time system of evaluating the predictions with reference to the actual situations".

TN-SMART initiative is in line with World Meteorological Organization's Global Framework for Climate Services, i.e. development and application of climate services to assist decision-making for addressing climate-related risks.

Risk assessment and impact assessment components are driven by the forecast and site-specific thresholds derived from the historical records of extreme events and hazards. The tool would capture the risk and the corresponding potential impact. NDEM (National Database for Emergency Management) developed by the National Remote Sensing Center (NRSC) which has inbuilt national level GIS datasets will be integrated with State Data Base for Emergency Management (SDEM) & TN-SMART. The TN- SMART will assist in Forecast and Analysis, Risk mapping and assessment, also act as a data management system for managing and processing weather, disaster risks and emergency response resources data for use during the different phases of disasters.

11.1.7 GIS Cell

GIS technology will be of immense help to map and analyse hazards of all types and visualize their potential impacts, integrate with critical risk reduction, response & relief infrastructure, population densities in the vulnerable areas to strengthen risk governance. The GIS technology by strengthening risk and hazard assessment provide the basic foundation for the overall risk reduction strategies. The GoTN has announced its decision to establish a GIS cell exclusively in the office of the Commissioner of Revenue Administration and Disaster Management at a cost of Rs.7.50 Crores. The TN SMART alert system, State Database for Emergency Management (SDEM), Storm Surge Model for early warning and Decision Support Systems on the real-time basis and other products will be integrated using GIS technology. This will be actualized by collaboration with R&D centres such as the Centre for Disaster Mitigation & Management (CDMM), Anna University, Institute of Remote Sensing, (IRS) Anna University, Indian Institute of Technology in Madras (IIT-M), as well as with RIMES an international agency registered with UN.

Exclusive Custom-made Query Tools will be developed to cater to the specific needs of Tamil Nadu for effective Pre-and Post-Management of Disasters based on the integration of different studies. The Tamil Nadu State Database for Emergency Management(TNSDEM) will have spatial and non-spatial information such as Hospitals (including both Govt. and Private – No. of beds, facilities etc.,) Ambulances associated with Private and Government hospitals and Ambulance Service Providers (location), Cyclone Shelters (location – Capacity) ,Schools (which could be used as Emergency Shelters) ,Police Station ,Coastal Security ,Fire Station, Transport Infrastructure ,Boats (Service Provider) ,Communication Infrastructure ,Energy and Utilities Infrastructure Industries, Critical Assets – Hazardous Industries Etc.,. The captured spatial data will be integrated with Non-Spatial Information pertaining to the spatial data for each of the thematic layer. The GIS cell will focus on the generation of models to strengthen efforts during the Preparedness, Response, Relief & Rehabilitation phases of a disaster. The real-time predictive models will help

in better governance to evacuate those likely to be affected and minimize loss of lives to the maximum possible extent.

11.1.8. Data Analytics for Risk Assessment

Big Data Analytics can play a significant role in strengthening management during different phases of the disaster. Data analytics enables real-time data analysis not only to map the most disaster affected areas, but also to uncover hidden patterns, unknown correlations and other vital information to make decisions and issue alerts before disaster onset and thereby help in effective preparedness, risk communication, response, relief & build back better strategies. The descriptive, predictive and prescriptive analytics will be used in multiple ways to handle disaster management more effectively.

11.1.9 Leveraging Technology to enhance the efficiency of disaster risk management efforts

Technology will be leveraged as a key to planning sustainable and disaster resilient infrastructure and systems. Satellite based/aerial photogrammetry based GIS system and computer simulation for vulnerability mapping will be the basis for strengthening disaster preparedness and response. State Disaster Response Network, a State wide electronic inventory of specialist and essential resources for disaster response will be established to strengthen the efforts during preparedness and response.

11.2. Risk Communication

Communicating risks to the community plays a very critical role in minimising the risk of loss of lives and moveable properties. Dissemination of information in time is a major challenge requiring investments in State of the art technologies. Government of Tamil Nadu being committed to minimize loss of lives and damages to public and private properties will strengthen risk communication by embracing new technologies besides strengthening existing technologies as noted below.

Social Media

Social Media will be utilized for information gathering and information dissemination in short notice. Social Media will be used extensively in disseminating Forecast, Early Warning Alerts and Messages to evacuate to avoid disaster mapping of disaster prone zones as well as in crowd management during Pre Disaster, during Disaster and post Disaster Phases.

Strengthening of Emergency Operation Centres for Real-time Risk Communication

Flood Control Rooms will be strengthened at State Emergency Operating Centre, Chennai, Greater Chennai Corporation, Kancheepuram and Thiruvallur District Collectorates. New tools for Risk assessment will be utilized for generating vital information during pre-disaster and during disaster phases to effectively communicate the risks to community as early as possible. The SEOC and DEOC are equipped with multi communication facilities like VHF, mobile telephony etc. The Government will strive to establish EOCs at Taluk & Sub-Taluk Levels and make communication in the EOCs at all levels from the State to local level, disaster proof by adding wireless communication sets Internet telephony, Ham radios, satellite radio etc., so that communication is uninterrupted even during power outages.

EOC for Sub Divisions, Taluks and Sub-Taluks

When distress calls are received from the community, government help should be close and fast. At present, EOCs have been established at State, District Headquarters and Coastal Sub Divisions.

With the burgeoning population, it is important to decentralize the EOCs further. Hence, it is envisaged that full fledged Emergency operation centres would be opened even at the Taluk level and Sub Taluk Level. Thus, disaster will be managed at micro level giving due importance to location, local culture etc.

11.2.1 Early Warning System

End to End Early Warning System

Tamil Nadu has made a huge progress during post Tsunami period in terms of getting real time information on weather events and seismic activities. State has a well equipped State Emergency Operations Centre (SEOC) that gets information on significant events from various agencies and presently disseminates information through multiple channels to the DEOs which in turn inform to various line departments and first responders and the communities. However limitation of the present system of information is that while gathering of critical information at State level and its dissemination to the districts is very fast, the dissemination from district level to the community in remote location gets delayed due to absence of an integrated information dissemination system.

Therefore a State of the Art End-to-End Early Warning System is being implemented in Tamil Nadu. The Disaster Warning Announcement System is a standalone system. Under the Early Warning System work it is proposed to provide 439 Disaster Warning Announcement System (DWAS) to remote locations for all the habitations in the 13 Coastal District Head Quarters which is called DWAS –R. One District Warning Announcement System- District Unit is proposed in each of the 13 Coastal District Head Quarters which is called DWAS –D. These shall be controlled by a Central Unit, DWAS –C which will be installed at the State Emergency Operation Centre (SEOC) in the Office of the Commissioner of revenue Administration, Chepauk, Chennai and one stand by Disaster Recovery Centre Unit. DWAS-(DRC) in one of the coastal district headquarters and it has been proposed to set it up at Thirunelveli. The DWAS-R units are stand alone equipments with Built-in Automated Test features (BITE facility) for carrying out warning announcements without any manual intervention. The DWAS-R unit has the capability to send out Siren Warning tone audible over 1 km radius and clearly audible warning voice message over a minimum of 700 m radius. It will give visual alert through red LED beacon with visibility over 1 km radius. The warnings will be automatically decoded and relayed as and when alerts are received either from DWAS-C or DWAS-D units.

The provision of the warning system with fully automated features and with minimum manual intervention is to ensure that human delays do not hamper the functioning of the system. The entire warning system will be made people friendly, by evolving a people- centric Early Warning System. Based on the experience of the project, similar systems will be placed in all vulnerable areas in the years to come.

11.2.2 Satellite Telephony

The satellite connection do not depend on land-based telephone wires or cellular towers and are capable of providing a full range of communications services, including voice, video and broadband data. Even when disasters strike, these networks can be used to provide seismic and flood sensing data to Government agencies, to enable early warning of an impending situation and broadcast disaster-warning alerts and facilitate general communication and information flow between Government agencies, relief organizations

and the public. The Government which is currently establishing Satellite telephony in Greater Chennai Corporation and neighborhood will expand these services to the entire State in the years to come.

11.2.3 Internet Telephony

Internet telephony allows voice calls and other services like fax, SMS and other voice-messaging applications to be transmitted using the Internet as a connection medium. The Government has a State wide area cable network offering internet facilities. Internet Telephony connectivity will be established upto Taluk level to ensure that during disasters communication is disseminated without interruption.

11.2.4 High Frequency (HF) communication system for Deep Sea venturing fishermen of Tamil Nadu

In Tamil Nadu coast, 31463 motorised country crafts and about 5900 Mechanised boats are operating all along the coastline of Tamil Nadu, 1500 nos. of deep sea fishing vessels are operating with their base in Chennai & Kanyakumari. These deep-sea fishing vessels go beyond 150 NM and they operate for a period of 10-15 days per voyage, During the recent OCKHI Cyclone, the fishermen who ventured for deep sea fishing before the onset of the OCKHI Cyclone could not be contacted and warned to return back to shore immediately. This communication gap has resulted in loss of life of fishermen, major injuries to those who had been rescued apart from damages and loss of fishing crafts and other fishing implements. More over many fishermen could not be contacted and have to be considered as untraceable. In order to avoid such situations in future, these deep sea fishing boats of Tamil Nadu will be brought under the seamless communication networking system in order to enhance the safety and security of the deep sea going fishermen of Tamil Nadu, by equipping the vessels with High frequency (HF) sets that provide a long-range service in both the ship to shore and the shore to ship directions, especially for usage by the deep-sea fishing marine fishermen mainly during distress situation.

In order to provide a proper and efficient communication system for the deep-sea vessels of Kanyakumari and Chennai Districts it is proposed to provide 1500HF communication equipment besides establishing HF control rooms in two locations in Tamil Nadu. Necessary marine frequency in the HF range would be obtained from Wireless Planning and Coordination Wing, Government of India.

11.2.5 Supply of distress alert transmitters to the fishermen/ fishing boats in Tamil Nadu

The Distress Alert Transmitter is a user friendly and seaworthy equipment which can easily be operated by any crew of the boat. Four types of emergency (Fire, Medical, Sinking, Man overboard) indicating switches are located on DAT equipment, the fishermen can press the type of emergency so that MRCC, of Indian Coast Guard (Maritime Rescue Coordination Centre) can initiate actions according to the type of emergency. Since it has an inbuilt GPS, the exact time and position from where the alert is transmitted will be received at MRCC, Indian Coast Guard- DAT hub with DAT identification number instantly. Immediate rescue operations can be initiated by ICG based on the alerts received.

Government of India have issued necessary administrative approval for the procurement and supply of 30,000 Distress Alert Tranmitters (DATs) to the fishermen/fishing vessels of Tamilnadu, at a total cost of Rs.3600.00 lakhs. The DATs will be procured soon and supplied to the fishermen.

PRIORITY - 2

Strengthening Disaster Risk Governance to Manage Disaster Risks:

The State Disaster Management Authority (SDMA) is responsible for coordinating the response to disasters and reduces risks. All measures for mitigation, preparedness, response and recovery are undertaken under the guidance and supervision of the Authority. The SDMA approves the State Disaster Management Plan and District Disaster Management Plans in accordance with the guidelines laid down by the National Disaster Management Authority. The authority is supported by State Executive Committee (SEC). Disaster-specific cells are being created to analyse the risk profile of the State in depth and to provide specific disaster risk reduction strategies for consideration of TNSDMA.

The Commissioner of Revenue Administration is the State Relief Commissioner and undertakes all activities relating to Disaster Management and Mitigation besides managing relief and rehabilitation activities for any disaster in the State.

State Advisory Committee

The State Advisory Committee has been constituted under the Chairmanship of the Principal Secretary / Commissioner of Revenue Administration. The Secretary, Revenue Disaster Management and Mitigation department is the co-chair. The Advisory Committee comprises of experts in various fields of Remote Sensing, Communication Networks, Weather Forecasting, Surface Transportation Engineering, Urban Drinking Water Supply and Sewerage, Public Health, Rural Drinking Water Supply, Ocean Sciences, Meteorology and Climate Change, Highways, Industrial Safety and Health, Public Health and Preventive Medicines, Petroleum and Explosives Safety, Forest Conservation and Forest Fires, Irrigation and Flood Management, Electrical Transmission, Water Resources Management and Environment to advise on measures for disaster risk reduction. The State Advisory Committee which comprises experts from diverse fields ensures that the concerns of diverse sectors are taken into account while formulating strategies for risk reduction.

Tamil Nadu Disaster Response Force (TNDRF)

Though the community always acts as a first responder during disasters that strike with limited warning time as well as during disasters which can be forecast at least 20-24 hours prior to the event, the role of specially trained disaster response forces will be extremely vital for quick and before time evacuation of the people likely to be affected as well as for efficient search and rescue in case of necessity. Realizing the importance and significance of Special Forces, Government of Tamil Nadu has decided to raise an exclusive battalion as Tamil Nadu Disaster Response Force and has also provided Rs.15 crores for procurement of State of the art Search, Rescue and Evacuation equipment. In the years to come the personnel of TNDRF will be continuously trained to upgrade their skills on par with NDRF. In addition, 2500 Police personnel from different specialized forces who have been trained in Search, Rescue and Evacuation operations will continue to be trained to take advantage of their location in all Districts. The SDRF personnel after being equipped with skills on par with NDRF will also be engaged in training young recruits (to the Police, Fire Services and other specialized services) in Search, Rescue and Evacuation operations so that over a period of time all the coastal districts will have well-trained personnel numbering about 300 – 500 Police / Fire services / Home guards etc. The SDRF personnel will also be utilized to train the First Responders identified from among the community, especially in the vulnerable areas.

The disaster response force will be equipped in a phased manner with modern technology like unmanned aerial vehicles, robots etc., which will be used in the following ways:

- High Antennas for Radio Communications-Tethered Drone (HARC-TD)
- HARC-Tethered Drone for improved network and communications range extension for tactical radio communicators, first responders and similar users of mission-critical radio networks.
- UAVs with sensor options such as visual, thermal, LiDAR etc. will be procured for use to map disaster areas, generate high-resolution and 3D mapping, identify hot spot areas and upload the data in real time to coordinate search, rescue and evacuation efforts during natural disasters as well as industrial disasters.

Capacity Building for TNDRF

The Capacity of TNDRF will be enhanced by training them at State and National level institutions to handle natural disasters like Flood (Urban, Rural and Flash Floods), Cyclone, Tsunami, Storm Surge, Landslide, Earthquake, and man-made disasters like Building collapse, disasters related to CBRN etc. The trained TNDRF personnel will also be utilised to build the capacity of the Community First responders.

Fire& Rescue Services

Fire and Rescue Services Department of the Government of Tamil Nadu is entrusted with the task of firefighting and rescue operations in times of emergency. The Fire and Rescue Services Directorate plays a very vital role in the area of firefighting and fire prevention. Apart from firefighting, this department also undertakes rescue activities and helps people, marooned in floods and caught in the debris of fallen buildings, road and rail accidents and other natural and man-made disasters.

Fully automated fire fighting futuristic equipment and Robots will be playing a major role in the years to come. A conscious effort will be made to procure such modern systems equipped with thermal sensors to help in detecting fire at the earliest possible time and strengthen the fire-dousing operations.

Interdepartmental Zonal Teams for group of vulnerable areas

Interdepartmental Zonal Teams are formed under the leadership of Revenue Authority. The team members are drawn from Police, Fire services, Rural Development, Forest, Agriculture Departments etc. Each team will closely monitor 5 to 7 vulnerable areas. 589 Interdepartmental zonal teams are formed to monitor the 4,399 vulnerable areas during Northeast Monsoon 2017. The capacity of the members of the Interdepartmental Zone teams will be enhanced and they will be equipped with equipment to reach out to the community and quickly evacuate them based on early warning alerts communicated to them.

First Responders

Community participation at grass root level is enabled through enrolment of able-bodied volunteers, with skills of swimming and climbing, as first responders. First responder teams are formed in Areas of very high and high vulnerability. The first responders are trained by Fire services / SDRF and Red Cross society. Mobile teams of First Responders and Snake Catchers at Block / Taluk / Sub-Divisional and District levels are formed for deployment based on need.

The First Responders play a key role in organizing (first aid, search and rescue, extrication from damaged buildings, road clearance, firefighting) raising awareness (about hazards, risks, disaster response) community drills (annual drills for disaster response in the community) equipping the community with minimum resources (first aid kit, extrication equipment, lifejackets, lifebuoys, rope and the like). In the years to come, they will be trained regularly to enhance their skills on the one hand and more volunteers will be enrolled on the other.

Local Self Governments

The Urban/Rural local bodies, Town/ Village Panchayats have a key role in prevention& Mitigation and Preparedness of disasters. There are 12 Corporations, 124 Municipalities, 528 Town Panchayats and 12,524 Village Panchayats in Tamil Nadu. The DDMAs will coordinate the functions of these local bodies at the district level. The elected representatives will be sensitized to the needs of the community during disasters and their capacities will be strengthened through orientation and other training programmes.

Civil Defence

The Civil Defence being a community based voluntary organization in addition to rescue, relief and rehabilitation, plays a significant role in the field of public awareness and also community capacity building to face any disaster situation as is being done by the Civil Defence in many countries. The Government has accorded administrative and financial sanction for the formation of Civil Defence Training Institute at Palani at an estimated cost of Rs.1.92 crores and Rs.89.00 lakhs in 2014 for creating Civil Defence units in Chennai, Mamallapuram, Tiruchirappalli, Madurai and Thirunelveli. With a view to assisting officials during times of natural disasters, the Tamil Nadu Government will establish a 1,000 member-strong Civil Defence Corps for units proposed in five districts, including Chennai. The Corps units will come up in Chennai with a strength of 500 persons, 200 in Mahabalipuram (Kancheepuram district) and 100 members each in Madurai, Thirunelveli and Tiruchirappalli districts. The necessity for such corps arose as there is a need for large number of human resources in areas affected by natural calamities such as cyclones *or* floods and to carry out rescue operations swiftly to ensure the early return of normalcy.

Some of the youth organizations namely, National Cadet Corps (NCC), National Service Scheme (NSS) and Nehru Yuva Kendra Sangathan (NYKS) have the inherent advantage of availability for immediate assistance at the ground level in the event of any disaster. These organizations are also

proposed to be integrated in the overall Disaster Management framework with linkages with the Civil Defence set-up at the State head quarters and District head quarters.

Multi-Stakeholder Involvement in Risk Governance

Disaster Management being complex, requires the participation of the community as well as multi-stakeholders viz., the private sector, NGOs, CBOs, such as SHGs, Academic Institutions, NSS, NCC and others. Involvement and participation of the communities will ensure a collective and coordinated action during different phases of disaster. Government will continue to accord very high priority to build a culture that harnesses leadership and volunteerism among the community to develop a team of trained community volunteers through the participatory approach. Volunteers from the local community will be identified on a regular basis from NSS, NCC and Youth Groups with skills of swimming and climbing, as First Responders and teams of First Responder are formed in areas of vulnerability (for search, rescue and evacuation). It is also ensured that Women volunteers are also included in First Responders Teams and also in other Committees.

Community involvement and participation will be the cornerstone of Governments strategy for disaster preparedness and it will further be strengthened by establishing linkages between the community, first responders and other stakeholders during different phases of a disaster. The stakeholder involvement will be encouraged to supplement the efforts of the Government as well as to build the capacity of the community and ensure community participation during the following stages of disaster management.

Special emphasis will be laid on greater participation of women in planning, designing, implementation & monitoring of programmes aimed at Risk Reduction. The women organisation networks will be strengthened & special focus will be laid on promoting leadership of women in Disaster Risk Management.

Planning

From the habitation/village level disaster management plans to Taluk level, District level and State level multi-stakeholder participation will be ensured. By involvement of multiple stakeholders, the plans will not only capture the perspective of the communities and various stakeholders but will also instil a sense of ownership.

Preparedness& Response

Community participation in preparedness will be ensured through enrolment of First Responders in areas identified as vulnerable to flooding and other hazards. The capacities of these first responders will be further enhanced through appropriate training tailored for advanced level of response in flood situation, as well as, to other types of hazards, local risks and accidents with the help of Government & Non-Government capacity building institutions.

Relief

Various stakeholders involvement is needed during different stages of relief. Identification of beneficiaries has to be done as per the guidelines/ broader framework given by the State Government and communities, who are the most important stakeholder, will be involved in identifying right beneficiaries.

A coordination mechanism with NGOs and other stakeholders at State level, as well as, District/ GCC level will be put in place to avoid duplication of efforts in relief distribution and to bring in more efficiency in terms of most affected areas getting more attention and equity in relief distribution.

Rehabilitation:- Build Back Better

Multiple stakeholder involvement will also be encouraged for undertaking mitigation

measures with an aim to build back better under the corporate social responsibility requirement of the profit-making Public and Private sectors as well as by dovetailing the projects being executed by civil societies from different sources of funding. Efforts will also be made to involve the community and other stakeholders in project implementation and monitoring.

New Multi-Purpose Evacuation Shelters

During the response and rehabilitation of the community to Tsunami, it was found that the existing number of cyclone shelters in Tamil Nadu along the coast were insufficient to accommodate the vulnerable population in coastal areas. Based on a study of the location, catchment area population, community needs, 121 Multipurpose Evacuation shelters have been constructed with statutory CRZ clearances. To accommodate livestock also separate facilities have been provided. These shelters are multipurpose utility buildings and can be used for activities like class rooms, community functions, meeting rooms for SHGs, community meetings, vocational trainings and other such other activities, making this infrastructure a vital part of the development of the communities. Based on need, the Government of Tamil Nadu will take up construction of New Multi-Purpose Evacuation Shelters wherever necessary.

Incident Response System

The management of response in disasters requires the Government, Community, civil society and other stakeholders to carry out a large number of tasks. The activities involved in response management would depend on the nature and type of disaster. The Government of Tamil Nadu is adopting Incident Response System (IRS) in the State to ensure the unification of efforts of all the stakeholders to ensure immediate response during disasters to protect people & their properties.

The Incident Response System provides a systematic, proactive approach guiding the concerned departments and agencies at all levels of Government, the private sector and Non-Governmental organizations to work seamlessly in disaster situations. For effective, efficient and comprehensive management of disasters in the State of Tamil Nadu, IRS is critical. The aim is not only to minimize loss of life and property but also strengthen and standardize the disaster response mechanism in the State.

The Chief Secretary to GoTN is the overall RESPONSIBLE OFFICER and is assisted by the Revenue and Disaster Management Department at the secretariat level and by the Commissioner of Revenue Administration / State Relief Commissioner who is the Incident Commander of the Incident Response System at the State level. The Commissioner, Disaster Management is the deputy Incident Commander. During Disasters all Line Departments function under the overall guidance of the Incident Commander. The District Collector is the Incident Commander at District level.

Coordination with Central Agencies and Armed Forces

The Chief Secretary convenes a meeting of all Central and State agencies prior to Northeast Monsoon in order to ensure perfect coordination among different agencies and to ensure efficient search, rescue and evacuation operation whenever necessity arises. The State Relief Commissioner / Commissioner of Revenue Administration shares the details of vulnerable areas and the map with the Central Agencies to familiarise themselves with the vulnerable areas so that they can respond swiftly and effectively. These coordination meetings are held annually and special meetings are convened based on need.

PRIORITY - 3

Investing in disaster risk reduction for resilience

Government will create a Disaster Mitigation fund for undertaking disaster risk

prevention and reduction through structural and non-structural measures to enhance the economic, social, health and cultural resilience/resistance of persons, communities and the State's assets, as well as the environment. The Government will further encourage the involvement of the community, civil societies and the Private sector to partner the Government in its efforts to transform vulnerable areas to resilient areas. The Government will also promote

- Tools for incorporating disaster risk considerations in cost-benefit analysis, budgetary tools and information systems.
- Sector based guidelines for the implementation of disaster risk management policies for public investment.
- Guidelines for the evaluation of investment projects, including tools and requirements for disaster risk management and climate change adaptation analysis in addition to Environmental Impact Analysis and compliance to regulatory requirements in fragile ecosystems and other general regulations.
- Tools for analyzing natural hazards in public investment projects.
- Developing and enforcing risk analysis criteria in private and public investment system regulations.
- Compendium of best practices

The Local bodies will be encouraged and incentivized to allocate necessary resources, including finance and logistics at the village level for the development and the implementation of disaster risk reduction strategies policies, plans and regulations in all relevant sectors with the active participation of the community and collaboration with different stakeholders. The Local Bodies will also be encouraged to promote the mainstreaming of disaster risk assessment, mapping and management into rural development planning and management of, inter alia, rivers, coastal flood plain areas-in coastal villages, hill areas, drylands, wetlands and all other areas prone to droughts and flooding, including preserving ecosystem functions that help reduce risks.

Risk Transfer:

The Government will continue to promote mechanisms for disaster risk transfer and insurance risk sharing for both public and private investment with special focus on Farmers and Livestock Farmers in order to reduce the financial impact of disasters especially during cyclonic storms, floods and drought. Special efforts will be made to enroll all the farmers in the areas identified as vulnerable to different disasters. The Risk coverage for all, will be aimed at universal enrollment especially in the agricultural & allied sectors, fisheries along with coverage of their assets.

Involvement of Private Sector:

The private sector will be brought together on a common platform to strengthen disaster resilient investments, particularly through: structural, non-structural and functional disaster risk prevention and reduction measures in Vulnerable areas and in critical facilities and building better from the start to withstand hazards through proper design and construction, including the use of the principles of design innovation and the standardization of building codes and materials; retrofitting and rebuilding; and taking into account economic, social, structural, technological and environmental impact assessments.

Non-Structural Measures:

As part of the non-structural measures the Government will promote the mainstreaming

of disaster risk assessments into land use policy development and implementation, including urban planning, land degradation assessments and housing for the poor and the use of guidelines taking into account anticipated demographic and environmental changes. The Government will also encourage the adoption of National building codes and standards, rehabilitation and reconstruction practices.

Social Inclusion:

Government of Tamil Nadu is known for welfare policies and is a pioneer in protecting and promoting the interests of the vulnerable sections be it women, weaker sections, children or differently abled. The design and implementation of inclusive policies and social safety-net mechanisms will be further strengthened, including community involvement, integration of livelihood enhancement programmes, access to basic health care services, including maternal, newborn and child health, sexual and reproductive health, food security and nutrition, housing and education and find durable solutions in the post-disaster phase to empower and assist people (currently) disproportionately affected by disasters to be resistant to risks.

Mainstreaming Risk concerns a way of disaster management

Mainstreaming Disaster Risk Reduction' into development plans strengthens risk reduction strategies by ensuring that new projects will incorporate measures to reduce existing risks and will ensure that new risks do not arise due to implementation of the new projects.

- On-going schemes and projects of the Ministries and Departments of Government of India and Government of Tamil Nadu as well as of all Government agencies and Institutions, including Public Sector Undertakings, will be mandated to mainstream disaster risks into the schemes and projects for ensuring that they address the disaster risk and vulnerabilities of the local areas and enhance the capacity of the community to resist disaster risks.
- At conceptualization or funding stage itself, the developmental schemes will be designed taking into consideration potential hazards associated with it and incorporate measures for mitigation of the same.

Major Areas identified for mainstreaming risk concerns into developmental plans.

During the period 2017-2030, Government of Tamil Nadu will focus on major thrust areas for mainstreaming risk concerns into development plans taking into account risk reduction as an essential investment to promote sustainable and inclusive development. The major thrust areas identified are 1) Natural Resources Conservation, 2) Comprehensive River Basin development 3) Restoration & Sustainable Management of Ecosystems, 4) Sustainable Agricultural Development and 5) Social Inclusion. The Convergence and mainstreaming risk concerns into these major thrust areas will enhance resilience/resistance of the community and the State to different disasters. The mainstreaming and convergence also incorporate the principle of Build Back Better to risk proof the Community from major disasters to a great extent.

The mainstreaming efforts will also ensure convergence of the programmes such as desilting of Water Bodies under G.O.Ms No 50. Industries), Kudimaramathu, MGNREGS-Improving Inflow Channels, Tree Planting, Watershed Development Special Area Development Programmes, Integrated Tribal Development, Micro Irrigation, Rain Water Harvesting, Artificial Recharging of Ground Water, New Irrigation Projects, Prevention of Sea Water

Intrusion to address the problems of drought, floods, landslides, heat waves and climate impact.

Sustainable Agricultural Development that combats Drought and Climate mitigation will be achieved through mainstreaming disaster risk concerns into programmes like Mission for Sustainable Dry Land Agriculture, Rain fed Area Development for Horticulture Clusters, desilting of water bodies under different schemes, Integrated watershed programmes, rainwater harvesting and other programmes.

Mainstreaming concerns of disaster into development plans will be undertaken by the District Disaster Management Agency at the district level and by the Commissioner of Revenue Administration & the State Relief Commissioner at the State level to ensure participation of relevant stakeholders and full engagement of all State institutions. The overall direction of mainstreaming of risk concerns into development will be provided by the Tamil Nadu State Disaster Management Authority under the chairmanship of Hon'ble Chief Minister.

State Disaster Risk Mitigation Fund:

A firm commitment has been made by Government of Tamil Nadu by making an announcement on the floor of the State Assembly by Hon'ble Minister for Revenue and Disaster Management during the 2017 - 2018 budget session for creation of State Disaster Mitigation Fund. Executive guidelines will be put in place as and when the Fund is formally constituted.

PRIORITY - 4

Enhancing Disaster Preparedness for effective response and Build Back Better in Recovery, Rehabilitation and Reconstruction

Resilience of community, resistance to risks and avoidance of risks requires strengthening and enhancement of preparedness to ensure that the response to different disasters is effective through multi stake holder involvement. It also involves mitigation measures following systems approach. Systems approach will be implemented treating river basin as a unit and at the same time taking into account their interconnectedness with other ecosystems. Government will adopt systems approach to promote holistic development of the river basins and to ensure that in the years to come the communities will develop resistance to different disasters and the areas identified as vulnerable are transformed into areas resilient to the disasters.

Data Analytics for Strengthening Preparedness and Response

Big Data Analytics can play a significant role in strengthening management during different phases of the disaster. Data analytics enables real-time data analysis not only to map the most affected disaster areas, but also to uncover hidden patterns, unknown correlations and other vital information to make decisions and issue alerts before disaster onset and thereby help in effective preparedness, risk communication, response and relief & build back better strategies. The descriptive, predictive and prescriptive analytics will be used in multiple ways to handle disaster management more effectively during different phases of disaster.

Build Back Better for rehabilitation and reconstruction

Though all disasters pose multiple challenges, each disaster throughs up new challenges and provides insights into the vulnerabilities even in areas that are considered to be safe. Systems approach sees opportunities in these challenges to build resistance of the communities and transform

areas resilient to disasters through innovation, redesigning, retrofitting, capacity building and social inclusion. Government of Tamil Nadu has been facing these challenges and each time responds by adopting build back better philosophy in the rehabilitation and reconstruction projects.

Taking into account the vulnerabilities being faced by Tamil Nadu the build back better strategies through systems approach will focus on the major vulnerabilities noted below:

I (a) Urban Floods

A comprehensive plan for Chennai and peri-urban areas to address the recurring water stagnation, vulnerability in these areas is being prepared. The various mitigation measures that will be implemented are detailed below:

a) Comprehensive flood protection to minimize risks in Greater Chennai &its peri-urban areas

The rapid urbanisation of Greater Chennai and Peri-Urban areas falling in the neighbouring Districts of Kancheepuram and Thiruvallur has created huge stress on the existing urban infrastructure and also necessitated the creation of infrastructure anew in the pockets of urbanisation. One of the adverse consequences of the rapid urbanisation is the change in land use pattern resulting in a situation where new colonies have sprung up on a massive scale in the erstwhile farmlands and waterways of the innumerable water bodies, that dot the landscape of Chennai, Kancheepuram and Thiruvallur Districts.

Greater Chennai and its Peri-Urban areas are spread over an almost flat terrain along the coastal plains, having an average altitude of only 4.00m to 6.00m above Mean Sea Level. The entire surface runoff drains into the Bay of Bengal only through the outlets namely, Ennore creek on the north, Cooum and Adayar river mouths in the centre and Kovalam creek in the south. The drainage network behind the above outlets formed with natural flood bowls like Ennore backwaters, Pallikkaranai marshland and Muttukadu backwaters spread over tidal flats and vast areas of floodplains along the natural rivers, are no longer able to render their functions due to the changes in the land use induced by rapid urbanisation and industrial needs resulting in inundation in the upstream areas.

The discharging capacities of the above-discharging outlets are also under severe stress due to shrinking of the width of the creeks/river mouths and inlets that pass through the marshlands, as a consequence of multiple factors that include

i. Encroachments,
ii. Siltation,
iii. Change in land use pattern,
iv. Existence of naturally formed ecologically sensitive shoals within the creek,
v. Sedimentation due to littoral movements,
vi. Accumulation of garbage along the waterways and
vii. Increased tide level during extreme weather condition.

The new land use pattern has not only thrown up several challenges for the urban planners but also threw new challenges for Disaster Management. These new challenges get pronounced during the monsoonal periods since several buildings have been established in the many of the water bodies, waterways, floodplains and farmlands. Coupled with the rapid urbanisation, the emergence of industrial establishments in the flood bowls and floodplains resulted in disruption of the erstwhile drainage system in the watersheds of the four major rivers traversing the three districts of Chennai, Kancheepuram and Thiruvallur. The

disruption of the drainage system has compounded the fragility of the ecosystems such as creeks and marshlands impacting the flood mitigating service rendered by these ecosystems.

The mitigation measures proposed to avert flooding problems in the newly developed areas include

i. Delineation of the flood-prone areas in the fringes of flood bowl and in the flood plains and evolving suitable method for draining the run-off from these areas by constructing flood walls on the boundary of flood bowl /rivers and collection wells for storm water with suitable pumping mechanism to drain the water into the river system.

ii. Forming link canals and diversion canals for discharging surplus of tanks into the river system wherever feasible.

iii. Where roads have been formed in the erstwhile waterways, cut and cover conduit system will be adopted to ensure proper drainage.

iv. Installing decentralized incinerators to dispose the generated garbage effectively instead of the routine practice of dumping those (landfills) in the water bodies.

The Greater Chennai city and its urban neighbourhoods are spread over the river basins of Kosasthalayar, Cooum, Adyar and Kovalam which are connected through the Buckingham Canal formed parallel to the coast in the tidal flats. This system also functions as a unique system for draining surface run off from the isolated water sheds sandwiched in the above 4 basins through the river mouths viz., Ennore creek, Cooum river mouth, Adyar river mouth and Kovalam creek. All these systems will be treated holistically to mitigate the risks for which detailed estimates are being prepared and taken up in a phased manner. The financial requirement is expected to be about Rs.2800 crores.

b) Integrated Cooum River Eco-Restoration Plan

The Eco-restoration activities (60 subprojects) for a 27.33 km stretch of the river between Paruthipattu and the river mouth are under progress. The stretch of Cooum River in the urban and peri-urban areas of Chennai is being rehabilitated and restored by implementing Cooum River Eco-Restoration Project in which the following works are under progress through the line departments namely PWD, GCC, CMA, DRD, CMWSSB and TNSCB under the coordination of CRRT:-

i. Desilting, demarcation and fixing boundary stones and bio-metric survey and improvements to the river like forming inner canal, providing rip rap cover for the inner canal with Geo textile fabric base, providing coconut blanket on the river banks to prevent erosion.

ii. Solid waste removal, fencing, boom deployment for collecting and removing floating and suspended debris, developing parks, cycle tracks and walkways

iii. Solid waste removal, fencing and developing parks

iv. Laying interceptors, installing modular sewage treatment plants and UGSS

v. Resettlement and Rehabilitation Plan

vi. Mangrove development, flora plantation, community education programmes and monitoring of project implementation.

By implementing the above scheme flood risk mitigation, environmental enhancement and ground water potential improvement are assured.

The restoration works were started in 2016 and the Government has accorded Administrative Sanction of Rs 604.77 crores for the short-term phase of the project.

c) Adyar Basin

I) Ecological Restoration of Adyar Creek and Estuary – 358 acres

(Phase I & Phase II)

The Government of Tamil Nadu conceived an ambitious and pioneering project in wetland conservation for the restoration of 358 acres of Adyar creek and estuary. Phase I included restoration activities such as removal of solid waste, increase in tidal interaction and planting of native species of plants which were undertaken in 58 acres of Adyar creek. This area is called Adyar Eco Park. After the completion of restoration activities, this wetland has undergone a remarkable transformation with a sizeable increase in faunal diversity and tidal interaction. The Eco Park today functions as a Centre for Environmental Education and Research Activities. To impart knowledge on the environment to the community, particularly for school children, regular environmental education programmes are being conducted in Adyar Eco Park.

The restoration of the Phase II Adyar Creek and Estuary (300 acres) was initiated in 2014. To enhance the tidal interaction and to increase the water spread in the degraded creek debris and sludge were removed along with the removal of exotic and invasive species like Prosopis juliflora, followed by bund stabilization. About 35,000 mangroves and 50,000 terrestrial saplings have been planted. All the project activities have now been completed in total and regular maintenance work is being carried out.

II) Phase III Adyar River Restoration from Origin to Mouth

The Adyar River has been under heavy anthropogenic disturbance for a very long duration and is highly degraded. The Eco-restoration plan for the entire 42 km stretch of the river from Adhanur lake to the River mouth has been prepared and the major components proposed are sewage management, solid waste management, river channel improvement, rehabilitation and resettlement, biodiversity management and riverfront development. The Government has accorded Administrative Sanction of Rs 555.46 crores in July 2017 for the short-term phase of the project.

III) Inter linking of Adyar river and Palar Basin

2015 December floods, revealed that the stretch of Adyar River within Chennai urban limits is incapable of discharging the flood of magnitude exceeding 10-year return period. In order to, minimize the risk due to the floods of higher return period, it is being examined the possibility of diverting the flood waters from the upper reaches of the Adyar River through a flood carrier canal with regulatory arrangements from the surplus channels of Sriperumbudur tank to Palar river by connecting the surplus courses of Pillaipakkam tank and Thenari tank (Neenjal madavu) for which investigations are in progress.

IV) Restoration / Formation of the disrupted links for the connection of minor irrigation tanks

The water shed of Pallikaranai marsh land situated in South Chennai Metropolitan limits is having a drainage area of about 225 sq. km. in which 60 and more no. of medium and minor irrigation

tanks are situated. Due to the changes in land use pattern for residential and industrial needs, the channels draining the surplus water of these tanks got disrupted. Hence, in order to convey the surplus water of the tanks safely into Pallikaranai marsh land a proposal for restoration / formation of the disrupted surplus channels with open channels, or closed conduits under the roads or combination of both depending upon the present land use is under consideration at a cost of about Rs.1000 crores.

In order to avoid inundation in the low lying areas of Tambaram, Mudichur, Perukalathur areas in Adyar Basin, construction of storm water drain for 4400 meters at an estimated cost of Rs.14.5 crores is in progress under CRIDP 2016 – 2017 scheme through Highways and Minor Ports department. Similarly, in other urban areas in Adyar & Kovalam Basin adjoining Chennai, a proposal for forming storm water drains in areas under the jurisdiction of Highways, Rural Development, Municipal Administration and Town Panchayats is contemplated by the respective departments at an estimated cost of Rs.230 crores. The Greater Chennai Corporation will develop integrated storm water drains in the extended areas.

V) Integrated River Restoration for Buckingham Canal, Kovalam & Ennore

To ensure that the river restoration is holistic and comprehensive three separate studies have been commenced for the preparation of DPR for plugging of outfalls, interception and diversion of sewerage, solid waste management and R&R in the major drains draining into the Adyar River and Buckingham Canal.

The Ennore and Kovalam Creeks are highly sensitive ecosystems which play a very important part in the ecological, hydrological and social security of the local inhabitants. Due to the burgeoning population in the Chennai Metropolitan Area, the Ennore and Kovalam Creeks are highly degraded by the disposal of wastewater from surrounding ULBs and industries. In this connection, Detailed Project Report (DPR) for Restoration of Ennore Creek and Kovalam Creek has also been initiated.

VI) Master Plan for Waterways and Water bodies in Chennai Metropolitan Area

The Government of Tamil Nadu has announced in the Assembly its plan to restore 42 water bodies in CMA. Out of 42 water bodies planned to be restored, CRRT has already completed the preparation of restoration plans for four lakes, namely Chetpet Lake, Kilkatallai Eri, Zamin Pallavaram Periya Eri and Pallikaranai Narayanapuram Eri. Therefore, the remaining 38 water bodies are being identified for restoration. To this end, an inventory of tanks and lakes lying within the boundary of Greater Chennai Corporation (GCC) and those lying outside the boundary of GCC, but within CMA was taken up. This survey identified 200 waterbodies within this area. For the 38 identified lakes, detailed conceptual plans have been prepared. For the remaining water bodies, baseline data has been collected and detailed conceptual plans will be developed soon and the projects executed in the years to come.

b. Flood Mitigation Measures in Madurai Corporation.

In order to reduce the flood risk in the urban areas of Madurai city desilting and deepening the tank bed to hold excess waters in Vandiyur tank in Madurai North Taluk is contemplated at an estimate cost of Rs.3.5 crore.

c. Flood Mitigation in Urban areas of Thirunelveli & Thoothukudi Districts

In order to avoid flood damages in the urban

areas of Thirunelveli and Thoothukudi Districts in Thamirabarani basin and also to enhance the livelihood of drought prone areas of Thirunelveli and Thoothukudi Districts Thamiraparani – Karumeniyar – Nambiyar Rivers Link project is under progress for diverting the excess flows in Thamirabarani basin to the water deficient Karumeniyar and Nambiyar basin.

d. Flood Mitigation measures in Urban areas of Kancheepuram District

The coastal district of Kancheepuram lies on the western and southern side of Chennai city which spreads over the river basins of Cooum, Adyar, Kovalam, Palar and Ongur. It's entire surface run of drains through rivers namely Cooum, Adayar, Kovalam creek, Ongur and Palar with its tributaries like Vegavathi, Cheyyar, Killiyar, Neenjal Maduvu and isolated independent water sheds of Pallikaranai and Perumbakkam Maduvu draining into sea through Buckingham canal. The rivers in Kancheepuram District are seasonal having floods during the period of heavy rainfall in Northeast Monsoon since the areas close to the coast in the river basins of Kancheepuram like Pallikaranai, Perumbakkam, Thambaram and the urban areas adjoining the rivers are highly prone to inundation during floods due to flat terrain with very low elevations. In order to reduce the flood risk the following interventions will be undertaken.

I) Adyar River Basin

The Rehabilitation and restoration of Adyar River and its tributaries by widening, desilting, regrading and standardising of the river regime with in-let arrangements and flood walls at vulnerable places, is taken up at a cost for an estimated amount of Rs.19.00 Crores which will minimize the flood risk in the sub-urban areas of South Chennai in Kancheepuram District.

Chembarapakkam tank in Adyar basin is being rehabilitated at an estimated cost of Rs. 3.85 Crores under Dam Rehabilitation Improvement Project which will also minimise flood risk in south Chennai besides formulating emergency action plan for its flood regulation.

Three numbers of riverine reservoirs by constructing flood banks with check dam and automatic falling shutters for flood regulation are contemplated across the tributaries of Adyar River for creating 99mcft of surface water potential and 41mcft of sub surface potential in villages viz. Somangalam, Athanur and Orathur in Kancheepuram District at a cost of Rs.9.00 Crores to minimise the flood risk in and around west Tambaram area and to enhance Ground Water potential so as to mitigate the drinking water crisis during drought periods.

II) Palar River Basin

Rehabilitation and restoration of Vegavathi river by widening, desilting, regrading of the river regime with lining at vulnerable places for its stretch within Kancheepuram town limits are in progress at a cost of Rs.4.00 crores to mitigate the floods in the urban areas of Kancheepuram town.

Also, a sub-surface dyke has been constructed across Palar river near Palur village in Kancheepuram District at a cost Rs. 16.00 Crore as a drought mitigation measure to enhance Gound Water potential.

Similarly sub-surface dykes with check dams are contemplated across Palar River in the Villages namely Vengudi, Pazhayaseevaram, Pazhaveli, L.N. puram, Vayaloor in Kancheepuram

District at an estimated cost of Rs. 268.00 crores for storing 825mcft of surface water and augmenting 1560 mcft of sub surface water besides mitigating the risk during droughts also.

III) Flood Mitigation measures in Urban areas of Thiruvallur District

The coastal district of Thiruvallur District lies on the western and northern parts of Chennai city which is spread over the river basins of Cooum, Adyar, Araniyar and Kosathalaiyar with its tributaries namely Nandhiyar, Nagariyar and isolated independent water sheds like Otteri Nalla, Captain Cotton canal, Kodungaiyur, Redhills etc. draining into Kosathalaiyar through Bankingham canal. The rivers in Thiruvallur District are seasonal having floods during the period of heavy rainfall in Northeast Monsoon since the areas close to the coast in the above isolated water sheds like Manali, Madhavaram, Kolathur, Korattur, Ambattur, Redhills adjoining north Chennai and the urban areas adjoining the rivers are highly prone to inundation during floods due to flat terrain with very low elevations. In order to reduce the flood risk the following interventions are being implemented and contemplated.

Cooum River Basin

Special Initiative for Storage of Excess Flood

The irrigation tank viz. Ayanambakkam which at present has no irrigation command is being standardised and rejuvenated at an estimated cost of Rs.30.00 crores to create an additional storage of 24 mcft of water for Chennai water supply which will also reduce the inundation in the urban areas of Chennai in Cooum river basin by storing excess flood flows.

Adyar River Basin

The irrigation tanks viz Nemam, Porur which at present have no irrigation command are being standardised and rejuvenated at an estimated cost of Rs.99.5 Crores to create an additional storage of 344mcft of water for Chennai water supply, which will also reduce the inundation in the urban areas of Chennai in Adyar Basin by storing excess flood flows.

Kosasthalaiyar River Basin

Poondi reservoir, Redhills and Cholavaram tank in Kosasthalaiyar basin are being rehabilitated for an estimated cost of Rs. 10.46 crores under Dam Rehabilitation Improvement Project with World Bank assistance which will also minimise flood risk in North Chennai besides formulating emergency action plan for their flood regulation.

It is proposed to desilt to a depth of 1.5 meters in about 50% of the water spread area of the three water supply reservoirs in Thiruvallur District viz. Poondi, Redhills and Cholavaram as a revenue model which will minimise flooding problems in the peri-urban areas of North Chennai and also improve the Chennai water supply position during the drought periods.

It is proposed to form sub-surface storage structures in the peri urban areas of Chennai in Kancheepuram, Thiruvallur and other Districts to reduce flooding problems and also to improve the Ground Water potential by desilting 34 nos. of tanks deeply below the sill level of their sluices for an amount of Rs.20.51 crore.

Araniyar River Basin

A new reservoir is being formed at Kannankottai village in Thiruvallur District by merging two tanks viz. Kannankottai hissa Rajaneri

and Thervaikandigai which will facilitate drinking water supply to Chennai city as well as assure the Agricultural interest of the farmers during drought situations besides regulating surplus waters during heavy downpours.

I (B) Flood Mitigation measures in the Rural Areas of the State

The problems of flooding due to excess rainfall, Cyclonic Storms and storm surges are by no means confined to Urban pockets. Many of the rural areas also bear the risks of flooding, which result in loss of lives and damages to both public and private property. The Government is committed to undertake a series of measures to prevent / mitigate floods as detailed below.

Cuddalore District

Cuddalore district also lies along the east coast with its terrain almost flat. The rivers namely Pennaiyar, Gadilam, Paravanar, Vellar and Coleroon flow through this district and confluences into Bay of Bengal. The rivers in Cuddalore District are seasonal having floods during the period of heavy rainfall in Northeast Monsoon. As the terrain in the coastal areas of Gadilam, Paravanar and Vellar basins in Cuddalore District is of alluvial nature, the rivers very often meander which aggravates the risk during floods. In fact the entire Cuddalore District is battered by cyclonic storms and cloud bursts very frequently causing extensive damages and significant loss of lives. Government is according very high property to undertake measures for rehabilitation, re-gradation and restoration of the channels and river courses besides undertaking formation of new dams / anicuts, deep water storage structures, link canals and diversion canals as indicated below.

a) Pennaiyar River Basin

Rehabilitation and improvements works to Velapakkam Channel, Gadilam River, Visur Odai and Periyakatupalayam Odai in Cuddalore District are in progress to a tune of Rs.40.00 crores to reduce inundation of urban and rural areas around Cuddalore town during floods. Two river interlinking proposals are contemplated for diverting the flood flows in Pennaiyar River to Palar basin so as to reduce the flooding problems in Cuddalore District and to stabilise irrigation potential in Thiruvannamalai, Vellore, Villupuram and Kancheepuram Districts during drought conditions.

b) Pennaiyar (Sathanur dam) – Cheyyar link

In this scheme it is proposed to divert 5.87 TMC ft. of water from Pennaiyar river by forming a new canal for a length of 23.55 km from Sathanur dam at FRL to connect with the Cheyyar river at upstream of Alathur anicut. Further, a branch canal taking off from the above main canal will link the Thurinjalar River and thereby benefit the ayacuts of Nandan channel besides flood mitigation.

c) Pennaiyar (Nedungal anicut) – Palar link

This scheme aims to divert 3.5 TMC ft. of flood waters of Pennaiyar river to Palar river during the months of October to December. The Detailed Project Report for this scheme is under scrutiny of the NWDA.

d) Paravanar River Basin.

It has been contemplated to form water storage structure in the upstream of NLC mine-I by removing the earth for an approximate depth of 20m for which feasibility study report is under preparation with a aim to improve ground water potential and to mitigate drinking water crisis during drought situation. By implementing this scheme, flood risk will also be minimised in the lower Paravanar sub basin areas of Cuddalore District by storing the excess flood flows in

Paravanar river.

In addition to the several mitigation measures under implementation as well as under contemplation in Cuddalore District, in order to reduce the impacts of floods, about 1300 acres of land has been identified which will be converted into a deep water storage structure for flood mitigation as well as to meet the drinking water requirements of Chennai. In addition, the Neyveli lignite corporation which will be completing its mining operations in Mines I in 2028 has agreed to convert Mines I into a water storage structure. The proposed deep water storage structure and the mines I on conversion as water storage structure will contribute significantly to reduce the risks of floods in the Paravanar Region. It is also proposed to deepen the Perumal Eri and Walajah Tank to enhance their storage capacity and aid in flood mitigation as well as augmenting the irrigation system, expand the ayacut area so as to enhance the income levels of the farmers as well as livelihood opportunities for the landless.

e) Vellar River Basin and Coleroom River Basin of Cauvery

Permanent flood protection works and improvements to increase the carrying capacity in Pasimuthan Odai, Thillaimman Odai, Omakulam drain, Khan Sahib Canal, Muthiahpillai surplus channel, Manavaikkal and old Coleroon channel in lower Cauvery sub basin to avoid flood damages in Chidambaram area of Cuddalore District have been taken up and are in progress at a cost of Rs. 100.00 crore.

The Veeranam tank in Lower Cauvery sub basin in Kattumannarkoil taluk of Cuddalore District is being desilted at an estimated cost of Rs.40.00 Crores, to restore its original capacity of 1465 Mcft., which Includes the rehabilitation works to increase the carrying capacity of its supply channel namely Vadavar Channel to facilitate stabilization of irrigation potential as well as to assure water supply to Chennai city during drought situations.

ii) Flood Mitigation in Cauvery Delta Districts (Tanjore, Thiruvarur, Nagapttinam, Pudukottai Districts)

Cauvery river originating from the State of Karnataka, receives water through its tributaries within the State of Tamil Nadu namely Bhavani, Noyyal, Amaravathy, Kodaganar, Ariyar, Sarabanga and Ayyaru and spreads over to the delta districts of Trichy, Thanjavur, Nagapattinam, Cuddalore, Thiruvarur and Pudukottai through its distributaries, off taking from the anicuts across it namely Upper anicut (Mukkombu), Grand anicut and Lower anicut besides no. of head works across its distributaries. Since the terrain in the delta districts of Thanjavur, Thiruvarur, Nagapattinam and Cuddalore are almost flat, whenever Cauvery river gets flows over and above the carrying capacities of its distributaries and Coleroon river, the urban and rural areas, agricultural lands in the coastal districts are prone to heavy damages. In order to mitigate the risk during floods and to make agriculture sustainable the following interventions are contemplated.

Improvements and Rehabilitation of Irrigation systems in **Thanjavur, Thiruvarur, Nagapattinam, Trichy and Pudukottai Districts** of Cauvery Basin at an estimated cost of Rs.11420 Crore are proposed as ERM project under "National Project "which is under consideration by CWC, Government of India for modernizing the irrigation system to minimise the conveyance losses and also to maximize the productivity and

mitigate floods.

iii) Flood Mitigation measures in Theni, Madurai, Sivagangai and Ramnad Districts Vagai Basin:

Vaigai river originating from the western ghats in Theni District passes through the districts of Madurai, Sivagangaii and Ramathapuram and its basin spreads over to the adjoining district of Dindigul and Virudhunagar also. The basin gets rains during Southwest and Northeast Monsoon besides the flows through inter basin transfer from Mullai Periyar dam across the west flowing river namely Periyaru in Kerala State. This basin is having water potential deficit to meet out the present demand and hence require measures for drought mitigation as well as flood mitigation measures like flood embankment, flood wall and re-grading the river in the downstream districts of Madurai, Sivagangaii and Ramanathapuram to protect the urban areas and agricultural lands from flooding.

In order to minimize the flood risk below Vaigai dam in Vaigai river basin, a project is being implemented for diverting the portion of surplus water for the irrigation facilities to 58 villages in Madurai District at Rs.86.5 crore. The renovation and Regradation of Gundar River from Sowdarpatti Anicut to Thirali Anicut is in progress at a cost of Rs.3 crore in order to minimise the inundation of the residential areas in the villages along the banks of the river in Thirumangalam Taluk.

In order to minimize the flood risk below Vaigai dam in Vaigai river basin a project is being implemented for diverting the inflows of Vaigai dam by extending the 18th canal upto Koovalingaaru at a cost of Rs.48 crore. Construction of retaining wall to strengthen the banks of Varaganathi River to avoid flood damages in Periyakulam town limits at an estimated cost of Rs.15.00 crore is also in progress. In order to minimize the flood risk as well as to recharge the ground water potential a check dam across Vaigai river in Thirupuvanam Town Panchayat is in progress at a cost of Rs.10 crore.

Pambar – Kottakaraiyar Basin

Construction of an Anicut across Palar river to feed Rettaikulam tank and other tanks in Mellur Taluk of Madurai District is in progress at a cost of Rs.2.95 crore to mitigate risks due to flood as well as drought. Construction of an Anicut across Palar river to feed Perumal tank and other tanks in Tirupathur Taluk of Sivagangai District is in progress at a cost of Rs.2.5 crore to mitigate risks due to flood as well as drought.

Gundar Basin

The Renovation and Regradation of Therkkar River from Melakottai Anicut to Kambikudi Anicut in Thirumangalam Taluk of Madurai District is in progress at a cost of Rs.3.36 crore in order to minimise the inundation of the residential areas in the villages along the banks of the river in Thirumangalam Taluk. In order to minimise flood risk in Vilathikulam taluk formation of flood carrier from Kanjampatti odai in Thoothukudi district to feed Sayalkudi tank and other tanks in the drought prone Kamuthi and Kadaladi taluks of **Ramanathapuram District** is in progress at an estimated cost of Rs.18 crore.

iv. Flood Mitigation In Virudhunagar, Thoothukudi, Thirunelveli and Kanyakumari Districts

The Districts namely Virudhunagar, Thoothukudi, Thirunelveli and Kanyakumari which are in the southern part of Tamil Nadu are having comparatively smaller river basins viz., Vaippar, Kallar (Korampallam) Thamirabarani,

Nambiyar and Kodaiyar. These river basins lie in between the Western Ghats on the West and gulf of Mannar, Indian Oceans on the east and south. The rivers namely, Vaippar, Kallar (Korampallam) Thamirabarani with their tributaries / distributaries like Chittar, Gadana, Ramanadhi and Manimutharu and Nambiyar, Hanumanadhi, Pzhayaru, Valliar and Kodaiyar are flowing through the basins. Though, these basins of the above districts, benefit during both the north east and south west monsoons, the areas are prone to floods as well as to drought. The following schemes are under progress and are being contemplated to mitigate the risk during floods and droughts.

Vaippar Basin

Construction of an Anicut across Koswhikanadhi river to feed Kaalaperumalpatti tank and other tanks in Virudhunagar Taluk is in progress at a cost of Rs.3.5 crore to mitigate risks due to flood as well as drought. In order to hold excess water to reduce risk during floods and droughts as well as to recharge the ground water rehabilitation and restoration of 22 nos. of minor irrigation tanks in areas of Virudhunagar district, where ground water is over exploited, are proposed to be taken up an estimated cost of Rs.12.88 crores.

Thamirabarani River Basin

In order to avoid flood damages in the rural areas of Thirunelveli and Thoothukudi Districts in Thamirabarani basin and also to enhance the livelihood of drought prone areas of Thirunelveli and Thoothukudi Districts Thamiraparani – Karumeniyar – Nambiyar Rivers Link project is under progress for diverting the excess flows in Thamirabarani basin to the water deficient Karumeniyar and Nambiyar basin as detailed below.

Inter-linking of Thambraparani Karumeniyar and Nambiyar rivers by excavating a new flood Carrier Canal for 75.175 km from LS 6.5 km of existing Kannadian channel near Vellankuzhi Village to M.L. Theri near Thisayanvilai to utilize 2,765 Mcft. of surplus water is being implemented. This scheme involves four stages of work viz., of which the works in stage I and II are in progress. The total estimated cost of the project is Rs. 872.45 crore.

To improve the efficiency of the irrigation systems in all the river basin, rehabilitation of irrigation channels, tanks, cross masonry structures and control arrangements will be taken up under the schemes TNIAMP (IAMWARM II), revived Kudimaramath scheme and the scheme for supplying earth to farmers at free of cost as per G.O. Ms. No. 50. In order to reduce flood risk in the coastal villages of Srivaikundam Taluk as well as to arrest sea water incursion construction of check dam across Thamirabarain river near Serndamangalam Village (Mukkani) of Thoothukudi District is in progress at a cost of Rs.25.75 crores.

Nambiyar Basin

In order to reduce flood risk as well as to augment ground water potential checkdam across Nambiyar river at Thiruvambalapuram Village in Radhapuram Taluk is proposed to be taken up at a cost of Rs.4 crore.

Kodayar Basin

To minimise flood risk, protection to the side banks of Chunkan Odai in Kanyakumari and improvements to Erappaiyar to feed Poigai dam is in progress at a cost of Rs.3.25 crore.

v) Interlinking of River basins

River interlinking proposal is under investigation for diverting the flood flows in Cauvery River to the drought prone Agniyar, South Vellar, Manimuthar and Gundar River basins so as to reduce the flooding problems in **Nagapattinam**

and Thiruvarur Districts and to stabilise irrigation potential in the drought prone areas of **Pudukottai, Ramnad, Sivagangaii and Virudhunagar Districts** during drought conditions.

Cauvery – Agniyar – South Vellar – Manimuthar – Vaigai- Gundar link is one of the links envisaged in the Feasibility Report prepared for "Peninsular River link" by the National Water Development Agency (NWDA) of Government of India. In the 1st phase of the scheme, the construction of a Barrage across River Cauvery near Mayanur has been completed. In the 2nd phase, a new canal taking off from the upstream of this barrage has been proposed to connect the Agniyar, South Vellar, Manimuthur, Vaigai and Gundar Rivers. Detailed Project Report for the work of "Excavation of link canal from South Vellar to Gundar River" at an estimated cost of Rs. 7840.87 crore is under consideration.

Similarly, another intra-linking river proposal for diverting the excess flows in Cauvery river from Mettur to the drought prone areas in the **Districts of Salem, Namakkal, Perambalur** is under preparation as detailed below.

Cauvery (Mettur dam) – Sarabanga – Thirumanimuthar – Ayyar link. This scheme envisages diversion of a portion of surplus water of Cauvery River to the **Districts of Salem, Namakkal, Perambalur and Thiruchirappalli** by excavating a new canal. The proposed length of canal is 169.400 km which will take off from the foreshore area of Mettur dam at FRL level and will link Sarabanga, Thirumanimuthar and Ayyar rivers which are all tributaries of the River Cauvery. As Phase-I of this scheme, a preliminary Detailed Project Report for the work of "Excavation of link canal for a length of 132.305 km from Mettur dam to Pavithram tank" has been prepared at an estimated cost of Rs.6800.00 crore for implementing in 5 stages. The investigation works for the Phase II work of "Excavation of link canal from Pavithram tank to Ayyar River" are in progress.

vi) Augmenting Storage Capacities of Water Bodies

In response to the extremely severe drought, the Government of Tamil Nadu, inter alia has brought in a major policy change in the management of mineral resources linked to the water bodies in the State. Accordingly the rule 12 (2) and 12 12 (2-A) (a) of the Tamil Nadu Minor Minerals Concession Rules, 1959 have been amended. The new policy enunciated in **GO Ms. No. 50 Industries (MMC1) Department dated 27-4-2017** has enabled the farmers remove the tank silt, free of cost for application on their fields. Within a period of six months 5.4 Crore cubic metre of tank silt has been removed from 33000 tanks benefitting nearly 5 lakh farmers who have applied the tank silt on their fields. The massive desiltation exercise throughout the State, (except in the districts of Chennai, Thiruvallur and Kancheepuram) has enhanced the water holding capacity of these water bodies by about 1.8 TMC. In addition, the removal of tank silt will accelerate the ground water recharge rates &increase the agricultural production as well as enhance the drinking water availability in the State. This continuing exercise of massive desiltation will aid in flood mitigation on the one hand and ensure drought proofing on the other. **The desilting programme will be continued and extended to cover all the remaining water bodies.**

vii) Kudimaramathu

The Kudimaramathu scheme in which PWD tanks are strengthened & desilted, paves the way for the people's participation and creates a sense of ownership in the community besides serving the

purpose of Flood Control, Drought Mitigation and Ground Water recharge and improved on-farm water management. An allocation of Rs.100 Cores was provided for the scheme in 2016-17 and is enhanced to Rs.300 Crore during 2017-18.

viii) Utilisation of abandoned quarry site as "Water Storage Structures" to mitigate Floods

Tamil Nadu, which is endowed with Major & Minor mineral resources such as Granite & Blue Metal, has over the years extracted the minerals and in many locations the metal/granite stone have been commercially extracted fully & the quarry sites have been abandoned. These abandoned quarry sites which are 15 to 40 metres deep and old significant quantities of water. A few sites are being utilized now by the Government as water storage structures, to tide over the worst drought known in the recorded history of Tamil Nadu, especially to meet the drinking water needs of Greater Chennai Corporation (GCC).

It has been decided by the Government of Tamil Nadu to assess the flood mitigation potential of the abandoned quarry sites available throughout the State. Based on a detailed survey 1,188 no. of quarry sites have been identified in the State of which 112 were operated by Government and 1,076 were operated by private. Arrangements will be made to create leading channels to divert rain water/surplus waters from Reservoirs/Dams, Tanks into the quarry site to avoid flooding of low lying areas. The above arrangements will be further strengthened in the years to come by deepening all the quarry sites further to convert them into deep water storage structures and help in flood mitigation.

ix) Removal of Encroachments:

The problems of flooding in several locations is due to the structural anthropogenic interventions which obliterate the existence width of the water ways, constrict the water ways and I some locations eve block the water ways. The structural interventions are due to the authorized construction of public buildings in the ester years as well as due to illegal encroachments by people of different strata. Removable of the encroachments and the relocation of the authorized structure plays a very important role in maintaining the integrity of the water ways and minimise the risks due to floods. The Government of Tamil Nadu will launch a special drive to remove the encroachments on a priority basis in all water bodies and water ways.

In cases were the matter is subjudice necessary clearances will be obtained from the Hon'ble courts.After securing clearance from the judiciary, a massive drive has been launched to remove the encroachments in Adayar, Kosathalaiyar Coovam, Kovalam and other river basins. The district administration will be according high priority for removal of the encroachments in the water ways and water bodies.

II (a) Drought Mitigation

Tamil Nadu is exposed to the risks of drought at regular intervals due to a combination of several factors, the notable being its geographical location which makes it dependent on upstream riparian States. Vagaries of monsoon as wells as sea water incursion, anthropogenic interventions such as indiscriminate exploitation of ground water resources, unscientific land use practices as well as damages to the forest, wet land and water body

eco-systems are other factors. Major areas of Tamil Nadu fall under rain shadow region of the Western Ghats and do not benefit from the Southwest Monsoon. Northeast Monsoon is associated with cyclones and low pressure in the East Coast and benefits the State along the east coast with its short duration high-intensity rains. A major part of Tamil Nadu always experiences Water Stress/Scarcity during most part of the year. Drought Mitigation has, therefore, become a continuous process in the context of vagaries of the monsoon and ever increasing dependence on already over exploited groundwater resources. Though all the districts are subject to periodic droughts most of the non-coastal districts and some coastal districts are more susceptible to the vagaries of the monsoon. Comprehensive drought mitigation will be taken up to drought proof **Ramanathapuram, Sivagangai, Perambalur, Virudhunagar, Dharmapuri, Dindigul, Namakkal and Ariyalur Districts in the coming years.**

In order to overcome the current drought risk profile of Tamil Nadu, the following measures are contemplated.

1. Augmenting Storage Capacities of Water Bodies through Desilting – G.O Ms No 50
2. Kudimaramathu
3. Integrated Watershed Development
4. Mission for Sustainable Dry Land Farming
5. Rainfed Area Development
6. Irrigated Agriculture Modernisation Project
7. Micro Irrigation under PMKSY - More Crop Per Drop
8. Special area development programme
9. Soil & water conservation in catchment of River Valley Project
10. MGNREGS
11. Tamil Nadu Village Habitations Improvement Scheme
12. Integration of Disaster Mitigation Measures in Village Panchayat Development Plan
13. Sustainable Water Security Mission
14. Conveyance of drinking water through closed conduit system
15. Utilisation of abandoned quarry site as “Water Storage Structures”
16. Programme for protection from sea water incursion

Integrated Watershed Management project

This scheme aims to promote balanced use of Natural Resources through Watershed approach. The various soil moisture conservation and water harvesting strategies of the Integrated Watershed Management project serve the purpose of drought proofing rain-fed agriculture, provide irrigation during critical periods of crop growth thus preventing crop failure and also facilitate recharge of groundwater. Integrated Watershed Management project is being implemented at a cost of Rs.781.731 crores in 26 districts through 24 DWDAs covering 2770 watersheds. The IWDP will be dovetailed with the MGNREGS in the years to come and is expected to improve the soil moisture regime, runoff management, water harvesting and land use.

Mission on Sustainable Dry Land Farming

The Mission on Sustainable Dry Land Agriculture (MSDA), focuses on improving the production and productivity of millets, pulses, oilseeds and cotton in an extent of around 25 Lakh Acre of dryland in a phased manner from 2016-17 to 2019-20, for which an amount of Rs.802.90

Crore has been sanctioned. The programme is being implemented on a cluster approach with participation of farmers and the major activities include water harvesting structures, adoption of new agronomical interventions, value addition to fetch remunerative returns to the dry land farmers. It is proposed to establish 1000 dry land clusters of 1000 Ha. each, during the project period of four years with Primary Agricultural Credit Cooperative Societies as the focal unit for each cluster. Cluster-wise Crop area has been identified and the Cluster Development Team and Block Level Team have been formed to take up the following activities:

i. Financial assistance will be extended to the entry point activities like creation of water harvesting structures viz., Farm ponds, Percolation ponds, community ponds and check dams.

ii. Financial assistance for Land development activities viz., summer ploughing.

iii. Agronomical assistance at 50% subsidy will be extended for distribution of short duration, drought-resistant seeds of Pulses, Millets, Oilseeds and Cotton.

iv. Each nodal Primary Agricultural Cooperative Credit Societies will extend credit for setting up Micro Enterprises such as Mini Dhal Mill, Oil expellers and Millet processing units. Financial assistance will also be extended to Farmer Producers Organisation or Farmers Club for establishing Mini Dhal Mills, Oil Expellers, Millet Processing Units, sales outlets, packaging and branding of products so as to enhance the livelihood opportunities of the small and marginal farmers.

v. Unemployed rural youth will be encouraged by providing assistance with 80% subsidy per cluster for creating custom hiring centres.

Rainfed Area Development (RAD)

Integrated Farming System (IFS) with emphasis on multi-tier cropping, rotational cropping, inter-cropping, mixed-cropping practices with allied activities like horticulture, livestock, fishery, agro-forestry, apiculture, conservation/ promotion of NTFPs etc. is recommended to enable farmers not only in maximizing farm returns for sustaining livelihood, but also to mitigate impacts of drought, flood or other extreme weather events. Rainfed Area Development under National Mission for Sustainable Agriculture will be implemented with a sharing pattern of 60:40 between Centre and State.

Irrigated Agricultural Modernisation Project

Tamil Nadu Irrigated Agricultural Modernisation Project is a massive effort which will serve Flood & Drought Mitigation together with its major component of rehabilitation of water bodies. The project also promotes water conservation/ management through Micro Irrigation, Agriculture, Horticulture and Animal Husbandry Fisheries components. The IAMWARM Project II is will be taken up in the remaining 66 sub-basins of the State covering 30 Districts to benefit an extent of 5.43 lakh hectare over a period of 7 years starting from 2017 with an outlay of Rs. 3,042 Crore. The Project will take up rehabilitation of 4,778 Tanks and 477 Anicuts, construction of Check Dams, Artificial Recharge Wells in water spread area of tanks and improving drainage cum irrigation channels in Cauvery Delta and other sub-basins. The concomitant benefits due to the synergy of convergence are expected to mitigate drought as well as to serve the flood control purposes.

Micro Irrigation

Considering the importance of water saving interventions, Tamil Nadu is the first State in the entire country to provide 100% subsidy for small

and marginal farmers and 75% for other farmers for adoption of micro irrigation systems. Micro Irrigation Scheme is implemented under "Pradhan Mantri Krishi Sinchayee Yojana (PMKSY)" for both Horticultural and Agricultural Crops. Various agricultural crops like red gram, cotton, sugarcane, maize, coconut and oil palm are covered under micro-irrigation. During the year 2017-18, a sum of Rs.800.00 Crore has been allocated for the State, out of which a sum of Rs.400.00 Crore has been allotted to cover agriculture crops in an area of 71,880 hectares and Rs.400 crores has been sanctioned to cover Horticultural crops in an area of 65,820 hectares.

Special Area Development Programme

In order to provide special attention to hill areas and to the forest fringe villages of Western Ghat areas, State Government have formulated a new scheme called Special Area Development Programme. The main objective of the programme is eco-restoration, eco-protection and eco-development and conservation by adopting an integrated watershed approach in a holistic manner for sustainable livelihood and enhancing agricultural productivity. The soil and water conservation measures are taken up for individual-based works, with 90 percent subsidy and 10 percent contribution for ST category and 80 percent subsidy and 20 percent contribution for SC category and 50 percent subsidy and 50 percent contribution for other category farmers. Community-based works are carried out with 100 percent Government funding. The Agricultural Engineering Department will take up Soil and Water conservation measures like Gully plugs, Percolation ponds, Silt detention tanks, Gabion check structures and Landslide treatment-related works in this scheme.

Soil and Water Conservation in the Catchments of River Valley Projects:

In Tamil Nadu, the Centrally sponsored scheme of River Valley Project is being implemented in South Pennaiyar and Mettur catchments in Dharmapuri, Krishnagiri and Erode districts under the National Agriculture Development Programme from 2013-14 onwards. Soil and water conservation measures such as Contour bunding, Land development activities, Drainage line treatments, Silt detention structures, Water harvesting structures, Support to farm production system, Livelihood support system and Tree plantation are taken up in the catchment areas. The soil and water conservation measures are taken up at Government cost in common lands with and the works in individual farmers land are executed with 50 percent farmer's contribution.

MGNREGS

The MGNREGS serves in multiple ways for drought proofing as well as for flood prevention. The Farm ponds and Percolation Ponds taken up under MGNREGS help to conserve water and aid in water harvesting. The construction, repair of canals, diversion drains, feeder channels, etc. help to stabilise irrigation under tanks systems. The afforestation (including plantation / necessary) provides drought proofing and moderates heat waves. The MGNREGS will be judiciously utilised to reduce the adverse impacts of droughts.

Tamil Nadu Village Habitations Improvement Scheme (THAI – II)

With the aim to provide basic infrastructure facilities in rural areas, the THAI Scheme has been extended for another five years from 2016-17 to 2020-21, with an annual allocation of Rs. 750.00 crore from State funds. The scheme will take up Rehabilitation of Minor Irrigation Tanks, basic infrastructures and amenities including road and Water Supply, This scheme will be implemented

in all Village Panchayats with an annual allocation of Rs.750.00 crores. This will enhance the storage of capacity water bodies in rural areas provide drinking water security to the Village and improve the logistics for the relief and rescue operations during floods.

Augmentation of Water Storage in Soil Profile, Surface & Sub Surface

By mainstreaming the risk concerns of drought, Flood, soil erosion, landslides into different development project, the emphasis of the projects will be on insitu Soil Moisture Conservation (SMC), recharge of groundwater aquifers by rain water harvesting and through farm ponds on watershed basis, run off management to prevent soil erosion as well as improvement of water ways to ensure free drainage (Water flow management), Artificial recharge of ground water through recharge shafts, conservation of defunct borewells, Rain Water Harvesting in residential, commercial & public buildings and institutions and Watersheds. Besides mainstreaming the risk concerns, the project will take in to account the special needs of areas that have already been identified as vulnerable to promote integrated development of vulnerable areas in the coming years, to enhance risk resilience as well as social inclusion.

Promotion of Water Conserving Technologies

Promotion of Water Conservation technologies like micro irrigation (Drip / Sprinkler) will be taken up and propagated widely for reducing the water demand from the irrigated agriculture. The projects like PMKSY 'More Crop per Drop' component, IAMP will be mainstreamed to reduce the water stress / scarcity situations of the most drought prone areas by encouraging use of Rain guns, Portable Sprinklers, Mini sprinklers, etc.

New technologies such as "Water Conserving Root Zone Irrigation Technique" developed and introduced by a Senior Civil Servant of Government of Tamil Nadu will be adopted widely in the tree planting programmes/Agriculture (coconut & oil seeds) and Horticulture (Tree crops + Climbers and medicinal plants) as well as by the farmers in their fields. The simple inexpensive technology will promote water conservation as well as accelerate growth of tree crops and climbers to increase the productivity of crops.

GoTN allocates in the order of more than Rs 800 crores annually for propagation of Micro Irrigation and this allocation will be enhanced in the years to come.

Propagation of Water Conserving Agronomic practises

The Government of Tamil Nadu have accorded the highest priority to adopt water conserving practice across the State. The System of Rice Intensification (SRI) and the Sustainable Sugarcane Initiative (SSI) and the Raised Beds and Furrow System (RBFS) under rainfed agriculture and concepts of deep ploughing, Contour Ploughing, Zero Tillage, Mulching Low Input Sustainable Agriculture Systems and Inter cropping, relay cropping etc., are being widely popularised to minimise the water requirements both under irrigated/rain fed agriculture. The Government of Tamil Nadu will continue to extend economic incentives to the farmers for adoption of these Water Conserving Agronomic practices.

Shift to Alternate Cropping System

In order to find alternate solutions for managing the water stress without compromising on the livelihoods of the farmers the Government of Tamil Nadu encourages the farmers by providing technology, inputs and financial support for

shifting to less water consuming crops like Pulses, Millets, Oil Seeds, Perennial Horticultural Crops from water guzzling crops like Paddy, Banana and Sugarcane. The assistance by Government will also cover, support for value addition to the producers by establishing post harvest and processing facilities & incentives for establishing such facilities by Farmer Producers Organisations.

Afforestation

The Government of Tamil Nadu in its continued effort to increase the green cover in the State promotes planting of trees in Government lands, along the roads and individual farms, residential areas etc. to prevent heat waves during droughts. The afforestation will be taken up through the MGNREGS and other State initiatives under Agriculture/Horticulture/Animal Husbandry/ Forest programmes.

Drought Tolerant Crop Varieties

The Tamil Nadu Agriculture University (TNAU) will be encouraged to continue research efforts for evolving drought tolerant crop varieties to withstand the moisture stress arising from severe drought and vagaries of monsoon induced by climate impact. The TNAU will also be encouraged to popularise drought tolerant crop varieties evolved by the Indian Council of Agricultural Research.

Tiding over fodder crisis

Tamil Nadu faces acute fodder shortage during periods of drought and consequently the cattle are put to hardship. To avoid the distress sale of cattle by farmers due to severe drought situation the Government of Tamil Nadu takes special effort for augmenting green fodder protection besides establishing dry fodder depots across the State. In order to protect the cattle which become me vulnerable to mineral deficiencies that adversely affects the milk production, general health and their reproductive life, the Government provides mineral mixture to the milch cow for a period of 2 months. This special care will continue to be provided to protect the cattle during periods of drought. In order to ensure fodder availability during crisis as well as enhance resistance to drought, a mission mode will be adopted to popularise Azolla cultivation and low cost hydroponics for fodder cultivation. Azolla as well as the fodder grown hydroponically will increase the milk yield besides enhancing the health of livestock.

ii (b) Hydrological Drought

Tamil Nadu being a water deficient State due its geographic position relies on release of its right full share of water from other States and on the benevolence of a favourable monsoon. This situation has pushed the State to exploit ground water resources for meeting both irrigation and drinking water requirements. Vogeries of monsoon exerts tremendous pressure on drinking water supplies resulting in Ahorlages of supplies. Hydrological droughts further accentuates the depletion of ground water reeaurces due over explorationof ground water to meet drinking water requirements. In order to overcome the current situation the Government is committed to build the groundwater resources with special focus on areas to augment drinking water supplies and develop resistance to the hydrological droughts to a great extent with a clew of measures described below.

Sustainable Water Security Mission

Sustainable Water Security Mission proposes to expand and strengthen rain water harvesting by promoting campus rain water harvesting system, restoring and rejuvenating water bodies in and around Chennai city, recycling and reuse of waste water for non-potable usage and recharging water

bodies. The Greater Chennai Corporation, other Corporations in Tamil Nadu, Urban and Rural Local bodies in the State will be encouraged to adopt the best practices of the Sustainable Water Security Mission to promote Rain Water Harvesting, Solid Waste Management and Waste water recycling which helps drought & flood mitigation.

Conveyance of Drinking Water through closed Conduit System

One of the major challenges faced during the severe hydrological drought in 2017 is the risk of acute contamination while transporting water from the major reservoirs to different districts for supply of safe drinking water to urban and rural habitations. The other challenges that are faced in are evaporation and seepage losses and pilferage enroute during transmission. These problems were overcome during the severest drought faced by Tamil Nadu in 2017 by a adopting multi-pronged approach which included structural and non-structural measures by which safe drinking water could be supplied to both urban and rural habitations throughout the State with minimal disruptions to the community.

One of the salient features that stood out in management of the hydrological drought is the robustness of strategies adapted by Tamil Nadu in implementation of combined water supply schemes under which water is tapped from reservoirs / dams and river systems with copious sub surface water to meet the drinking water requirements of the burgeoning urban conglomerations as well as highly water stressed rural and semi urban pockets of the State. These schemes have played an extremely significant role to ensure adequate supply of water during the worst drought in the ever-known recorded history of Tamil Nadu. These schemes primarily rely on transmission of water through the existing irrigation canals and river courses. In very few schemes the water is transported through closed conduits.

One of the most important learning from the drought 2017 is that even one of the best Build Back Better strategies adapted by Tamil Nadu can be bettered. From this learning it has been decided that the drinking water should be transported especially to long distances and to areas which are acutely water stressed through closed conduits. The transmission of water through closed conduits is expensive but in order to ensure that the safety concerns of the people are uncompromised and to ensure better water resource management to minimise evaporation and transmission losses, the GoTN will embark upon a policy to transmit water through closed conduits in a phased manner according high priority to those areas which were highly vulnerable during the severe drought of 2017. This policy shift besides meeting the basic needs of the community will also promote public health in view of the prevention of risks due to contamination of the water during transmission.

Check Dams for Drought Mitigation

In order to augment the ground water resources through artificial recharging and mitigate drought situation the following works for augmenting ground water potential are proposed to be taken up. Government orders have been issued in G.O (Ms.) No. 6, Revenue (DM 3(1)) Dept., Dated 10.1.2017 for constructing sub surface reservoirs, sub surface dykes and other water conservation works at an estimated cost of Rs.25.00 crore for which 64 estimates have been prepared for Rs. 24.91 crore which are under consideration for sanction.

Construction of 28 Nos. of sub surface dykes in rivers & streams in 6 Districts namely Nagapattinam, Thanjavur, Thiruvarur, Pudukkottai, Ramanathapuram and

Thoothukudi for an amount of Rs. 3.03 crore are proposed to be taken up. Construction of Check dams in The Nilgris district for an amount of 1.37 crore are proposed to be taken up. In order to recharge the ground water and divert water from rivers to fill up tanks, it is proposed to construct new check dams, subsurface dykes and anicuts at cost of Rs. 1000 Crore in the coming years with special focus on drought prone districts.

New Storage Structures / Rehabilitation works to Mitigate Drought

A new reservoir is being formed across Marudhaiyar River in Cauvery basin in Kottarai Village of **Perambalur District** to store 211.58 Mcft of water at an estimated cost of Rs.124.20 Crores as a drought mitigation measure to enhance the livelihood of the farmers in Perambalur District.

Similarly, the new tank across a jungle stream in Lower Bhavani sub basin of Cauvery river basin near Kanakkampalayam village in Gobichettipalayam taluk in **Erode district** and a percolation pond across Kannimaroadi in Kodaganar sub basin of Cauvery basin near Komberipatti Village of Vedasanthur taluk in **Dindigul district** are proposed to be formed at an estimated cost of Rs.66.50 Crores to enhance the livelihood of the farmers in the drought prone areas. In order to hold excess water to reduce risk during floods and drought as well as to recharge the ground water rehabilitation and restoration of 9 nos. of ex-zamin tanks are proposed to be taken up in **Ramanathapuram District** at an estimated cost of Rs.2.18 crores.

Formation of Sub-surface storage structures by Desilting the tank deeply below sill level

Most of the PWD Tanks are cone shaped and their depth will be about 1-2 metres, the water upto sill level flows by gravity when released for irrigation. The capacity of these tanks will be enhanced by more than 2 to 3 times by desilting the tanks even below the sill level and also deepening the foreshore area to form cylindrical structures. The deepening will help to store more water, recharge the ground water and also help in flood mitigation. 34 Nos. of sub-surface storage structures will be formed by desilting the tank deeply below the sill level in Greater Chennai Area and in the Districts of Coimbatore, Dindigul, Erode, Madurai, Tiruppur and Virudhunagar at a cost of Rs.20.51 crore.

Utilisation of abandoned quarry site as "Water Storage Structures" to mitigate Drought

Tamil Nadu, which is endowed with Major & Minor mineral resources such as Granite & Blue Metal, has over the years extracted the minerals and in many locations the metal/granite stone have been commercially extracted & the quarry sites have been abandoned. These abandoned quarry sites which are 15 to 40 metres deep and some sites covering an extent of 50 hectares are now being utilized as water storage structures, to tide over the worst drought, known in the recorded history of Tamil Nadu, especially to meet the drinking water needs of Greater Chennai Corporation (GCC). The Chennai Metropolitan Water Supply and Sewerage Board (CMWSSB) has utilized the water available in the quarry sites in Sikkarayapuram, after treatment to meet the requirement of GCC area. The supplies from these quarry sites proved extremely helpful during the crisis period.

It has been decided by the Government of Tamil Nadu to assess the potential of the abandoned quarry sites available throughout the State. Based on a detailed survey 1,188 no. of quarry sites have been identified in the State of which 112 were operated by Government and 1,076 were operated

by private. Arrangements are being made to create leading channels to divert rain water/surplus waters from reservoir/Dams, Tanks into the quarry site. The water stored will be utilized for meeting the drinking water requirement based on suitability. The water from sites which are unsuitable for drinking water will be utilized for irrigation purposes. The above arrangements will be further strengthened in the years to come by deepening all the quarry sites further for converting them for water harvesting and to act as deep water storage structures.

In addition to the several mitigation measures under implementation as well as under contemplation in Cuddalore District, in order to reduce the impacts of floods about 1300 acres of land has been identified which will be converted into a deep water storage structure for flood mitigation as well as to meet the drinking water requirements of Chennai. In addition, the Neyveli lignite corporation which will be completing its mining operations in Mines I in 2028 has agreed to convert Mines I into a water storage structure. The proposed deep water storage structure and the mines I on conversion as water storage structure will contribute significantly to reduce the risks of floods in the Paravanar Region. It is also proposed to deepen the Perumal Eri and Walajah Tank to enhance their storage capacity and aid in drought mitigation as well as augmenting the irrigation system, stabilize the existing ayacut, expand the ayacut area so as to enhance the income levels of the farmers as well as livelihood opportunities for the landless.

Augmenting Storage Capacities of Water Bodies for Drought Mitigation

In response to the extremely severe drought, the Government of Tamil Nadu inter alia has brought in a major policy change in the management of mineral resources linked to the water bodies in the State. Accordingly the rule 12 (2) and 12 12 (2-A) (a) of the Tamil Nadu Minor Minerals Concession Rules, 1959 have been amended. The new policy enunciated in **GO Ms. No. 50 Industries (MMC1) Department dated 27-4-2017** has enabled the farmers to remove the tank silt, free of cost for application on their fields. Within a period of six months 5.4 Crore cubic metre of tank silt has been removed from 33000 tanks benefitting nearly 5 lakh farmers who have applied the tank silt on their fields. The massive desiltation exercise throughout the State, (except in the districts of Chennai, Thiruvallur and Kancheepuram) has enhanced the water holding capacity of these water bodies by about 1.8 TMC. In addition the removal of tank silt will accelerate the ground water recharge rates &increase the agricultural production as well as enhance the drinking water availability in the State. The application of silt in agricultural field enhances soil health and moisture levels as well as water retention capacity and increases productivity and production at a reduced cost of cultivation due to reduction in consumption of chemical fertilisers. This continuing exercise of massive desiltation will aid in flood mitigation on one hand and ensure drought proofing on the other. **The desilting programme will be continued and extended to cover all the remaining water bodies.**

iii) Sea Water Incursion Mitigation

Seawater ingression impacts the ecosystems that are very rich in biodiversity and provide valuable ecosystem services. The ingressed seawater renders agricultural lands unfit for cultivation, besides affecting drinking water. Climate change and the resultant sea level rise, changing precipitation regimes and increased groundwater demand all have a significant

influence on saltwater intrusion. The problem of seawater incursion is more pronounced in the delta districts and in the Greater Chennai Corporation and its neighbourhood. All coastal habitations are under constant sea water incursion threat.

In order to arrest, reverse and prevent incursion both structural and non-structural measures will be implemented. The following structural interventions are proposed to prevent the intrusion of seawater into coastal aquifers. Check dams/Bed dams help to store the Freshwater on the upstream side which acts as a buffer storage of rainwater, help to recharge the groundwater and thereby prevent seawater intrusion. Sub-surface Barriers (Dykes) will be constructed across the stream courses to serve as impermeable subsurface barriers, where sandy or porous soil columns are available to hold water below ground. These barriers will prevent the subsurface flow of groundwater and maintain freshwater columns in the surface layers.

Recharge shafts will be installed to recharge groundwater at an enhanced rate. Fresh water entering into the aquifer will help to prevent the intrusion of seawater at the subsurface level. The project is proposed to be implemented by the Agricultural Engineering Department, in 10 Coastal districts at a total cost of Rs. 265.00 Crore. The Tamil Nadu Water Supply and Drainage Board has also prepared a proposal that would cost Rs.800.00 Crore. This climate resilience hydraulic infrastructure will reduce the sea water incursion problems and consequently drinking water problems and salinity of agriculture lands will also be controlled in all the coastal Districts.

iv) Land Slides

The downward movement of consolidated and unconsolidated soils, rock matter of any geomorphic features due to natural or man-made causes results in landslide. Excess rains make the rock and soil loose as well as mobile resulting in landslides causing breaches of infrastructure, blockage of road ways, destruction of properties and loss of lives. Construction of road and rail net works in the hill terrains causes disturbances in the geomorphic features making them susceptible to landslides especially during the monsoon months.

The problem of landslides of late, is becoming a recurring problem in Nigiris district and sporadic in Dindigul (Kodaikanal) Theni (Megamalai) and Salem (Yercad) districts. Landslides cause a devastating effect on human life, livelihood systems, transport, health and public and private infrastructure and loss of lives The process of relief, recovery and rehabilitation have to be carried out in severe weather conditions and during torrential rains.

In order to mitigate the problems of landslides in Nilgiris District and pockets of Dindigul, Theni, Salem, Namakkal, Vellore, Villupuram and Krishnagiri District. Government has been undertaking integrated watershed programs as part of the Hill area development &Western Ghat Development, now the Special Area Development and Integrated Tribal Development programs. Under these programs risk reduction due to landslides is accorded highest priority and series of structural interventions such as revetments, check dams, drainage line treatments are being taken up besides special efforts for the vegetative treatment of the areas. The Govt of Tamil Nadu in collaboration with the Ministry of Earth Sciences and Geological Survey of India is reassessing the problem and will come out with mapping of priority Watersheds.

Prevention & Mitigation of the adverse impacts of landslides will be achieved in the years to come through both structural and non-structural measures.

The watersheds will be treated with the following structural measures.

- Prevention of Soil Erosion through masonry structures and vegetative measures
- Improvement of drainage systems of the entire watershed through River/Stream training, strengthening of embankments, to facilitate free flow of runoff.
- Stabilization of Slopes through Bio Engineering Methods
- Construction of Revetments to protect landslides along Highways and Roads
- Gabion check dams anchored with chaining and
- Ground anchor wall.

The following Non -Structural Measures will also be adopted as part of the holistic treatment of the watersheds.

1. Advance Early Warning systems.
2. Capacity Building to understand the risks and handle emergency Situations through Mock Drills
3. Land Use Regulations through Hill Area Conservation Authority

The GoTN with the support of GOI will be launching an Integrated landslide prevention programme.

v) Fire Accidents

Tamil Nadu is vulnerable to fire risk disasters and some of the districts fall in the very high risk and high-risk categories. Districts have been analyzed based on fire risk ranking by specialized groups and the analysis reveals that six districts namely Chennai, Coimbatore, Dindigul, Kancheepuram, Madurai and Thiruvallur are under the 'very high risk' category, with Cuddalore, Namakkal, Thanjavur, Tuticorin, Tiruchirapalli, Thirunelveli, Tiruppur, Vellore and Virudhunagar in the 'high risk' category. The analysis was borne out of assessing the population density, residential built-up area and Industrial areas in these districts.

In order to enhance the preparedness of the Fire & Rescue Services Department the Government have been strengthening the department by procuring modern equipment which play a significant role in dousing the fires quickly.The Fire Services Training Institutue will aslo be strengthened in the years to come to build the capacity ofpersonnel of the department as wel as act as a nodal agency for building the capacity of First Responders in colloboration with Red Cross and other NGOs.

Forest Fire

Forest fires are also a major problem in Nilgiris, Salem, Theni and Dharmapuri due to acute drought conditions, lightning and some times induced by human activities. Forest fire occurs quite frequently during summer.The conventional method of fire protection involves clearing network of fire lines, watchtowers,blocklines and guidelines. The three phases of Forest fire management viz. Pre fire (preparatory planning for fire control), during fire (fire detection,spread and control planning) and Post fire (Damage assessment and mitigation planning) need effective inputs.Understanding fire vulnerability and forest fire spread model will be accorded priority to provide sufficient data for fire control planning.Fire detection, spread and control planning are vital during fire scenario.

Forest Fire Management

Forest fire is always considered as an isolated incident until it becomes a threat to the

neighbouring private property. But every fire incident will be considered as an emergency. The regular / frontline staff of the Forest Department in the States carries out various activities of forest fire management. During fire season fire watchers are engaged by the State Governments under special provision. The conventional method of fire protection involves clearing network of fire lines, watchtowers, block lines and guide lines. The Government will strengthen the capacity of the department by providing necessary modern equipment and also by promoting involvement of multiple stakehoders,

Daily fire alert

The Fire information for Resource Management System (FIRMS) distributes Near Real-Time (NRT) active fire data within 3 hours of satellite overpass from both the Moderate Resolution Imaging Spectro-radiometer (MODIS) and the Visible Infrared Imaging Radiometer Suite (VIIRS). FIRMS Web Fire Mapper integrates Remote Sensing and GIS technologies to deliver global MODIS and VIIRS fir locations/hotspots to the natural resource managers and other stakeholders. The MODIS/VIIRS fire data provides Geo-coordinates (Latitude and Longitude), of center of pixel, Date, Time of overpass of Satellite, Satellite Name etc., for the fire spots. Geomatics Centre, Tamil Nadu Forest Department downloads these near real time data, overlay with Forest Administrative map to identify the Reserved Forest/ Beat/Range/Division. Once the beat is identified, the information is communicated to the concerned District Forest Officer, Conservator of Forests for immediate action at the field. The Government will be equipping the department with necessary technology and modern equipment to handle the forest fires.

Addressing Human Wildlife Conflict and Mitigation Measures:

In view of the increased intrusion of human habitations and encroachment in the forest areas, the Human Wildlife conflict has been on the ascendency causing serious concerns both to the conservation efforts as well as the welfare of the population living in the areas bordering the forest areas. In order to minimize the conflict the Forest department initiated measures that benefit both the wildlife and local human communities, enabling mutually beneficial co-existence. The following policy initiatives will be taken to address Human wildlife conflicts and its mitigation:

- Surveillance of vulnerable areas and monitoring of wildlife habitats.
- Mitigation measures to prevent Human wildlife conflicts
- GIS enabled information and technology driven system for monitoring of wildlife habitats to reduce human wildlife conflicts.
    - sensitizing the inhabitants and locals through modern tools and technologies.
    - Timely distribution of benefits to win confidence of people.
    - Protocols for the rescue and rehabilitation of wildlife straying out of forest areas.
    - Strengthening the veterinary services for wildlife through Rapid Response Teams and Mobile Veterinary Units.

vi) Lightning

Lightning causes catastrophic damages to human lives, livestock, communication & electronic equipment and infrastructure. Prediction of lightning as to the precise time and

location is very difficult. Injuries and fatalities happen during lightning and thunderstorm due to underestimation of risks by people and lack of awareness on safety measures to be adopted. Off late the loss of life due to lightning have increased and it is pronounced from the central part of Tamil Nadu(Trichy, Ariyalur, Perambalur etc). In view of the seriousness GoTN has declared Lightning as a Local Disaster and is providing relief from SDRF.

It is predicted that lightning will increase with the global warming and that lightning strikes would increase by about 12% for every 1 degree centigrade of global warming. Deforestation is one of the major causes of enhancing the problem, with the absence of trees making farmers and farm workers working in fields an easy target for lightning to strike. It is reported that planting of palm trees can reduce the fatalities of lightning and efforts will be made to grow more palm trees near farm fields in the years to come. The Government will initiate measures to provide special education on the do's and don'ts so as to minimize the exposure of the farmers and farm labourers to lightning.

vii) Bioshields

Natural disasters like Cyclone, Tsunami cannot be prevented, but its adverse impacts can be mitigated to a great extent by raising Bioshields along the Coast. Bioshields are barriers raised perpendicular to the direction of the wind that is capable of protecting the coastal environment by absorbing the energy from wind, tide and wave action. The coastal sand dunes formed by the action of coastal wind have been stabilized by raising shelter belts. These natural barriers act against coastal disasters and thus protect lives and properties within the coastal zone. It was observed that the intensity of Tsunami was snapped up by a belt of green vegetation and some locations in the path of the 2004 "Indian Ocean Tsunami" escaped almost without damages. Establishing shelterbelt plantations and identifying and regenerating the degraded mangroves along the coastal areas also proved to be successful in the past for tackling natural calamities.

In order to provide protection to the people living in the coastal areas, from natural calamities such as cyclone and tsunami and to reduce sea erosion and velocity of wind, Coastal shelterbelt plantations and mangrove plantations were raised and maintained by involving local people with the financial assistance from World Bank. Coastal vegetation have been found to act as buffering zone for cyclonic storm surges. Taking into account the potential of bio-shields in mitigating the risks of nature's fury, the Government will adopt an integrated approach in restoration and conservation of coastal ecosystems, to promote sustained livelihood and effective coastal protection. Coastal bio-shields besides offering long-lasting solutions are also cost effective.

The National Forest Policy, 1988 has envisaged one-third of the geographical area under forest and tree cover. While there are efforts to increase the recorded forest area in Tamil Nadu tree planting outside forest areas also needs to be implemented in a big way. Partnerships will be created with Non Governmental organizations, farming community, land owners, institutions and public so as to undertake a massive afforestation initiative outside forest areas. Economically important species are being supplied to farmlands and ecologically aesthetic species to urban areas and institutions. Tree cultivation in Private lands (TCPL) has been a major agro forestry initiative of forest department to ensure food and wood security in the State. The State funded TCPL programme has been further continued as a major component under the Tamil Nadu Biodiversity Conservation and Greening Project (TBGP). Through this

programme, fallow land available with farmers have been put to productive use. This programme not only ensures increased income to farmers in future but will also help meet future pulpwood and timber needs of the State. The Tamil Nadu Forest Department is the Nodal department to implement the Agro forestry scheme in Tamil Nadu for the projects under "Sub-mission on Agro forestry (SMAF) under National Mission for Sustainable Agriculture.

The wastelands, unused and fallow lands will be used for raising timber, fuelwood and fodder plantations through Social Forestry programme. Panchayat lands, Revenue lands and other non forest lands will be taken up for afforestation with suitable tree species under social forestry programme. Rapid population increase and urbanization have resulted in increased levels of pollution in cities, towns and the surrounding sub-urban areas. Tree plantations will be raised in the urban and surrounding areas under the Urban Forestry programmes with the objectives of controlling the adverse effects of air, water and noise pollution and improving the aesthetic appearance of these areas and create more lung spaces. The forest department will also undertake tree planting programmes along National Highways and State Highways to increase tree cover outside the forests.

Government of Tamil Nadu will launch a programme for establishing shelter belts & Bioshields along the coastal area by mainstreaming afforestation programmes of the State and MGNREGS and harnessing the support of the Community.

Agroforestry for Food and Wood Security in Tamil Nadu

Tree cultivation in Private lands (TCPL) has been a major agroforestry initiative of forest department to ensure food and wood security in the State. The State funded TCPL programme has been further continued as a major component under the Tamil Nadu Biodiversity Conservation and Greening Project (TBGP). Through this programme, fallow lands available to farmers have been put to productive use. This programme not only ensures increased income to farmers in future but will also help in preventing of soil erosion and bealized flash floods. Large scale Agroforestry programmes are launched by the Government under various schemes through the Forest, Rural Development, Agriculture, Horticulture and Municipal Administration departments.

viii) Climate Change Adaptation Programme:

Global warning and consequent climatic change will have deliterious impacts on a host of sectors and climate change induced disasters will be a major challenge for mankind in the years to come. The vulnerability is expected to be very substantial in coastal ecosystems and coastal communities requiring multi-sectoral interventions and multi stakeholder involvement. The Tamil Nadu State Action Plan on Climate Change (TNSAPCC) has identified inter alia, the following seven major vulnerable Sectors,

- Agriculture
- Water Resources
- Coastal Ecosystems
- Forest Ecosystems & Biodiversity
- Habitat – Human as well as Animal
- Health
- Public infrastructure

All the concerned line departments are using the action plan as base document for future plan formulations. The Department of Environment, Nodal Agency for implementing TNSAPCC has

submitted proposals for mitigation of climate change under the National Adaptation Fund for Climate Change(NAFCC) and the Green Climate Fund (GCF) in consultation with the National Bank for Agriculture and Rural Development (NABARD), which is the National Implementing Entity for NAFCC and GCF. In the coming years climate change adaptation will be one of the major focus areas.

National Adaptation Fund for Climate Change (NAFCC)

The Department of Environment, Nodal Agency is implementing the project "Management and rehabilitation of coastal habitats and biodiversity for Climate Change Adaptation and Sustainable Livelihood in Gulf of Mannar, Tamil Nadu" at a cost of Rs. 24.74 crores.The above project involves carrying out a baseline study to asses vulnerability to climate change of both coastal ecosystems (including biodiversity and fishery) and coastal communitiesin the Gulf of Mannar, restoration of Habitats(Coral reef and sea grass rehabilitation) in Kariyachalli and Vilanguchalli Islands.

Green Climate Fund (GCF)

The Green Climate Fund (GCF) was adopted as a financial mechanism of the UN Framework Convention on ClimateChange (UNFCCC) to assist developing countries in adaptation and mitigation practices to counter adverse effects of climate change. The Department of Environment, Nodal Agency for implementing the TNSAPCC in Tamil Nadu will be coordinating with the concerned line Departments in submitting proposals under Green Climate Fund (GCF) in consultation with the National Bank for Agriculture and Rural Development (NABARD).Presently five projects are under the consideration of funding under GCF in consultation with NABARD.

Climate Change Adaptation Programme with ADB assistance in Delta Districts namely Thanjavur, Nagapattinam & Thiruvarur:

The Vennar Sub Basin of Cauvery delta suffers from high levels of water stress, recurrent flooding and increasing risks of climate change. The Climate Change Adaptation Programme with ADB assistance in Vennar Sub Basin addresses to reduce complex climate impacts with the rehabilitation of irrigation and drainage system for safe disposal of flood waters and prevents seawater ingress by replacement of dilapidated tail-end regulators. The Climate Change Adaptation Programme in Cauvery Delta is under implementation at a cost of Rs. 1,560 crores, out of which the assistance of Rs.1,092 crores is from Asian Development Bank (ADB) and the State Share is Rs.468 crore.

Enhancing Climate Resilience in Forests

Ecosystems and associated services are sensitive to changes in climate. Forests are subject to multiple stresses. Climate change brings an additional stress that can result in serious impacts on the forests. Intermittent occurrences of drought and floods also result in an increase in soil erosion and degradation of the watershed, thereby affecting the forest cover. The effects of climate change, including the increase in temperature, changes in precipitation patterns, rising sea levels and increased frequency of weather-related anomalies will create risks for forests, wildlife, marine and terrestrial ecosystems in the State. Many of the services that forests provide may become vulnerable on account of climate change. The climate change within the Forest eco-systems will be studied. Steps will be taken to reduce the adverse impacts of climate change by ecosystem-based adaptations such as Societal adaptation to climate change by supporting communities, local knowledge and

technologies that promote conservation of forests and enhancing ecosystem resilience in landscapes and seascapes, through scientific interventions.

ix) Coastal Protection against Sea Erosion

In order to protect the coastal villages against sea erosion the following remedial measures are taken up in vulnerable areas as per the coastal management plan. Construction of groynes for protecting the coast from Sea erosion in the coastal villages namely Vembar, Veerapandianpattinam, Keelavaippar, Periyathalai and Kallamozhi in Thoothukudi District a cost of Rs. 69.49 crore. Construction of a groyne field with 10 Nos of groynes from Ernavurkuppam to Ennore of North Chennai in Thiruvallur District at a cost of Rs. 31.82 crore. Rehabilitation of the Rubble Mound Sea Wall in Eraviputhenthurai Village in Kanyakumari District at a cost of Rs.3.00 crore. Construction of Groyne at Mandaikadauputhur in Kanyakumari District at a cost of Rs. 7.82 crore will be taken up shortly. A proposal will be taken up for anti-sea erosion measures such as, construction of Groynes, RMS walls, Training wall and River training works will be taken up in Villupuram, Cuddalore, Kanyakumari, Ramanathapuram, Thoothukudi, Nagapattinam and Thanjavur Districts at a tentative cost of Rs. 4564.94 after securing approval, under the Centrally sponsored Scheme of River Management activities and works related to Border areas and Union Territories.

Protection and Restoration of Ecosystems

Ecosystems besides providing essential service of maintaining bio-geo-chemical cycles are also extremely important due to the services rendered by them in flood, drought and other disaster mitigation. All the diverse ecosystems are vital for sustainable development. Government will endeavour to restore the different ecosystems that have been damaged and restore their vibrancy.

Conservation of Coastal and Marine Ecosystems

The marine and coastal ecosystems of Tamil Nadu are of utmost importance for the overall well-being of the region including supporting activities such as fishing, shrimp farming, saltpans, shipping and tourism. The most important ecosystems are the mangroves, coral reefs, mud flats, sand dunes estuarine wetlands, salt marshes, seagrass meadows etc., Despite their immense significance, these ecosystems are being rapidly degraded as a result of high population growth, unsustainable development, over-exploitation of natural resources, loss of habitat, loss of biodiversity, pollution and climate change. Therefore, there is an urgent need to conserve, protect and restore coastal and marine ecosystems, to secure back the multiple ecosystem services rendered by them. The Government proposes to continue schemes for Protection and Conservation of important mangroves like Muthupet, Pichavaram and Ramnad, Coral Reefs and Marine life in Gulf of Mannar National Park and Gulf of Mannar Biosphere Reserve, important wetlands like Pallikaranai, Kazhuveli, Point Calimere Wildlife Sanctuary (also a Ramsar Site) during 2017-18 and the coming years.

Restoration of Green cover in Cyclone affected areas

The coastal districts of Tamil Nadu are susceptible to damages by high-intensity cyclones. The Tree cover in coastal districts is under severe stress, whenever severe cyclones strike the coast. Restoration of green cover in cyclone affected areas is undertaken by the Government both in the urban and rural areas. While restorating the tree cover priority is accorded to the native species that are known to withstand high gusting winds, along with species that have been indigenised several centuries

back. Exotic species that are easily uprooted during high winds will be avoided.

x) Conserving Wetland Ecosystems

Wetland ecosystems that are part of forests constitute an essential component of the drainage systems of the State and are one of the most productive ecosystems. Wetlands are life supporting systems that ensure the functioning of water cycle by storing water, reducing flooding, improving water quality, recharging aquifers, maintaining shorelines and preventing soil erosion. They also support a rich aquatic biodiversity by serving as prime habitats for numerous aquatic and amphibious plant and animal species. For migrating water birds, wetlands provide critical feeding, nesting and breeding habitat. Wetlands are important for fisheries, food & medicinal plants and are a major source of livelihood. They act as important carbon sinks, nutrient transformer and a repository of rich genetic material. Wetlands are also an important attribute of our cultural heritage and deeply connected with societal beliefs and practices. India is also a signatory to the Ramsar Convention on Wetlands.

With a view to secure and protect the wetlands of the State, the Government of Tamil Nadu has constituted the Tamil Nadu State Wetland Authority vide G.O. (Ms) No. 55, Environment and Forests (FR.5) Department dated 25-05-2016 with the prime aim of conservation and sustainable management of Wetlands in the State. Tamil Nadu State Wetland Authority is mandated with the task of policy development, implementing regulatory functions, capacity building, research networking, communications, awareness and raising funds for Wetland management. The total Wetland area in Tamil Nadu is about 9,02,524 Ha comprising 6.92% of the geographical area of the State. The Government of India has notified the Central Wetlands (Conservation and Management) Rules, 2010 as a significant step to conserve, manage and maintain the ecological character of the Wetlands for sustainable use of Wetlands. Central Wetland Rules 2010 require the State Government to prepare an inventory of wetlands and identify/ prioritize wetlands for notification by the Central Government. This work is in progress and will be completed shortly.

At present, there are 15 wetlands which have been notified as wildlife sanctuaries under Wildlife Protection Act, 1972 for protection of Wildlife including birds. Special priority will be accorded to restore and protect the notified as well as yet to be notified wet lands.

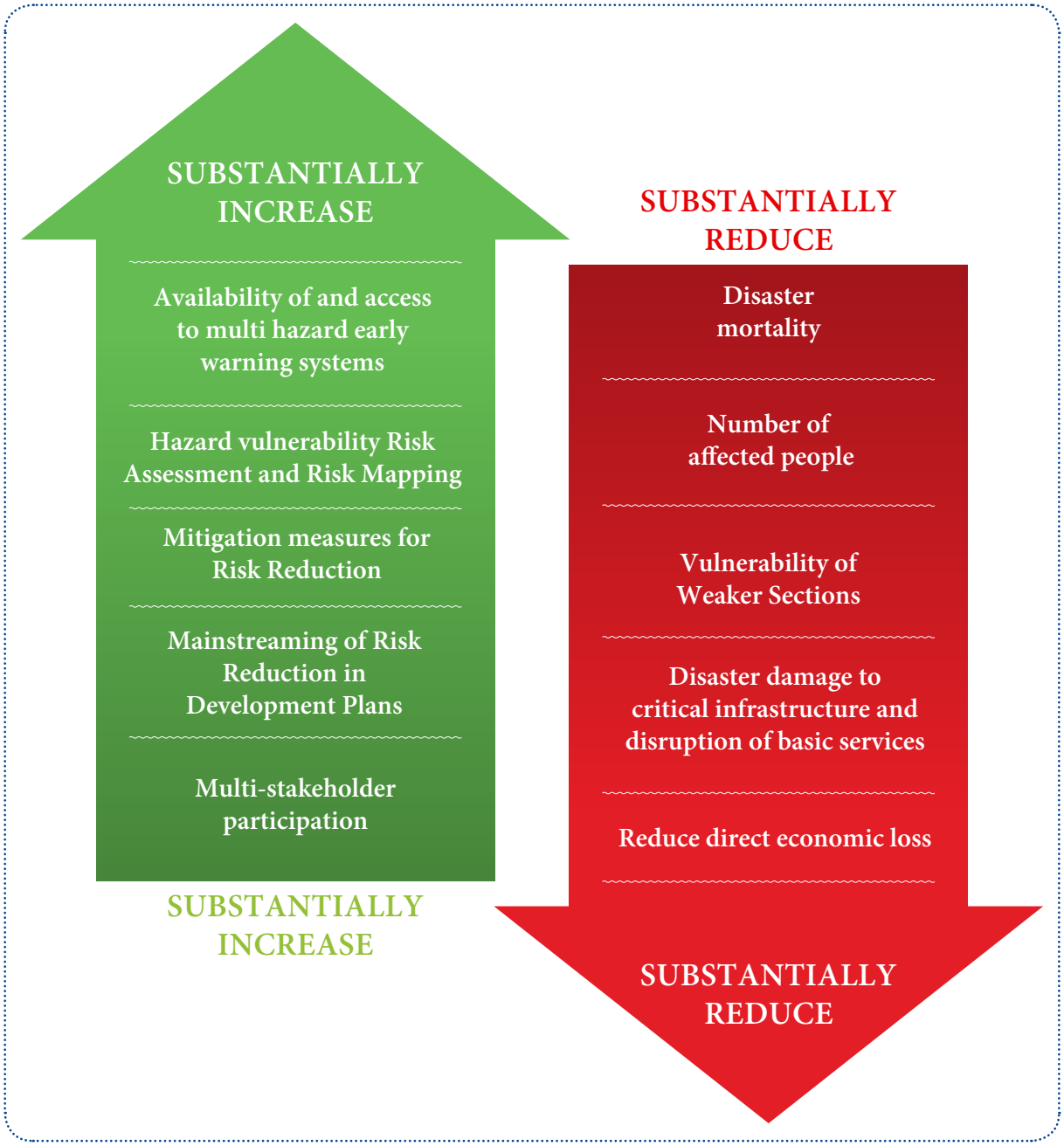
Eco-Restoration of Interface Ecosystems

The interface ecosystems are very heterogeneous and include, macrotidal estuaries, marsh lands, mangrove dominated wet lands, creeks, beach sands etc. Theses ecosystems play a vital role ecologically through the multiple services rendered by them. They also help in flood mitigation and water absorption to recharge the aquifier. The State Government is committed to protect the estuaries, wetlands, creeks & marshlands Pallikaranai Marsh Land a unique freshwater swamp located within the Chennai Metropolitan area situated in parts of Perungudi, Pallikaranai and Thoraipakkam villages of Kancheepuram districts will be reclaimed & restored. An area of 690.65 ha is under the control of Tamil Nadu Forest

Department and a comprehensive scheme will be implemented over for a period of five years from 2017-18 with an outlay of about Rs.250 crores, for taking up various restoration activities like habitat improvement, protection, research, monitoring, publicity and awareness. Conservation Authority Pallikaranai Marshland has been constituted to monitor all the activities. The Government will also launch special programmes for restoration and protection of Ennore Creek, Wet lands spread over in different Districts and the marsh lands as part of its commitment to conserve and protect different Ecosystems with focus on securing the ecosystems services of flood and drought mitigation.

xi) Integrated Development of Vulnerable Areas

Disasters can be wipe out years of development within minutes or even seconds as is the case during Tsunami and Earthquakes, within hours / days as in the case of cyclonic storms and over a prolonged period as in the case of as in the case of a creeping disaster like drought. The risks get



accentuated in view of the extreme weather events, unplanned urban development, indiscriminate over exploitation of various ecosystems. As a result disaster management is no longer the problem of Government but it has become everyone's problem. The learnings from the past do indicate that the vulnerabilities, though spread throughout State, are more pronounced in certain areas and based on legacy data 4399 areas have been identified as vulnerable in Tamil Nadu.

Risk assessment will be undertaken through multiple studies to reveal the vulnerable areas in the State to all disasters. The different technologies being used and those proposed will aim to reveal with accuracy the vulnerable areas along with the sources and causes. Taking into account the findings of the different studies, the vulnerable areas will be mapped in each river basin to unravel the interconnectedness of the identified vulnerable areas.

The focus of the systems approach and mainstreaming of risk concerns into developmental plans will be to transform the areas vulnerable to disasters. Integrated development of vulnerable areas will aim to develop resistance to disasters. However, disasters cannot be eliminated nor the intensity of disasters are predictable, as it is not uncommon to note that the forces of nature unleash their fury unheard of earlier therefore integrated development will aim to ensure resilience of the community & the State, whenever the resistance to disasters is breached. The social, political and economic vulnerabilities will be addressed as part of the efforts to promote integrated development of vulnerable areas.

Besides focusing on treatment of the entire river basin for risk reduction as part of the system approach the focus of mainstreaming disaster risk concerns into developmental plans will be on immediate measures as well as holistic and integrated development of the vulnerable areas so as to reduce the existing disaster risks over a specified period and prevent the emerging and new challenges. Plans will be developed for all the vulnerable areas, along with the entire river system in which they are located. The integrated development of the vulnerable areas will be achieved through special mitigation measures, mainstreaming disaster risk concerns into the sectoral schemes and convergence of different structural & non-structural schemes. In addition, all risk reduction strategies will accord primacy to social and financial inclusive growth. The approach besides preventing & reducing hazard exposure to vulnerability & disaster will also ensure the resilience and resistance of the community to risks through robust preparedness, preventive and mitigation strategies. The plans will be developed on completion of the different studies being undertaken.

Integration of Disaster Mitigation Measures in Village Panchayat Development Plan (VPDP)

As per the Section 240 of Tamil Nadu Panchayats Act, 1994, every Village Panchayat prepares a development plan for the Village Panchayat every year. Government of Tamil Nadu in its G.O.Ms.NO.34, RD & PR (PR-I) dated: 02.03.2016 has issued guideline for the preparation of Village Panchayat Development plan. Accordingly, every Village Panchayat needs to prepare a Perspective Five year Plan and an Annual

Plan for its holistic development covering the following sectors, though a participatory process as envisaged in the Government Order. The Village Panchayat Development Plan essentially includes.

- Drinking Water Supply
- Cleanliness and sanitation
- Infrastructure – Roads, Culverts, OHTs, Pipelines, Street Lights, Sewerage systems
- Natural Resources Management
- Disease preparedness
- Drought, Floods and disaster preparedness
- Poverty eradication, Employment generation and Social Security.

All the above measures will contribute to the mitigation of floods, drought and ensure livelihood and improve the resistance and resilience of the Village against disasters. This programme funded from the 14th Finance Commission grants has an allocation of Rs. 7,900 crores and will be implemented up to by 2019-2020. The village Panchayats will be encouraged to focus on development that promotes sustainable development and accord priority to the areas already identified as vulnerable within a village Panchayat.

Though man made hazards can be reduced, it is extremely difficult to reduce the occurrence of natural hazards. However Risk resistance and invulnerability can be achieved by focusing on the vulnerabilities and also on the area of exposure and density of the population exposed to risks through a holistic systems approach. Therefore the government will accord high priority to address the vulnerabilities in all the 4399 areas identi fied so as to convert these vulnerable areas as resilient areas in a phased manner.

The schemes discussed above are only indicative and not exhaustive. Only some of the major schemes are being described. The schemes that are being implemented currently and in the next few years as well as schemes that are likely to be implemented in the next few years alone are discussed. The schemes that will be implemented subsequently will be detailed in the Action Plans that will be prepared periodically. The current plan lays down the road map up to the year 2030. The systems approach, Integrated development of vulnerable areas mainstreaming of disaster risk concerns into developmental plans will be the corner stones of TNSDMP. All future plans will be conceived with the above three concepts providing the backbone for the disaster risk reduction efforts.

Where We want to be in 2030

Understanding Disaster Risk

- Hazard Risk & Vulnerability Assessment and Mapping for all major – Natural as well as man-made disasters.
- Big Data Analytics based Risk Assessment
- Comprehensive Flood Mitigation through appropriate interventions aided by Mapping of Flood Prone River Basins with Unmanned Aerial Vehicle (UAV)
- Integrated Coastal Zone Management Plan (ICZMP) for Village level planning
- State Data Base on Emergency Management

Strengthening Disaster Risk Governance

- Incident Response System (IRS)
- Strengthening and Capacity Building of TNDRF
- Modernisation of Fire and Rescue Services
- Inter Departmental Zonal Teams
- Multi Stakeholder Participation
- Disaster Response Guards to provide service in all vulnerable areas
- First Responders including Women in Vulnerable areas.

Investing in Disaster Risk Reduction

Structural Measures

- Flood resistant Thiruvallur, Kancheepuram, Cuddalore, Nagapattinam, Thoothukudi, Ramanathapuram and Kanyakumari Districts.
- Flood resistant Urban pockets of Chennai, Tambaram, Cuddalore&Nagapattinam Districts etc.
- Restoration and protection of fragile ecosystems
- Prevention of Sea water intrusion
- Enhanced storage of water bodies [Desilting of water bodies (G.O. Ms. No. 50) and Kudimaramathu]
- Conversion of over exploited and critical aquifers into safe categories
- Enhancement of bio-shields in coastal ecosystems
- Climate resilient Hydraulic Infrastructures
- Promotion of sustainable Agricultural practices in Rain fed areas for drought and climate mitigation.
- Integrated development of Vulnerable areas.

Non Structural Measures

- Risk Transfer (enlarging Insurance cover – PMFBY)
- Encouraging Private Participation (CSR)
- Non-structural measures (CMDA - Master Plan 2030 with Land use Regulation & Directorate of Town and Country Planning – (land use and building regulation)
- Disaster Risk Reduction to become a new norm in all projects

Enhancing Disaster Preparedness for effective response and Build Back Better

Disaster Preparedness

- Real-time Forecasting with Tamil Nadu system for Multi – Hazard Potential Impact Assessment and Emergency Response Tracking (TN - SMART)
- Chennai Flood Warning System (C-FLOWS) – a forecast based and real-time flood warning system for Chennai up to ward level
- Real Time Flood Forecasting and Spatial Decision Support System for Adyar, Cooum, Kosasthalaiyar Rivers, Kovalam Basins, other River basins in Coastal and Non Coastal Districts
- Storm Surge Model based on Geo Spatial Technology for real-time warning
- Use of Social Media, Mobile Technologies, Satellite Telephony, HF sets, NavIC, Navtex and Distress Alert Transmitters in Risk Communication

Build Back Better

- Coastal Disaster Risk Reduction Project (CDRRP)
- Multi Purpose Evacuation Shelters (MPES)
- Multi Hazard Resistant Houses
- Chief Minister's Solar Powered Green House Scheme (CMSPGHS)
- Tamil Nadu Irrigated Agriculture Modernisation Project (TNIAMP)
- Climate Change Adaptation Programme with ADB assistance in Delta Districts viz., Thanjavur, Nagaapattinam and Thiruvarur
- Sustainable Mission for Dryland Agriculture.

INDICATIVE TIMELINES FOR DISASTER RISK REDUCTION MEASURES

SL. No	Disaster Risk Reduction Measures	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
1	**Understanding Disaster Risk - Priority I of Sendai Framework**													
1.1	Hazard Vulnerability Risk Assessment (Systems approach)													
1.2	Digital Risk Mapping in Public domain													
1.3	Storm Surge model for coastal areas													
1.4	Digital Elevation Model for areas of Very High & High Vulnerability													
1.5	State Database on Emergency Management													
1.6	Big data analytics to strengthen multihazard disaster risk assessment													
1.7	ICT Based Disaster Knowledge and information transfer system													
1.8	Strengthening of Post Disaster Disease Surveillance Systems													

INDICATIVE TIMELINES FOR DISASTER RISK REDUCTION MEASURES

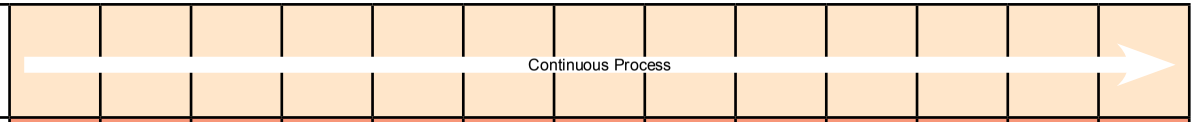
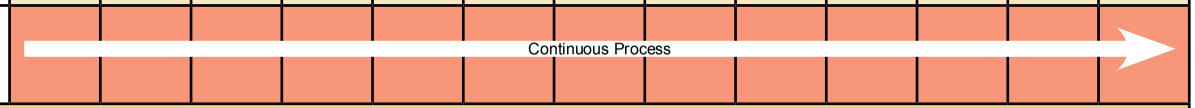
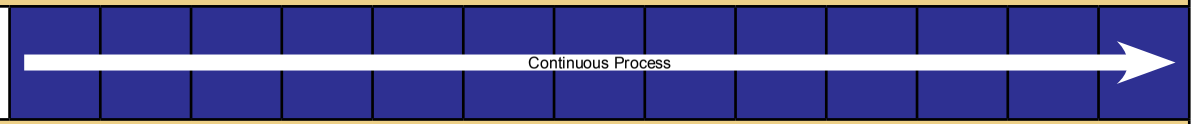
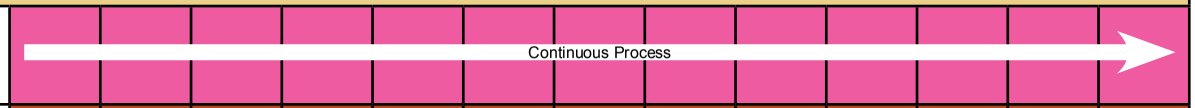
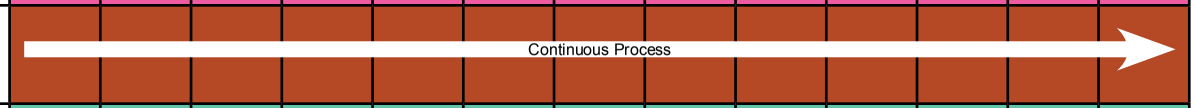
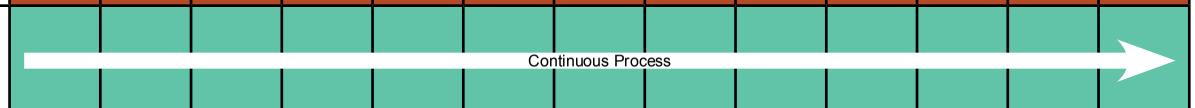
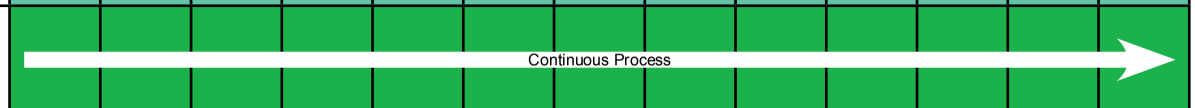
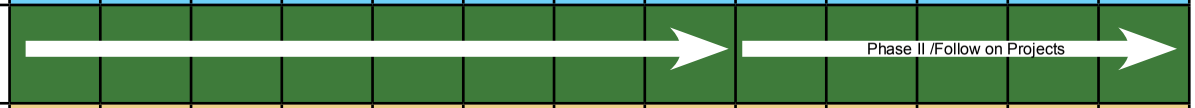
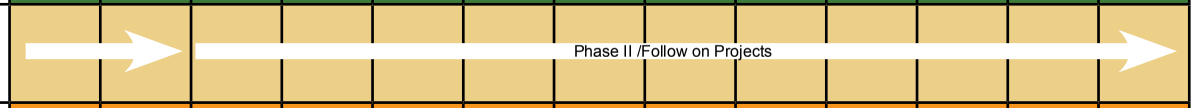
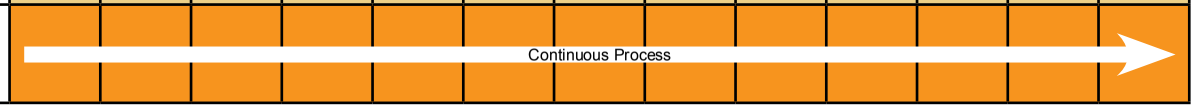
SL. No	Disaster Risk Reduction Measures	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
2	**Strengthening Disaster Risk Governance To Manage Disaster Risks - Priority II of Sendai Framework**													
2.1	Strengthening Incidence Response System	→	→	→										
2.2	Strengthening of TNDRF	→	→	→	→	→								
2.3	Strengthening Emergency Medical Response, Emergency Support Functions													
2.4	Strengthening Inter-departmental Zonal Teams	→	→	→										
2.5	Strengthening Disaster Response Guards and First Responders	→	→	→										
2.6	Capacity building of multisectoral departments,TNDRF, Disaster Response Guards and First Responders etc.	→	→	→	→	→	→	→	→	→	→	→	→	→
2.7	Prepare and update multi-hazard disaster preparedness, response, relief and recovery SOPs.	→	→	→										
2.8	Strengthen inter sectoral, inter-departmental coordination besides strengthening co-ordination with Central Agencies	→	→											
2.9	Quinquennial Updating of Safety standards for Buildings(Educational, Hospitals & Multi-storeyed etc.) National Building Code 2016	Being Adopted →			To be Revised & Adopted →					To be Revised & Adopted →				
2.10	New land use regulations for protecting ecologically sensitive areas.	→	→	→										

INDICATIVE TIMELINES FOR DISASTER RISK REDUCTION MEASURES

SL. No	Disaster Risk Reduction Measures	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
3	**Investing in Disaster Risk Reduction for Resilience - Priority III of Sendai Framework**													
3.1	Creation of State Disaster Mitigation Fund	→												
3.2	Comprehensive flood risk reduction in highly vulnerable rural districts	→												
3.2	Urban flood risk reduction with special focus on GCC and its urban neighbourhood	→												
3.3.	Mainstreaming of disaster risk concerns into developmental plans	Continuous Process →												
3.4	Risk transfer with special focus on at-risk population such as farmers, women and weaker sections	Continuous Process →												
3.5	Climate smart land and water management for sustainable Agriculture	Continuous Process →												
3.6	New cropping strategies to overcome impacts of Climate Change	Continuous Process →												
3.7	Restoration and protection of river ecosystems and ecologically fragile areas (based on Systems approach)	Continuous Process →												
3.8	Bio Shields for Protection against Heat Wave, Lightning, Gale Wind	Continuous Process →												
3.9	Deliver climate resilient hydraulic infrastructure to reduce risk of flood and sea water incursion in delta areas.	Phase I →				Phase II /Follow on Projects →								
3.10	Livelihood support with special focus on the poor in Vulnerable Areas	Continuous Process →												
3.11	Integrated Development of Vulnerable Areas	Continuous Process →												

INDICATIVE TIMELINES FOR DISASTER RISK REDUCTION MEASURES

SL. No	Disaster Risk Reduction Measures	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030
4	**Enhancing Disaster Preparedness for effective Response, Build Back Better in Recovery Rehabilitation and Reconstruction Priority IV of Sendai Framework**													
Preparedness														
4.1	Multi-hazard Alert, Response and Tracking system (TNSMART)													
4.2	Real time forecasting and spatial decision support system for major river basins													
4.3	End to End Early Warning Systems													
4.4	Strengthening MPES and Shelter Management	Continuous Process												
4.5	Enhance Public Private co-operation in Response, Recovery, and Build Back Measures	Continuous Process												
4.6	Strengthen community based disaster reduction strategies during all phases of disaster	Continuous Process												
4.7	Strengthen Information Management and risk Communication systems	Continuous Process												
4.8	Enhance Public Private co-operation in Response, Recovery, and Build Back Measures	Continuous Process												
4.9	Strengthen the resilience of critical infrastructure and basic social services	Continuous Process												

4.10	Strengthen Non-structural measures to reduce the risks due to Man- made and Natural Disasters.	
4.11	Build the capacity to manage CBRN and other man-made disasters.	
Response		
4.12	Equip multi-sectoral agencies with the state of art machinery and robotics to strengthen response and recovery efforts.	
Build Back Better		
4.13	Multihazard disaster resistant housing (Green Housing) for the poor	
4.14	Comprehensive river training measures for risk reduction of floods	
4.15	Integrated Watershed Management for risk reduction of drought and enhance resilience to climate change with special focus on Vulnerable areas	
4.16	Restoration and protection of river ecosystems and ecologically fragile areas such as Creek, Mangroves, Marshlands etc.	
4.17	Deliver climate resilient hydraulic infrastructure to reduce risk of flood & sea water incursion in delta areas.	
4.18	Irrigated Agriculture Modernisation	
4.19	Sustainable Mission for Dry land Farming	
4.20	Enhancing storage capacities of water bodies	

ANNEXURE - 1

RESPONSIBILITY MATRIX FOR PREPAREDNESS AND RESPONSE STATE / DISTRICT AGENCIES

PRE DISASTER

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
1	**Planning**	**Lead Agencies:** MHA, CWC, INCOIS, SASE, GSI, BRO, MoIB, MoES, MoWR, MoAFW.	**State Agencies:** TNSDM Authority, Revenue &Disaster Management Department, Commissioner of Revenue Administration / State Relief Commissioner, Line Departments	**Agency - DDMA - District Disaster Management:** DistrictAdministration, Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services, Agriculture, Fisheries etc."
		Support Agencies: SoI, NSRC, DoT, MHA, NDMA, MoCIT, Hazard specific nodal Ministries	**Responsibilities:** • Preparation of SDMP. • Preparation of DMP by Line Departments. • Procurement Plan of Search, Rescue and Evacuation equipment. • Incorporate lessons learnt from earlier disasters. • Hazard Risk Analysis.	• Preparation of DDMP. • Analyse the disasters that happened on previous occasions. • District Deployment Plan • Hazard Risk Analysis."

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
2	**Early Warning, Maps, Satellite inputs, Information Dissemination**	**Lead Agencies:** IMD, CWC, INCOIS, SASE, GSI, BRO, MoIB, MoES, MoWR, MoAFW.	**State Agencies:** Tamil Nadu Government TNSDM Authority, Revenue and Disaster Management Department, Commissioner of Revenue Administration/State Relief Commissioner, TNSDM Agency, FES, Line Departments., Civil defence.	**Agency - DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: SoI, NSRC, DoT, MHA, NDMA, MoCIT, Hazard specific nodal Ministries	**Responsibilities:** • To secure forecasts, alerts and early warnings. • To secure Satellite imageries and other scientific methods for risk assessment, mapping & forecasting. • Disseminate alerts, warning and information to Line Departments and DDMA to reduce loss of life and property. • Compile data of equipments preparedness, etc., • Issue Circulars for preparedness • Facilitate dissemination of disaster risk with reputed information update to the general public through electronic & print media. • Ensure Proper communication between State and National agency Ensure fail safe functionality and Secure critical instrumentation available at the vulnerable areas. • Vulnerability profiling and Mapping.	• Identify very High, High medium low vulnerable area and prepare vulnerability map. • To disseminate early warning signals to local Authorities, and the community in the vulnerable areas so as to reduce loss of life and reduce damages to property. • Ensure appropriate compilation/ analysis of received data such as evacuation carried out damages caused etc. • Report compiled data to CRA/SRC by the District Collector / Commissioner GCC.

S No		Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
3	**Preparedness**	**Lead Agencies:** IMD, CWC, INCOIS, SASE, GSI, BRO, MoIB, MoES, MoWR, MoAFW.	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management Department, State Relief Commissioner, TNSDM Agency, Police, FES, Health Dept., and line departments, Civil defence, PWD, MAS MD (Transport Corp)/ Transport Secretary, TANGEDCO availability of heavy equipment	**DDMA - District Disaster Management Agency:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services & District level Line Departments.
	a) Human Resource Management and Logistics	**Support Agencies:** SoI, NSRC, DoT, MHA, NDMA, MoCIT, Hazard specific nodal Ministries	**Responsibilities:** • CRA / SRC –Preemptive deployment of TNDRF and NDRF teams. • Public Secretary – Mobilization of Armed forces. • Appointment of Monitoring Officers. • Mobilization Plan of men & materials. • **Strengthening, Positioning & Training personnel for Disaster Management** • Promote skill development for multi hazard resistant construction in all the disaster Prone areas. • Monitor/Identification of "Green Corridors" for easy transportation.	• Effective utilization of Prepositioned TNDRF personnel in combination with local volunteers ApdaMitra/ First Responders (Ready to move). • Appoint Inter - Departmental Zonal Teams. • Alert Health personnel and advise them to be in a state of readiness for immediate response to the needs. • Mobilize adequate number of sanitary workers, Rescue men, Staff of Electricity Board, Transport corporation, Food &civil supplies, pump operators and keep them in readiness • Mobilize First Responders from the available Man power • Formulate Sector specific teams for transport, evacuation distribution of relief etc • Prepare relief centers and repair the existing cyclone shelters • Adequate mock drills to be done.

S No		Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
3	**b) Infrastructure**		• Removal of encroachment in water bodies • Maintenance of vehicles to make them road worthy • Identify alternate means of water supply • Ensure proper maintenance of power supply & Identification of alternate sources. • Establish helplines for proper communication at the state level • Secure funding for construction of Multipurpose evacuation shelters. • Clearing of Blockages under Bridges and Culverts • De-siltation of Tanks, Irrigation canals, River Courses streams in vulnerable areas. • Secure funding for procurement of vehicles to transport of men and materials • Secure funding for procurement of necessary machinery and equipment for search, rescue and evacuation operations.	• Train personnel for operation of DEOC • Alert armed forces • Preposition Interdepartmental zonal teams, First responders and materials in vulnerable areas. • Fix the location of response bare and give adequate coverage.- DEOC & other emergency Operation centers • Monitoring of Rainguages/ Weather Stations • Identification of Public Buildings for rehabilitation • Prepare relief centers and repair the existing cyclone shelters. • Prepare multipurpose evacuation centers. • Ensure availability of essential commodities in the vulnerable areas Move adequate stock of essential commodities to the vulnerable points. • Clear blockages in Storm water Drains. • Desisting works for canals etc. • Removal of dumped material. • Removal of encroachments in Culverts, Bridges, River Courses, Irrigation canals and Tanks etc. • Prepare relief centers and repair the existing cyclone shelters • Ensure alternative sources of power and water supply.

S No		Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
				• Ensure the lines of communication are functioning properly and Transportation are clear without any blockages. • Ensure multiple router to the most vulnerable area for quick access by IRT's • Ensure proper accommodations for medical, paramedical & volunteers from outside.
3	**c) Logistics**	**"FCI, MHA Ministry of health**	• Secure funding for procurement of vehicles transport of men and materials.	• Keep the roads and drainage lines free from blockages and identify **"Green Corridors"** • Keep road worthy vehicles ready. • Monitoring of Rainguages / Weather stations • Adequate mock drills to be done. • Prepare multipurpose evacuation centers. • Ensure availability of essential commodities in vulnerable areas • Move adequate stock of essential commodities to the vulnerable points • Ensure availability of necessary equipment and machinery for evacuation • Ensure adequate stock of essential medicines, water purifying tablets &….. (white powder) • Ensure appropriate storage and stock entry for all the relief materials received during disaster as donations.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
4	**Evacuation of People and Animals**	**Lead Agency:** MHA Support Agencies, MoD, CAPF, MoRTH, MoR, MoCA, ministries/depts., with hazard-specific responsibilities, NDRF, Civil Defence	**Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, SDRF, FES, DDMA, Health Dept., all other relevant departments, Civil defense **Primary Responsibility.** • Overall supervision of Evacuation of people during floods, Cyclones, Tsunami and other disasters • Overall supervision of Rescue of Fishermen/others stranded on high seas due to disasters/accidents etc **Responsibility:** • Coordinate with Central agencies to mobilize required resources • Identify requirement of resources for evacuation such as trucks, small boats, high speed boats, ships, helicopters and aircrafts • Earmark resources/units/battalions of SDRF for quick deployment.	• Based on advisory from State and Central Agencies quick assessment of number of people and animals to be evacuated and mode of evacuation • Mobilize transport and resources for evacuation (Rev.& Animal Husbandry Departments, Transport & Fisheries departments). • Identify and prepare sites for temporary relocation of affected people and animals (Revenue Administration & Disaster Management, Police, Fire Services, Transport, Animal Husbandry • Departments) • Monitor the situation and send report to the SRC. • Inform the people about the care and protection-of disaster affected animals. • Establish fodder swag facilities

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
PRE, DURING AND POST DISASTER				
5	**Search and Rescue of People and Animals**	**Lead Agencies:** MHA, NDMA, NDRF	**Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNSDM Agency, SDRF, FES, DDMA, Health Dept., all other relevant departments, Civil defence	• Various positions of IRTs (District, Sub-division and Taluk) are trained and activated for response at their respective administrative jurisdiction • TNDRF teams are utilized in the affected areas. • Identify suppliers for blankets, tarpaulins, tents, boats, inflatable lights, torches, ropes, etc. with a condition that they should be supplied on time.
		Support Agencies: MoD, CAPT, MoR	**Responsibility:** • Deploy adequate TNDRF/NDRF forces to the vulnerable / affected areas. • Develop SOPs for sending rescue/relief material from other adjoining District to the affected District immediately. • Requisition of additional forcesfrom NDRF (CRA/SRC) • Requisition Support of armed forces and Central Armed Police Force (CAPF) as per requirement. (Secretary, Public Department) • Ensure fail safe communication between early warning agencies and EOC of Central and State/District.	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
6	**Medical Care**	**Lead Agencies:** MoHFW	**State Agencies:** TNSDM Authority Revenue Administration, Disaster Management Department, State Relief Commissioner, TNSDM Agency, SDRF, FES, DDMA, Health Dept., all other relevant departments, Civil defence	• Assess the likely health impacts and plan prepositioning of emergency health teams with required kits in the most vulnerable areas. • Include the hospital wise information in the DM plans at local levels • Keep District wise repository of hospitals (both Government and Private), availability of beds, doctors, paramedics and other trained staff • available along with other infrastructure details and update it on a regular basis • Health and Family Welfare Department to work with logistic section of District level IRT to provide effective services (Medical Unit) to the • field level IRTs for response. • Tie-up with the pharma companies/ retail outlets for easy availability of common medicines during the emergency situations. • Ensure Hygienic conditions prevails in various facilities established as well as hospitals to curb the spread of diseases • Ensure strict compliance with minimum standards of relief as per section 12 of DM Act 2005. • Ensure proper storage and distribution of medicines and other health department related donations from outside.
		Support Agencies: MoD, CAPT, MoR	**Function:** • Mobile medical care units with OT facility, power sources, dedicated trained staff of doctors, and paramedics who could be immediately deployed at the time of emergency • Mobile medical support units stocked with medicines usually needed such as those for BP, diabetics, heart problems, common ailments, etc. as well as provision such as: bleaching powder, chlorine tablets; nutritional supplements catering to specialised groups such as lactating mothers, elders, and children below 6. • Medical assistance to the affected districts in response to their request for post-disaster emergency medical care. • Timely technical support to the District and local bodies for restoration of damaged hospitals as well as infrastructure, if any. • Establishment of sound protocols for co-ordination of state's health Dept. with central agencies.	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
7	**Drinking Water/Dewatering Pumps/Sanitation Facilities/ Public Health**	**Lead Agencies:** MoDWS, MoFPI	**State Agencies:** TNSDM Authority/ State Relief Commissioner, Revenue Administration, Disaster Management and Mitigation Department, WRD, Water Supply and Sanitation Dept., Health Dept., all other relevant Departments / Agencies.	• Prepare a fully operating OT at the response &bare along with maternity facility. • Ensure all the ambulance services available in the district and available on call. • Ensure strict compliance with minimum standards of relief as per section 12 of DM Act 2005. • Provide disaster-affected areas with clean drinking water and prevent the spread of water borne diseases • Provide emergency water supplies when there is scarcity of potable water • Respond to the public health needs so as to prevent and mitigate a sudden outbreak of epidemic, water and food contamination as well as other public health-related problems in the aftermath of a disaster • Necessary arrangements and supply of drinking water through tankers • Necessary arrangements and supply of chlorine tablets • Agreement with vehicle manufacturers for vehicle mounted RO Systems with integrated power source. • Agreement with companies for providing vehicle mounted heavy duty dewatering pumps at short notice. • Availability of hygienic mobile toilets and bleaching powder through pre-disaster agreements / contracts with suppliers
		Support Agencies: MoWR, MoRD, MoHFW, MCAFPD	**Responsibilities:** • Assist the Districts in providing disaster-affected areas with clean drinking water and to prevent the spread of water borne diseases • Quick availability of hygienic Mobile toilets through pre-disaster agreements / contracts with suppliers • Agreement to be in place with companies for providing vehicle mounted heavy duty de-watering pumps at short notice. • Quick availability of packaged drinking water. • Easy availability of chlorine tablets on demand. • Assist affected District to address the public needs to prevent and mitigate a sudden outbreak of epidemic, water and food contamination as well as other public health-related problems in the aftermath of a disaster • Ensure strict compliance with minimum standards of relief as per section 12 of DM Act 2005.	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
8	**Food & Essential Supplies**	**Lead Agencies:** MoCAFPD, MoFPI	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNSDM Agency, Food and Civil Supply Dept., all other relevant Departments, Civil Defence	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: MoRTH, MoCA, MoR, MoSJE, MHA, FCI	**Function:** • Ensure availability of adequate and appropriate food supplies to the disaster affected areas • Immediate availability of ready-to-eat / pre-cooked food / meals • Preposition essential supplies at strategic locations • Agreement with suppliers to provide required quantities of family packs of essential food provisions • Special provisions to address the needs of infants / small children (baby food) • To ensure Government orders to supplyrequired food grains as per the requirement of disaster affected areas.	• Setting up community kitchens in the affected areas to cater to the needs of affected people. • Coordinate with the relevant departments to make sure that the supplies reach the people housed in relief centers. • Deploy a dedicated team at the Relief center to receive the supplies, maintain log (manual or computerised), and distribute them at required locations and families • Ensure proper arrangements for the storage & distribution of food & other relief materials donated from outside. • Civil Supplies Corporation to preposition essential commodities to provide effective services to the field level IRTs for effective response • Food godowns to have sufficient food materials that can be transported easily to affected areas

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
9	Communication	**Lead Agencies:** MoCIT, DoT	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNSDM Agency, Information Technology Dept. Information and Public Relations Dept, all other relevant departments.	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: MoR, MoCA, MoD, Telecom providers	**Responsibilities:** • Detailed plans for fail safe communication with all the early warning agencies (such as IMD, CWC, etc.) and control rooms (Central/State) for getting accurate information at regular intervals. • Restoration of emergency communication in disaster affected areas • Contingency plans including pre-disaster contracts with suppliers – Government and private for easy availability or resources at the time of emergency • Emergency response teams to be in place with detailed technical plans to restore communication after the occurrence of a disaster • Provide a dedicated radio frequency for disaster communications • Mobile communication units with V-SAT terminals, VHF repeaters, reserve WT VHF Sets, portable mobile towers, etc.	• Arrange for effective communication as well as public address system • Prepare fail safe communication plan with all early warning agencies • Prepare, update and maintain a Taluk / Block wise list of HAM Operators who could be contacted and deployed at the site of emergency • Prepare plans for communication including telephone and HAM for smooth coordinating with State agencies and various service providers • Logistic section of District level IRT to coordinate with service providers agencies for effective communication support to the field level IRTs for response. • Close coordination with Telecom service providers to restore damaged facilities and set up temporary facilities on emergency basis

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
9			• Operational plan for establishing temporary telecommunication facilities in the affected areas jointly with service providers • Secure, failsafe communication network among Central, State and other Control rooms for exchanging reliable and authentic information about the affected areas, and resource mobilization • Prepare, update and maintain a District wise list of HAM operators who could be contacted and deployed at the site of emergency when all other modes of communication fails • SEOC to be strengthened HF/ VHF etc.	• Ensure all communication equipment, especially the satellite phones are in good working condition 24X7 on all days through regular testing • EOCs are equipped with satellite phones / VHF / HF as a backup to the landlines

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
10	**Housing and Temporary Shelters**	**Lead Agencies:** MoHUPA, MoUD, MoRD	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNSDM Agency, H&UDDept, RD Dept., all other relevant Departments.	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: MHA, MoRTH, CBRI, HUD-Co, MoR, BMTPC	**Responsibilities:** • Ensure strict compliance with minimum standards of relief as per Section 12 of DM Act2005. • Setting up of relief camps and catering to the needs of the responders • Providing temporary shelters/ tents to the affected population, if required. • Establish logistic facilities that are well-coordinated with the corresponding NDRF unit to maintain stocks of temporary shelters, tents and other non- food resources. • Assist the concerned Districts in the task of providing temporary, safe, hygienic and secure living spaces to meet the needs of people in disaster-affected areas.	• Ensure strict compliance with minimum standards of relief as per Section 12 of DM Act 2005 • Logistic section of the IRT must coordinate with Transport Dept to provide effective services to the field level IRTs for response • In case of emergency, Alternate places for establishment of facilities as mentioned in the IRS guidelines such as relief camp, base, camp etc. are identified in advance and included in the local DMPlan • Identify shelter suppliers for supply of tents/ shelters up to the village level and enter into an agreement for supply at short notice (usually less than 24 hours) as per requirement • Stockpile tents, tarpaulins and temporary shelter material in regional warehouses/ stores/ERCs • Coordinate to make sure that the tents/ shelters reach the site ontime • Deploy a dedicated team at the local level to receive the tents/shelters Maintain logs (manual or computerized) of all material movements and details of distribution to required locations.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
11	**Power**	**Lead Agencies:** MoP	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNSDM Agency, Electricity Board, Power Distribution Companies.	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: MoNRE, MoPNG, Power generating/ distribution companies	**Responsibilities:** • To mobilize men, material and other resources and keep them ready at strategic points. • Restore power supply in the disaster-affected areas on war footing. • Technical support for restoration of power supply as well as infrastructure in the affected areas. • Coordination with central and neighboring state governments for technical support in restoration of power supply and infrastructure	• Establish temporary power connections to relief centres, relief camps, first response cite etc., • To work with the logistic section to provide effective services to the field level IRTsfor response • Make arrangements for quick restoration of power supply with alternate mechanisms to critical facilities.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
12	Transportation	**Lead Agencies:** MoRTH, MoR, MoCA	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNDRRA, PWD, Railways, Airport Officer, Commissioner of Transport and all other relevant Departments.	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services, Regional Transport officer / Greater Chennai Corporation.
		Support Agencies: MHA, MoD, NHAI, IWAI, NDRF, MoHFW	**Responsibilities:** • Adequately address the post-disaster transportation needs to ensure that the emergency response and recovery efforts are carried out in a timely manner; restore the public transport; resumption of the movement of essential goods • Pool heavy duty earth moving machineries, tree cutters, fork lifters and other required equipment. • Quick deployment of resources and equipment for quick repairs/ restoration of roads and highways for movement of rescue and relief teams with their supplies • Operational plans are in place to transport heavy machinery (like dewatering pumps, boats, etc.) through road in close coordination with Departments. • Establishment of emergency services group within the Transport department with staff having experience of working in disaster situations	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
12			• Availability of diesel locomotives and drivers in disaster-affected areas where power is disrupted/ shut as a preventive measure; maintain a live roster of such emergency support systems which can be mobilized at very short notice by periodic review of readiness • State Relief Commissioner to conduct and coordinate with Regional Railways for Rail coaches as makeshift shelters, railway hospitals/ mobile rail ambulances and the availability of heavy equipment if required. • State Relief Commissioner to conduct a meeting with AAI representatives and evolve a plan for quick restoration of airport runway and restoration of air traffic for facilitation of transport of relief teams / supply / equipment, stranded passengers, etc., • Control room gets activated for smooth coordination in receiving and dispatching resources and equipment in close coordination with various Departments. • Availability of trained manpower for making night landing during emergencies • Availability of Air Ambulances at strategic locations with trained manpower and equipment in close coordination with the Health Dept.	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
13	**Relief Logistics and Supply Chain Management**	**Lead Agencies:** MHA, ministries with hazard-specific responsibilities, NDMA	**State Agencies:** TNSDM Authority/ State Relief Commissioner, Revenue Administration, Disaster Mitigation and management Department, TNDRRA and all other relevant Departments / Agencies	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services / Greater Chennai Corporation.
		Support Agencies: MoD, MoR, MoRTH, MoCA, MoCAFPD, MoFPI, MoAFW	**Responsibilities:** • Provide necessary support to the disaster - affected Districts for organizing logistics for the availability of relief and emergency supplies of food, medical, and non-food materials • Support for emergency supply of food and in some cases drinking water; first aid kits; temporary shelters, relief supplies • Make a rapid assessment of emergency relief needs in consultation with the affected District. • Establish a mobilization centre at the strategic locations for the movement of relief supplies within the District. • Deploy special transport mechanism for the movement of relief supplies within the District. • Make arrangements to receive and distribute relief and emergency supplies received from different parts of the State / Country • Establish a mobilization centre at the airport/ railway station for the movement of relief supplies	• Coordinate transportation (air, rail, road, water) with the agencies • Arrange alternative means of transportation to send relief supplies to the affected locations if normal transport system is affected

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
13			• Deploy special transport mechanisms for the movement of relief supplies • Coordinate transportation of material from different parts of the country, and coordinate and provide relief supplies from neighboring states • Coordinate transportation (air, rail, road, water) for other Central ministries/ departments/agencies • Locate, procure and issue resources to Central agencies involved in disaster response, and supply to the affected state • Adopt alternative means of transportation for swift delivery of relief supplies to the affected state / district	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
14	Fuel	**Lead Agencies:** MoP	**State Agencies:** TNSDM Authority, Revenue Administration, Disaster Management and Mitigation Department, State Relief Commissioner, TNDRRA,` Oil Companies, Civil Supply Dept., all other relevant Departments	**Agency DDMA - District Disaster Management:** District Revenue Administration, Disaster Management and Mitigation Department, Police, Fire Services.
		Support Agencies: MoD, MoR, MoRTH, MoCA	**Responsibilities:** • Coordination with all the concerned Oil companies to have adequate stock of essential fuel and supply them with first priority to relief works. • Ensure Petrol pumps are functional and adequate petrol, oil and diesel are available for relief, rescue and general public • Adequate supply of petrol, diesel, kerosene and LPG Gas in the affected areas for general public as well as emergency responders / equipment • Quick mobilization of fuel in hilly areas to avoid delays. • Assess and indicate clear requirement of fuel to the Oil Companies / Central Ministry and coordinate the delivery of fuel through local arrangements.	• Arrange for and ensure sufficient availability of tankers / other vehicles for local transportation through the relevant Department. • Establish mechanism for stocking the fuel at strategic locations with relevant agencies • Ensure distribution of fuel is done in a rational manner with preference to relief and rescue operations

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
15	**Disposal of animal carcasses**	**Lead Agencies:** MoAFW, DoAHDF	**State Agencies:** State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, AHD,Agriculture Dept.,Police Dept., all other relevant Departments	**Agency DDMA - District Disaster Management:** Equip and train the staff in carcass removal/ disposal at pre-identified sites to ensure that no other health hazard is created both for the staff as well as general public
		Support Agencies: MHA, MoHFW	**Responsibilities:** • Detailed plans for close coordination with the State Government for managing the removal/ disposal of carcass of animals from the affected areas as soon as possible. • Proper safety kits are available with the staff deployed in carcass disposal so that they are not infected.	

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
16	**Fodder for livestock in scarcity-hit areas**	**Lead Agencies:** MoAFW, DoAHDF	**State Agencies:** State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Forest/ Environment Dept., Agriculture Dept., AHD, Animal Welfare Organizations	**Agency DDMA - District Disaster Management:** Mobilize fodder and cattle feed to meet shortages, as in drought or scarcity conditions
		Support Agencies: MoRTH, MoR	**Responsibilities:** • When required, mobilize fodder and cattle feed to meet shortages, as in drought or scarcity conditions • Transport fodder from storage facilities or distant areas to the scarcity-hit areas • Organize fodder resource and mobile station centres Enlist PSUs and private agencies for providing fodder and other support	• Transport fodder from storage facilities or collection centers to the scarcity-hit areas Organize collection centers for fodder and cattle feed Enlist PSUs and private agencies for providing fodder and other support.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
17	**Rehabilitation and Ensuring Safety of Livestock and Other Animals, Veterinary Care**	**Lead Agencies:** MoAFW, DoAHDF	**State Agencies:** State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Forest/ Environment Dept., Agriculture Dept., AHD, Animal Welfare Organizations	
		Support Agencies: MoRTH, MoR	**Responsibilities:** • Support the setting up of livestock camps/ shelters for animals in distress due to disasters, including drought • Provide assistance for care of animals in the camps/shelters • Assist State/UT in the proper management, and running of livestock camps/shelters • Assist in proper rehabilitation of animals Supplement the needs of State/UT to provide veterinary care to disaster-affected livestock, including drought-hit areas	• Transport fodder from storage facilities or collection centers to the scarcity-hit areas Organize collection centers for fodder and cattle feed Enlist PSUs and private agencies for providing fodder and other support.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
18	**Data Collection and Management**	**Lead Agencies:** MHA, NDMA	**State Agencies:** State/UT, Revenue Dept./ SEOC/ CoR, SDMA, DDMA, Bureau of Economics and Statistics, all other relevant Departments	**Agency DDMA - District Disaster Management:** Mobilize fodder and cattle feed to meet shortages, as in drought or scarcity conditions
		Support Agencies: MoRTH, MoR	**Responsibilities:** • Maintain proper records of all the essential services needed for rescue, response and relief phases, both by the State Governments and by the Central Ministries/ Departments Establish a sound reporting mechanism to meet the information needs of both Central and State Governments about the disaster response	• Representative of SDMA works with the planning section at state level for making of IAP and dissemination of information. Creation of a cell at the District level (preferably as part of DEOC) and place dedicated resources to collect/ update data on all essential services (as per the template given in the IRS guidelines) which will help during the response phase for effective reporting and compilation.

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
19	**Relief Employ-ment**	**<u>Lead Agencies:</u>** MoRD, MoPR, MHA	**<u>State Agencies:</u>** State/UT, Revenue Dept./ CoR, SDMA, DDMA	
		<u>Support Agencies:</u> MoLE, MoWR, MoDWS, MoAFW	**<u>Responsibilities:</u>** • Provide projects to employ people seeking work in drought affected areas as a relief measure Provide financial support for such scheme	• Provide opportunities for un-skilled work in public works for people seeking work in drought affected areas as a relief measure Ensure quick and prompt pay-ment of wages • Carry out health check-up of those seeking work Draw from various funds including Di-saster Response Fund to implement the employment schemes

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
20	**Relief Employment**	**Lead Agencies:** MoIB, MHA, NDMA	**State Agencies:** State/UT, SDMA, Revenue Dept., CoR, SEOC, DDMA, Information Dept., all other relevant Departments	
		Support Agencies: MoCIT, MoST, MoES, MoWR, MoEFCC, ministries/ departments with hazard-specific responsibilities	**Responsibilities:** • Collect, process and disseminate information about an actual or potential disaster situation to all stakeholders so as to facilitate response and relief operations; update information on disaster and disaster victims; maintain contacts with mass media; inform public regarding the impact of disaster and the measures taken for the welfare of the affected people • Ethical guidelines for disaster coverage by media as per accepted global standards respecting dignity and privacy of the affected communities and individuals and work with media to adopt the guidelines through self-regulation as well as over sight by relevant regulatory institutions	• Dept. of Information and Public Relations works with the Command staff as Information and media officer of the state level IRT to provide effective services • Ethical guidelines for coverage of disaster is prepared and shared with all media agencies Plan is prepared for providing/ broadcasting warnings, do's and don'ts etc. to media and ensure its dissemination

S No	Major theme	Nodal Central Agencies	State (in Consultation /Coordination with Central and State Level Agencies)	Responsibility – District (DDMA)
			• Mechanisms for broadcasting warnings, do's and don'ts etc. to media and public before (if applicable), during and after the disasters Proper schedule for media briefing (once/ twice/ thrice daily depending on the severity of the disaster) and designate a nodal officer for interacting with media on behalf of the Government	

ANNEXURE -2

NDMA GUIDELINES

(https://ndma.gov.in/en/ndma-guidelines.html)

1.	Guidelines on Museums
2.	Guidelines on Cultural Heritage Sites and Precincts
3.	Guidelines on Boat Safety
4.	Guidelines for Preparation of Action Plan – Prevention and Management of Heat-Wave-2017
5.	Guidelines on School Safety Policy
6.	Guidelines on Hospital Safety
7.	Guidelines on Minimum Standards of Relief
8.	Guidelines on Management of Earthquakes
9.	Guidelines on Management of Tsunamis
10.	Guidelines on Management of Cyclones
11.	Guidelines on Management of Floods
12.	Guidelines on Management of Urban Flooding
13.	Guidelines on Management of Drought
14.	Guidelines on Management of Landslides and Snow Avalanches
15.	Guidelines on Management of Nuclear and Radiological Emergencies
16.	Guidelines on Chemical Disasters
17.	Guidelines on Management of Chemical(Terrorism) Disasters
18.	Guidelines on Medical Preparedness and Mass Casualty Management
19.	Guidelines on Management of Dead in the Aftermath of Disaster
20.	Guidelines on Management of Biological Disasters
21.	Guidelines on Psycho-Social Support and Mental Health Services in Disasters
22.	Guidelines on Preparation of State Disaster Management Plans
23.	Guidelines on Incident Response System
24.	Guidelines on National Disaster Management Information and Communication System
25.	Guidelines on Scaling, Type of Equipment and Training of Fire Services
26.	Guidelines on seismic retrofitting of deficient buildings and structures

ABBREVIATIONS

AAI	*Airport Authority of India*
ACS	*Additional Chief Secretary*
ADB	*Asian Development Bank*
ADGP	*Additional Director General of Police*
AF	*Armed Forces*
AHD	*Animal Husbandry Department*
AIDS	*Acquired Immune Deficiency Syndrome*
ARG	*Automatic Rain Gauge*
ASSZ	*Andaman Sumatra Subduction Zone*
AWS	*Automatic Weather Station*
BARC	*Bhaba Atomic Research Centre*
BGL	*Below Ground Level*
BITE	*Built In Automated Test Facility*
BMTPC	*Building Materials and Technology Promotion Council*
CAPF	*Centre Armed Police Force*
CAPT	*Centre for the Advancement of Process Technology*
CBDRM	*Community Based Disaster Risk Management*
CBO	*Community Based Organisastion*
CBRN	*Chemical Biological Nuclear and Radiological*
CCS	*Cabinet Committee on Security*
CDMM	*Centre for Disaster Mitigation & Management*
CDPO	*Child Development Project Officer*
CDRRP	*Coastal Disaster Risk Reduction Project*
CEO	*Chief Executive Officer*
CMDA	*Chennai Metropolitan Development Authority*
CMSPGHS	*Chief Minister's Solar Powered Green House Scheme*
CMUPT	*Chief Minister's Uzhavar Padhukappu Thittam*
CMWSSB	*Chennai Metropolitan Water Supply and Sewerage Board*
COM	*Chief Medical Officer*
CRA	*Commissioner of Revenue Administration*

CRIDP	*Comprehensive Road Infrastructure Development Programme*
CRPF	*Central Reserve Police Force*
CRRT	*Chennai River Restoration Test*
CRZ	*Coastal Regulation Zone*
CSS	*Centrally Sponsored Schemes*
DAE	*Department of Atomic Energy*
DAE-CMG	*Department of Atomic Energy – Crisis Management Group*
DAP	*Differently Abled Pension Scheme*
DATs	*Distress Alert Transmitters*
DDMAs	*District Disaster Management Authorities*
DDMP	*District Disaster Management Plan*
DDWP	*Destitute Deserted Wives Pension Scheme*
DEOC	*District Emergency Operation Centre*
DGP	*Director General of Police*
DIPR	*Disaster Information and Public Relations*
DM	*Disaster Management*
DRC	*Disaster Recovery Centre Unit*
DRD	*Director of Rural Development*
DRO	*District Revenue Officer*
DRR	*Disaster Risk Reduction*
DWAS	*Disaster Warning Announcement System*
DWAS-R	*Disaster Warning Announcement System –Remote locations*
DWP	*Destitute Widows Pension Scheme*
ECMWF	*European Centre for Medium-range Weather Forecast*
ENS	*Earthquake Notification System*
EOCs	*Emergency Operation Centres*
ERC	*Emergency Response Centre*
ERM	*Extension Renovation and Modernization*
ETRP	*Emergency Tsunami Reconstruction Project*
FFC	*Fourteenth Finance Commission*
FIRMS	*Fire Information for Resource Management System*
FRL	*Full Reservoir Level*

GCC	*Greater Chennai Corporation*
GCF	*Green Climate Fund*
GIS	*Geographical Information System*
G.O	*Government Order*
GoI	*Government of India*
GoTN	*Government of Tamil Nadu*
GPRS	*General Packet Radio Service*
GPS	*Geographic Positioning System*
Ha	*Hectare*
HARC-TD	*High Antennas for Radio Communications – Tethered Drone*
HF	*High Frequency*
HFL	*Highest Flood Level*
HLC	*High Level Committee*
HSC	*Hazard Safety Cell*
HUDCO	*Housing and Urban Development Corporation*
HVRA	*Hazard and Vulnerability Risk Analysis*
IAMP	*Irrigated Agricultural Moderation Project*
IAMWARM	*Irrigated Agricultural Modernisation and Water bodies Restoration and Management Project*
IAP	*Incident Action Plant*
IB	*Intelligence Bureau*
ICG	*Indian Coast Guard*
ICT	*Information and Communication Technology*
ICZM	*Integrated Coastal Zone Management*
IDRN	*India Disaster Resource Network*
IFAD	*International Fund for Agricultural Development*
IG	*Inspector General*
IGN-DPS	*Indira Gandhi National Disability Pension Scheme*
IGN-OAPS	*Indira Gandhi National Old Age Pension Scheme*
IGN-WPS	*Indira Gandhi National Widow Pension Scheme*
IIT	*Indian Institute of Technology*
IMD	*Indian Meteorological Department*

INCOIS	*Indian National Centre Ocean Information Services*
IRS	*Institute of Remote Sensing*
IRS	*Incident Response System*
IRTs	*Incident Response Teams*
IT	*Information Technology*
ITEWC	*Indian Tsunami Early Warning Centre*
IWDP	*Integrated Watershed Development Programme*
JMA	*Japan Meteorological Agency*
Kcal	*Kilo Calories*
LED	*Light Emitting Diode*
LiDAR	*Light Detection and Ranging*
LISS	*Linear Imaging Self Scanning sensor*
LPG	*Liquid Petroleum Gas*
M&E	*Monitoring and Evaluation*
MAH	*Major Accident Hazard*
MAI :	*Moisture Adequacy Index*
MANAGE :	*National Institute of Agricultural Extension Management*
MCAFPD	*Ministry of Consumer Affairs Food and Public Distribution*
MCI :	*Medical Council of India*
MEA :	*Ministry of External Affairs*
MGNREGS	*Mahatma Gandhi National Rural Employment Guarantee Scheme*
MHA :	*Ministry of Home Affairs*
MIS	*Management Information System*
MNREGA	*Mahatma Gandhi National Rural Employment Guarantee Act*
MoAFW :	*Ministry of Agriculture and Farmers Welfare*
MoCA :	*Ministry of Civil Aviation*
MoCAFPD :	*Ministry of Consumer Affairs, Food and Public Distribution*
MoCF :	*Ministry of Chemicals and Fertilizers*
MoCI :	*Ministry of Commerce and Industry*
MoCIT :	*Ministry of Communications and Information Technology*
MoD :	*Ministry of Defence*
MODIS	*Moderate Resolution Imaging Spectroradiometer*

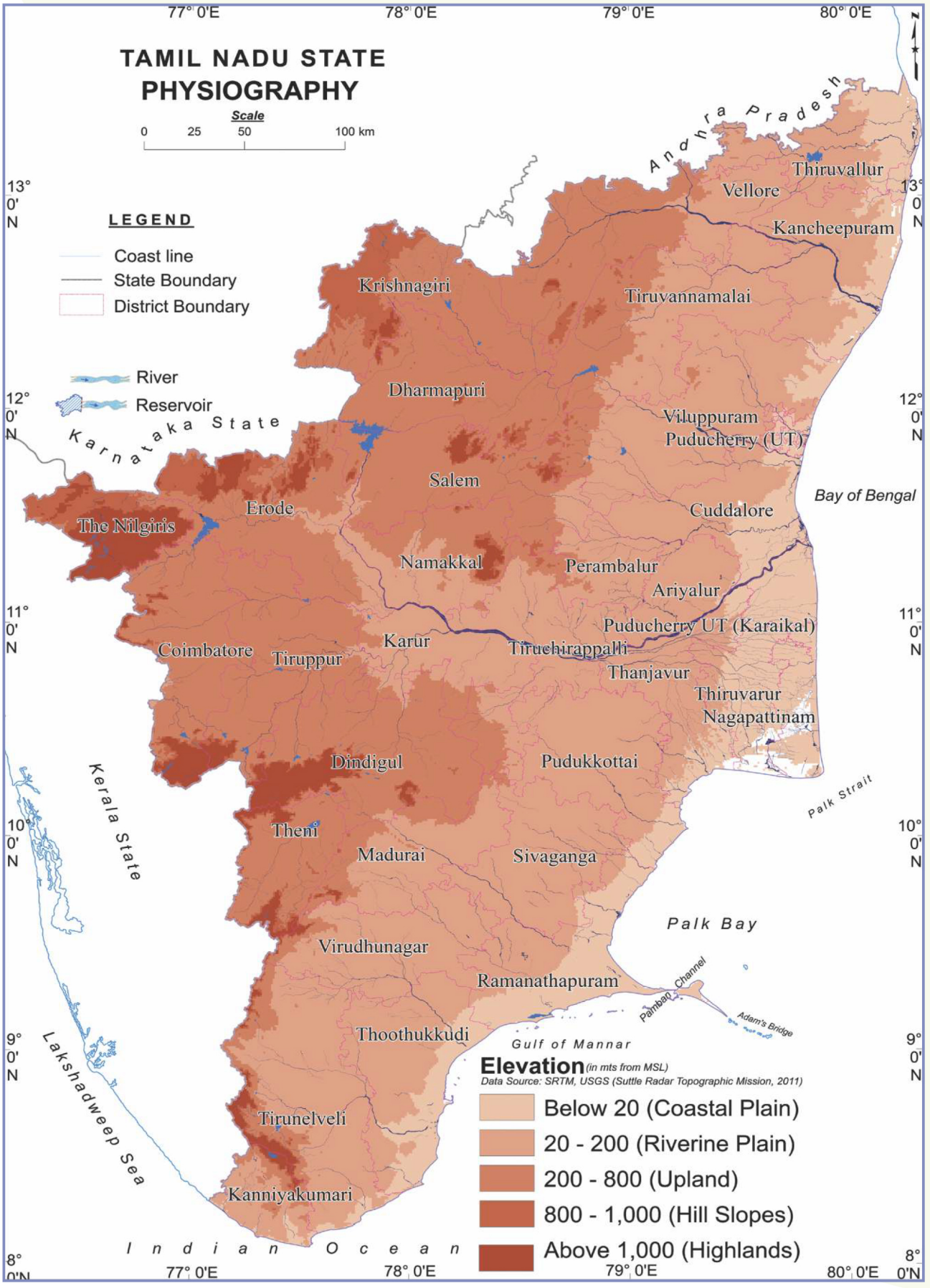
MoDWS :	*Ministry of Drinking Water and Sanitation*
MoEF	*Minister of Environment and Forests*
MoEFCC :	*Ministry of Environment, Forests and Climate Change*
MoES :	*Ministry of Earth Sciences*
MoF :	*Ministry of Finance*
MoFPI :	*Ministry of Food Processing Industries*
MoHFW :	*Ministry of Health and Family Welfare*
MoHIPE :	*Ministry of Heavy Industries and Public Enterprises*
MoHRD :	*Ministry of Human Resource Development*
MoHUPA :	*Ministry of Housing and Urban Poverty Alleviation*
MoIB :	*Ministry of Information and Broadcasting*
MoLE :	*Ministry of Labour and Employment*
MoM :	*Ministry of Mines*
MoMSME :	*Ministry of Micro Small and Medium Enterprises*
MoNRE :	*Ministry of New and Renewable Energy*
MoP :	*Ministry of Power*
MoPA :	*Ministry of Parliamentary Affairs*
MoPNG :	*Ministry of Petroleum and Natural Gas*
MoPR :	*Ministry of Panchayati Raj*
MoR :	*Ministry of Railways*
MoRD :	*Ministry of Rural Development*
MoRTH :	*Ministry of Road Transport and Highways*
MoSDE :	*Ministry of Skill Development and Entrepreneurship*
MoSJE :	*Ministry of Social Justice and Empowerment*
MoST :	*Ministry of Science and Technology*
MOU	*Memorandum of Understanding*
MoUD :	*Ministry of Urban Development*
MoWCD	*Ministry of Women and Child Development*
MoWR :	*Ministry of Water Resources*
MoYAS	*Ministry of Youth Affairs and Sports*
MPCS :	*Multi-Purpose Cyclone Centre*
MPES	*Multipurpose Evacuation Shelters*

MRCC	*Maritime Rescue Coordination Centre*
MRTS	*Mass – Rapid – Transit System*
MSDA	*Mission on Sustainable Dry land Agriculture*
MSIHC :	*Manufacture Storage and Import of Hazardous Chemicals*
MW	*Mega Watt*
NABARD	*National Bank for Agriculture and Rural Development*
NAFCC	*National Adaption Fund for Climate Change*
NBC	*National Building Code of India*
NC	*Natural Calamity*
NCC	*National Cadet Corps*
NCMC	*National Crisis Management Committee*
NDEM	*National Database for Emergency Management*
NDMA	*National Disaster Management Authority*
NDMP	*National Disaster Management Plan*
NDRF	*National Disaster Response Force*
NEC	*National Executive Committee*
NEOC	*National Emergency Operation Centre*
NFDB	*National Fishery Development Board*
NGO	*Non-Governmental Organisation*
NHAI	*National Highways Authority of India*
NIDM	*National Institute of Disaster Management*
NIMHANS	*National Institute of Mental Health and Neuro Science*
NLC	*Neyveli Lignite Corporation*
NM	*Nautical Miles*
NRSC	*National Remote Sensing Centre*
NRT	*Near Real-Time*
NSRC	*National Remote Sensing Centre*
NSS	*National Service Scheme*
NTFPs	*Non. Timber Forest Products*
NULM	*National Urban Livelihood Mission*
NWDA	*National Water Development Agency*
NYKS	*Nehru Yuva Kendra Sangathan*

OHT	*Over Head Tank*
OTF	*Operation Theatre Facility*
PA(G)	*Personal Assistant (General)*
PAP	*Parambikulam Aliyar Project*
PDS	*Public Distribution Systems*
PHC	*Public Health Centre*
PMFBY	*Prime Minister's Fasal Beema Yojana*
PMKSY	*Pradhan Mantri Krishi Sinchayee Yojana*
PRIs	*Panchyat Raj Institutions*
PTSD	*Post-Traumatic Stress Disorder*
PTSLP	*Post Tsunami Sustainable Livelihood*
PWD	*Public Works Department*
R&D	*Research and Development*
RAD	*Rain fed Area Development*
RADM&M	*Revenue Administration Disaster Management and Mitigation Department*
RBFS	*Raised Beds and Furrow System*
RCC	*Reinforced Cement Concrete*
RD	*Rural Development*
RD & PR	*Rural Development and Panchayat Raj Department*
RDO	*Revenue Divisional Officer*
RGRP	*Rajiv Gandhi Rehabilitation Programme*
RIMES	*Regional Integrated Multi-Hazard Early Warning System*
RSM	*Risk Assessment and Mapping*
SAC	*Space Application Centre*
SAMP	*Special Area Management Plan*
SASE	*Snow and Avalanche Study Establishment*
SDEM	*State Data Base for Emergency Management*
SDMAs	*State Disaster Management Authorities*
SDMP	*State Disaster Management Plan*
SDRF	*State Disaster Response Fund*
SDRF	*State Disaster Response Force*
SEC	*State Executive Committee*

SEOC	*State Emergency Operation Centre*
SHGs	*Self Help Groups*
SHN	*Sector Health Nurse*
SLSC	*State Level Sanctioning Committee*
SMAF	*Sub-mission on Agro Forestry*
SMC	*Soil Moisture Conservation*
SMS	*Short Message Service*
SP	*Superintendent of Police*
SRC&CRA	*State Relief Commissioner and Commissioner of Revenue Administration*
SSI	*Sustainable Sugarcane Initiatives*
SSS	*Social Security Schemers*
TANGEDCO	*Tamil Nadu Generation and Distribution Corporation*
TBGP	*Tamil Nadu Biodiversity Conservation and Greening Project*
TCPL	*Tree Cultivation in Private Lands*
TEAP	*Tsunami Emergency Assistance Programme*
THAI	*Tamil Nadu Village Habitations Improvement Scheme*
TMC	*Thousand Million Cubic feet*
TN	*Tamil Nadu*
TNAU	*Tamil Nadu Agricultural University*
TNCF	*Tamil Nadu Commando Force*
TNCSC	*Tamil Nadu Civil Supplies Corporation*
TNDRF	*Tamil Nadu Disaster Response Force*
TNDRRA	*Tamil Nadu Disaster Risk Reduction Agency*
TNIAMP	*Tamil Nadu Irrigated Agricultural Modernisation Project*
TNRTP	*Tamil Nadu Rural Transformation Project*
TNSAPCC	*Tamil Nadu State Action Plan on Climate Change*
TNSCB	*Tamil Nadu Slum Clearance Board*
TNSDEM	*Tamil Nadu State Database for Emergency Management*
TNSDMA	*Tamil Nadu State Disaster Management Agency*
TNSDMP	*Tamil Nadu State Disaster Management Plan*
TNSDRF	*Tamil Nadu State Disaster Response Force*

TNSMART	*Tamil Nadu System for Multi-Hazard Potential Impact and Emergency Response Tracking*
TNSRLM	*Tamil Nadu State Rural Livelihood Mission*
TNSUDP	*Tamil Nadu Sustainable Urban Development Project*
TNUDP	*Tamil Nadu Urban Development Project*
TNULM	*Tamil Nadu Urban Livelihood Mission*
TOT	*Training of Trainers*
TWAD	*Tamil Nadu Water Supply and Drainage Board*
UAV	*Unmanned Aerial Vehicle*
UGSS	*Under Ground Sewerage Scheme*
UKMET	*United kingdom Meteorological Model*
ULBS	*Urban Local Bodies*
UNDP	*United Nation Development Programme*
UNFCCC	*Un Framework Convention on Climate Change*
UWP	*Un-married, Poor, Incapacitated Women of age 50 years and above*
VAO	*Village Administrative Officer*
VHN	*Village Health Nurse*
VIIRS	*Visible Infrared Imaging Radiometer*
VPDP	*Village Panchayat Development Plan*
VRCC	*Vulnerability Reduction of Coastal Communities*
VSAT	*Very Small Aperture Terminal*
WLS	*Wildlife Sanctuary*
WMO	*World Meteorological Organisation*
WPS	*Widow Pension Scheme*
WRD	*Water Resources Department*
WRF	*Weather Research and Forecasting Model*


TAMIL NADU STATE
PHYSIOGRAPHY
Scale
0 25 50 100 km
LEGEND
Coast line
State Boundary
District Boundary
River
Reservoir
77° 0'E
78° 0'E
79° 0'E
80° 0'E
13° 0' N
12° 0' N
11° 0' N
10° 0' N
9° 0' N
8° 0'N
Andhra Pradesh
Karnataka State
Kerala State
Bay of Bengal
Palk Strait
Palk Bay
Gulf of Mannar
Lakshadweep Sea
Indian Ocean
Pamban Channel
Adam's Bridge
Thiruvallur
Vellore
Kancheepuram
Krishnagiri
Tiruvannamalai
Dharmapuri
Viluppuram
Puducherry (UT)
Salem
Erode
The Nilgiris
Cuddalore
Namakkal
Perambalur
Ariyalur
Puducherry UT (Karaikal)
Karur
Coimbatore
Tiruppur
Tiruchirappalli
Thanjavur
Thiruvarur
Nagapattinam
Dindigul
Pudukkottai
Theni
Madurai
Sivaganga
Virudhunagar
Ramanathapuram
Thoothukkudi
Tirunelveli
Kanniyakumari
Elevation (in mts from MSL)
Data Source: SRTM, USGS (Suttle Radar Topographic Mission, 2011)
Below 20 (Coastal Plain)
20 - 200 (Riverine Plain)
200 - 800 (Upland)
800 - 1,000 (Hill Slopes)
Above 1,000 (Highlands)

Tamil Nadu System for Multi-hazard Potential Impact Assessment, and Emergency Response Planning, Alerting and Tracking
(TNSMART)

For disaster related information : Toll free Number

1070
State Emergency Operation Centre

1077
District Emergency Operation Centre

COMMISSIONER OF REVENUE ADMINISTRATION, REVENUE ADMINISTRATION, DISASTER MANAGEMENT & MITIGATION DEPARTMENT

Chepauk, Chennai - 600 005.