GUJARAT STATE DISASTER MANAGEMENT PLAN

VOLUME 1

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GSDMA

GUJARAT STATE DISASTER MANAGEMENT AUTHORITY
Block No. 11, 5th Floor, Udyog Bhavan, Gandhinagar

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Abbreviations

AAI	Airport Authority of India
ACWCs	Area Cyclone Warning Centres
AERB	Atomic Energy Regulatory Board
BARC	Bhabha Atomic Research Centre
BIS	Bureau of Indian Standard
BISAG	Bhaskaracharya Institute for Space Applications and Geo-Informatics
BOOT	Build Own Operate and Transfer
BPL	Below Poverty Line
CBOs	Community Based Organizations
CBRN	Chemical, Biological, Radiological and Nuclear
CCG	Central Crisis Management Group
CDMA	Code Division Multiple Access
CDO	Central Design Organization
CEO	Chief Executive Officer
CFO	Chief Fire Officer
CMG	Crisis Management Group
CoH	Commissioner of Health
COR	Commissioner of Relief
CP	Commissioner of Police
CWC	Central Water Commission
CWCs	Cyclone Warning Centres
CWCS	Cyclone Warning Dissemination System
DAE	Department of Atomic Energy
DCG	District Crisis Management Group
DCR	District Control Room
DDO	District Development Officer
DEOCs	District Emergency Operation Centres
DG	Director General
DGHS	Directorate General of the Health Services
DGP	Director General of Police
DIG	Deputy Inspector General
DISH	Director Industrial Safety & Health
DM	Disaster Management
DoR	Director of Relief
DP&S	Directorate of Purchase and Stores
DPR	Detailed Project Report
DRM	Disaster Risk Management DRM
DRMP	Disaster Risk Management Programme
EFC	Expenditure Finance Committee
EMS	Emergency Medical Services
EOC	Emergency Operation Centre
ERCs	Emergency Response Centres
ERTs	Emergency Response Teams
F&ES	Fire and Emergency Services
GAD	General Administration Department
GEB	Gujarat Electricity Board
GERI	Gujarat Engineering Research Institute
GIDC	Gujarat Industrial Development Corporation
GIDM	Gujarat Institute of Disaster Management

GIS	Geographic Information System
GMB	Gujarat Maritime Board
GoG	Government of Gujarat
GoI	Government of India
GPCB	Gujarat Pollution Control Board
GSDMA	Gujarat State Disaster Management Authority
GSI	Geological Survey of India
GSM	Global System for Mobile Communications
GSWAN	Gujarat state Wide Area Network
GUVNL	Gujarat Urja Vikas Nigam Limited
GWSSB	Gujarat Water Supply & Sewerage board
HAZCHEM	Hazardous Chemicals
HF/VHF	High Frequency/Very High Frequency
HoD	Head of Department
HRVA	Hazard, Risk and Vulnerability Assessment
HWB	Heavy Water Board
IDRN	India Disaster Resource Network
IEC	Information Education Communication
IMD	Indian Meteorology Department
INCOIS	Indian National Centre for Ocean Information Services
INSAT	Indian National Satellite System
IRC	Indian Road Congress
IRIS	Incorporated Research Institute for Seismology
ISR	Institute of Seismological Research
ISRO	Indian Space Research Organisation
ITC	Information and Communication Technology
ITCS	Information Communications Technology System
KAPS	Kakrapar Atomic Power Station
LCG	Local Crisis Management Group
MAH	Major Accident Hazard
MFRs	Medical First Responders
MHA	Ministry of Home Affairs
MoA	Ministry of Agriculture
MoC & F	Ministry of Chemicals and Fertilizers
MoC & I	Ministry of Commerce and Industry
MoD	Ministry of Defence
MoEF	Ministry of Environment & Forests
MoF	Ministry of Finance
MoLE	Ministry of Labour and Employment
MoP & NG	Ministry of Petroleum and Natural Gas
MoSRT & H	Ministry of Shipping, Road Transport and Highways
MSDS	Material Safety Data Sheet
MSZ	Makran Subduction Zone
NCC	National Cadet Corps
NCMC	National Crisis Management Committee
NDRF	National Disaster Response Force
NEC	National Executive Committee
NEIC	National Earthquake Information Centre
NGO	Non Government Organization
NGRI	National Geophysical Research Institute
NIDM	National institute of Disaster Management

NIOT	National Institute of Ocean Technology
NPCIL	Nuclear Power Corporation of India Ltd.
NSRA	Nevada Seismic Research Affiliates
NWRWS	Narmada Water Resources Water Supply
PESO	Petroleum and Explosive Safety Organization
PFZ	Potential Fishing Zones
PGA	Peak Ground Acceleration
PMO	Prime Minister's Office
PMS	Probable Maximum Surge
PPP	Public private Partnership
PS	Principal Secretary
QCI	Quality Council of India
QRMT	Quick Reaction Medical Team
R & B Dept.	Roads & buildings Department
R & R	Rehabilitation & Reconstruction
RDD	Radiological Dispersal Device
RED	Radiation Exposure Device
RESECO	Remote Sensing and Communication Centre
RSO	Radiological Safety Officer
SAR	Search and Rescue
SCG	State Crisis Management Group
SCMC	State Crisis Management Committee
SDMA	State Disaster Management Authority
SDMP	State Disaster Management Plan
SDRF	State Disaster Response Force
SDRN	State Disaster response Network
SED	Site Emergency Director
SEOC	State Emergency Operation Centre
SMS	Short Messaging Service
SOG	Standard Operations Guide
SOP	Standard Operation Procedure
SRPF	State Reserve Police Force
SSNNL	Sardar Sarovar Narmada Nigam Limited
SST	Sea Surface Temperature
SWP	Single Wire Protocol
TEOCs	Taluka Emergency Operation Centers
UD & UHD	Urban Development & Urban Housing Development
UNDP	United Nations Development Programme
UTs	Union Territories
WALMI	Water and Land Management Institute
WAN	Wide Area Network
WSEAC	World Scientific and Engineering Academy and Society

Chapter 1 Introduction

1.1 Need for the Plan

As per Section 15 (3) of The Gujarat State Disaster Management Act, 2003, 'The Authority shall prepare, or cause to be prepared and maintain a master plan for the State'. Section 23 (1) of The Disaster Management Act, 2005 also reads "There shall be a plan for disaster management for every State to be called State Disaster Management Plan". Apart from these statutory requirements, the hazard profile and disaster history of the state demands for a comprehensive state disaster management plan to be in place for coordinated and streamlined management of disaster in the state.

1.2 Vision

Making a resilient Gujarat where communities respond to disasters with sense of urgency and in a planned way to minimize human, property and environmental loss.

1.3 Policy

Saving human lives with utmost priority and ensuring minimum loss to property and environment.

1.4 Objectives of the Plan

i) To assess various hazard, vulnerability, capacity and risk associated with the state.
ii) To lay down various measures and guidelines for prevention and mitigation.
iii) To lay down preparedness measures for all stakeholders.
iv) To build the capacity of all stakeholders in the state to cope with the disasters and promote community based disaster management.
v) To mainstream disaster management concerns into the developmental planning process.
vi) To develop efficient, streamlined and rapid disaster response and relief mechanism in the state.
vii) To provide clarity on roles and responsibilities for all stakeholders concerned with various phases of disaster management.
viii) To ensure co-ordination and promote productive partnership with all other agencies related to disaster management.
ix) To commence recovery programme as an opportunity to build back better in case of a future disaster by incorporating community in the programme

1.5 Sendai Framework of Actions for Disaster Risk Reduction 2015-2030

The Sendai Framework for Disaster Risk Reduction 2015-2030 was adopted at the Third United Nations World Conference on Disaster Risk Reduction held in Sendai, Japan in March 2015.

1.5.1 Global Targets

To support the assessment of global progress in achieving the outcome and goal of this Framework, seven global targets have been agreed. These targets will be measured at the global level and will be complemented by work to develop

appropriate indicators. National targets and indicators will contribute to the achievement of the outcome and goal of this Framework. The seven global targets are:

i) Substantially reduce global disaster mortality by 2030, aiming to lower the average per 100,000 global mortality rate in the decade 2020-2030 compared to the period 2005-2015
ii) Substantially reduce the number of affected people globally by 2030, aiming to lower the average global figure per 100,000 in the decade 2020-2030 compared to the period 2005-2015
iii) Reduce direct disaster economic loss in relation to global gross domestic product (GDP) by 2030
iv) Substantially reduce disaster damage to critical infrastructure and disruption of basic services, among them health and educational facilities, including through developing their resilience by 2030
v) Substantially increase the number of countries with national and local disaster risk reduction strategies by 2020
vi) Substantially enhance international cooperation to developing countries through adequate and sustainable support to complement their national actions for implementation of this Framework by 2030
vii) Substantially increase the availability of and access to multi-hazard early warning systems and disaster risk information and assessments to the people by 2030

1.5.2 Guiding Principles

The implementation of the framework shall be guided by the following principles:

i) Each country has the primary responsibility to prevent and reduce disaster risk
ii) DRR requires sharing of responsibility by central govt., relevant national authorities, sectors and stakeholders
iii) Managing disaster risks is aimed at protecting persons and their property, health, livelihoods & protective assets, cultural and environmental assets while promoting all human rights including right to development
iv) DRR requires an all-of-society engagement and partnership based on empowerment and inclusive, accessible and non-discriminatory participation
v) DRR and management requires a full engagement of all institutions at various levels with laid down responsibilities of each stakeholder, accountability and follow up
vi) It is essential to empower local authorities and local communities for DRR
vii) DRR requires a multi-hazard approach and inclusive risk-informed decision making based on open exchange and dissemination of data
viii) DRR is essential to achieve sustainable development
ix) Local and specific characters of disaster risks must be understood for determining the measures for DRR
x) Addressing underlying disaster risk factors through informed

public and private investment is more cost effective than post disaster response and recovery

xi) Post disaster recovery, rehabilitation and reconstruction phase is critical in DRR by 'Building Back Better'

xii) Effective global partnership and international cooperation are essential for effective DRR

xiii) Developing countries need adequate, sustainable and timely provision of support, finance, technology transfer and capacity building from developed countries tailored to their needs and priorities

1.5.3 Priorities for Action

Framework has identified the need for focused actions within and across sectors in the following priority areas:

i) Understanding Disaster Risk

ii) Strengthening Disaster Risk Governance to Manage Disaster Risk

iii) Investing in Disaster Risk Reduction for Resilience

iv) Enhancing Disaster Preparedness For Effective Response and to 'Build Back Better' in Recovery, Rehabilitation and Reconstruction

Chapter 2 State Profile

The State of Gujarat was formed on 1st May 1960. It is located on the western most part of India and shares international border with Pakistan. As per 2011 census, the population of the State comes to nearly 6.04 crores, which is around 5% of the population India.

The State of Gujarat can be divided in to three major parts:

a. Central and South Gujarat
b. Saurashtra and Kutch
c. North Gujarat

2.1 Administrative Profile

Administrative Unit	Number
Districts	33
Talukas	249
Municipal Corporation	8 (Ahemdabad, Surat, Vadodra, Rajkot, Bhavnagar, Jamnagar, Junagadh and Gandhinagar)
Municipalities	159
Villages	Around 18000

Table 2.1: Administrative Divisions of Gujarat

2.2 Geographical Profile

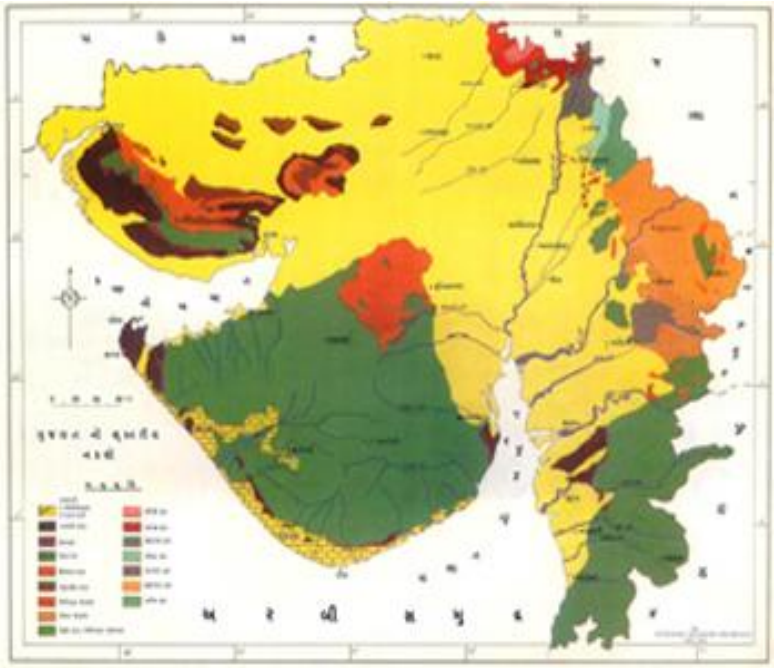


Figure 2.1: Geographical Profile of Gujarat

The total geographical area of the state is 196,024 km^2. It stretches from 20-6' N to 24-42' N latitude and from 68-10'E to 74-28' E longitude.

Geographical Regions	• Peninsula of Saurastra - Hilly track sprinkled with low mountains • Kutch – Barren and rocky in north-west • Mainland (from Aravalli hills in north to Damanganga river in south) – a level plain of alluvial soil
Connected States/UTs	• Rajasthan in north east • Madhya Pradesh in east • Maharashtra and the Union Territories of Daman, Diu and Nagar Haveli in south
Major Rivers	• Sabarmati and Mahi (Cenrtal & North Gujarat) • Mithi, Khari, Bhadar, Shetrunji and Bhogavo (Saurastra) • Narmada, Tapi, Purna, Ambika, Auranga and Damanganga (South Gujarat)
Mountains	• The northern and eastern borders are made up of mountains which are the tails or offshoots of outside ranges like the Aravallis, Vindhyas, Satpuras and Sahyadris • Saurashtra contains two parallel ranges, one stretching from east to west and the other from north-east to south-west • The Girnar which is the highest mountain in the state (1,145 metres) forms a part of the range south of the Bardo and is about 160 km in length.
Deserts	Kutch on the north-east is barren and rocky and contains the famous Rann (desert) of Kutch, the big Rann in the north and the little Rann in the east
Forest cover	Total forest 14,653 km^2 (7.48% of total geographical area) Very dense 376 km^2; moderately dense 5,220 km^2; Open Forest 9,057 km^2 (As per State of Forest Report 2013)
Mangrove Cover	1,058 km^2 (As per State of Forest Report 2013)
Tree Cover	8,358 km^2 (4.26% of total geographical area) (As per State of Forest Report 2013)
Coastline	Over 1600 km

Table 2.2: Geographical Profile of Gujarat

2.3 Demography

Population	604.40 lakhs	
	Male – 314.91 lakhs	Female – 289.48 lakhs
• **Rural Population**	346.95 lakhs (57.40 %)	
	Male – 177.99 lakhs	Female – 168.95 lakhs
• **Urban Population**	257.45 lakhs (42.60%)	
	Male – 136.92 lakhs	Female – 120.53 lakhs
• **Child Population (0-6 yrs)**	77.77 lakhs (12.87%)	

	Male – 41.15 lakhs	Female – 36.62 lakhs
	Rural – 48.25 lakhs	Urban- 29.52 lakhs
Population Density	308 per km²	
Decadal Growth Rate	19.3% (2001-2011)	
• **Rural**	9.3% (2001- 2011)	
• **Urban**	36.0 % (2001-2011)	
Sex Ratio	919 females per 1,000 males	
• **Rural**	949	
• **Urban**	880	
• **Child (0-6)**	890	
Literacy Rate	78 %	
	Male – 85.8 %	Female – 69.7 %
• **Rural**	71.7 %	
	Male – 81.6 %	Female – 77.2%
• **Urban**	86.3%	
	Male – 91.0 %	Female – 81.0 %
Effective Literacy Rate	67.99	
Crude Birth Rate	20.8 per '000 population (SRS 2013)	
Crude Death Rate	6.5 per '000 population (SRS 2013)	
Infant Mortality Rate (IMR)	36 per '000 live birth (SRS 2013)	
Maternal Mortality Rate (MMR)	122 per 1 lakh live births (SRS 2010-12)	
Natural Growth Rate	14.3 per '000 population (SRS 2013)	

Table 2.3: Demography of Gujarat; (Source: Census of India)

2.4 Social Profile

2.4.1 Religion

Majority of the population in the state practices Hinduism. Religion wise population of the state is mentioned in Table 2.4.

Religion	Percent of Total Population (2001)
Hindu	89.09 %
Muslim	9.06 %
Jains	1.04%
Christian	0.56 %
Sikhs	0.09 %
Buddhists	0.04 %
Others	0.06 %

Table2.4: Religion wise Population

2.4.2 Caste and Tribes

As per Census 2011, the population of Scheduled Castes and Scheduled Tribes in the state is 40.74 lakh (6.7 %) and 89.17 lakh (14.8 %) respectively. The tribal population is concentrated in the 14 eastern districts, from Mt. Abu on the Rajasthan border in the north to Dahanu district on the Maharashtra border in the south. The tribal sub plan (TSP) area constitutes 18% of the state's geographical area. There are 11 major tribes in Gujarat; the largest

Bhil constituting 47.89% of the state's tribal population. The 5 Particularly Vulnerable Tribal Groups number about 1,44,593 (as per Census 2011).

Social Indicators	Scheduled Castes		Scheduled Tribes	
Population (Lakhs)	Male- 21.10	Female- 19.64	Male- 45.01	Female- 44.16
	Rural- 22.82	Urban- 17.93	Rural- 80.22	Urban- 8.95
Literacy Rate	79.18 %		62.48%	
	Male- 87.87%	Female- 69.87%	Male- 71.68%	Female- 53.16%
Sex Ratio	931		981	

Table 2.5: Social Indicators of SC and ST Population

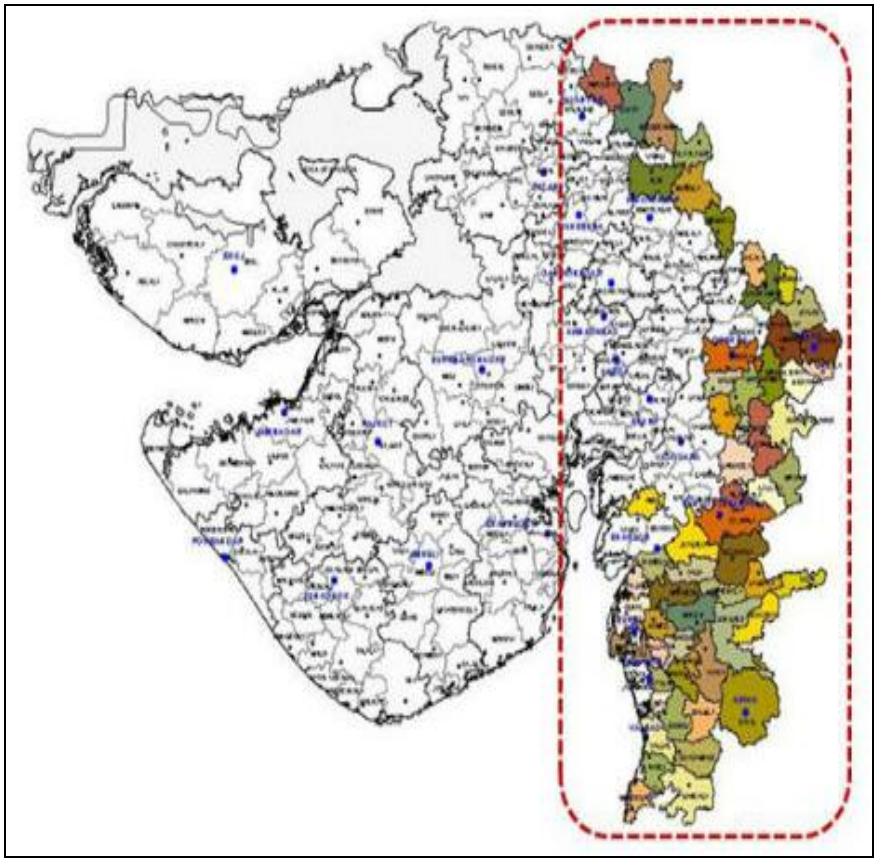


Figure2.2: Tribal Population in Gujarat

2.5 Economic Profile

Gujarat's State Domestic Product (SDP) had been rising at an average growth rate of 10.1% since 2005 to 2013, this is more than the national average. It contributes more than 7.5% to India's GDP.

28% of GSDP contribution comes from manufacturing sector and accounts more than 10% factories in India. Its key industry sectors are textile, engineering, chemicals, petrochemicals, drugs and

pharmaceuticals, dairy, cement and ceramics, gems and jewellery, etc.

Total crop area is more than one half of the total land area. Gujarat produces cotton, groundnuts, dates, sugarcane, milk and milk products.

2.5.1 Main occupation

The occupation in the state is business, agriculture and industries workers. As per Population Census 2011, the total number of workers (who have worked for at least one day during the reference year) is 247.68 lakhs. Of this, 180.01 lakh workers are males and 67.67 lakhs are females. The workers have registered a growth of 16.5 per cent during the decade. 155.7 lakh workers are in the rural areas and 92.0 lakh workers are in the urban areas. The female workers in rural and urban areas are 54.0 lakhs and 13.7 lakhs respectively.

2.5.2 Income Pattern

The Per Capita Income at current prices has been estimated at Rs. 96976 in 2012-13 as against Rs. 87175 in 2011-12, showing an increase of 11.2 percent during the year.

2.5.3 Sectors of Economy

The key sectors in the economy of the state and the respective production are:

Sector of Economy	Detail of Sector	Production/ Quantity (Annually)
Agriculture	Food grains production	99.90 lakh tonnes
	Cotton production	95.09 lakh bales (170 kgs. each)
	Oil seeds production	74.23 lakh tonnes
	Major vegetables grown	Onion, Brinjal, Tomato, Okra and Cucurbits
	Spices	Cumin, Fennel and Garlic
Animal Husbandry	Livestock population	237.94 lakhs
	Milk production	111.13 lakh tones
	Fish production	7.88 lakh tonnes
	Fishing boats	36770 (24612 mechanised)
Water Resources	Irrigation potential	67.24 lakh hectare
Industries	No of registered factories	27754(2012)
	No. of MAH Factories	402
	Employment in factories	13.84 lakh
Mining	Agate, Steatite (soap stone) , Gypsum, Limestone, Lignite, Bauxite, Laterite, Dolomite, China and other clay, Bent mite, Quartz, Silica and sand, Chalk, Crude, and Natural Gas	
Electricity	Installed capacity	18510 MW
	Total generation of electricity	86221 million units (2013-14)
	Total consumption	67971 million units (2012-13)

Table 2.6: Sectors of Economy

2.6 Climate

The maximum temperature ranges between 26°C and 45°C while the minimum temperature varies between 10.8°C and 27.4°C. Gujarat's agro climate is very heterogeneous and constitutes about 20 per cent of arid and 9 per cent semi-arid areas of the country. Vast area of Saurashtra Kutch and North Gujarat falls under Arid to Semi-arid. It comprises low and erratic rainfall. The winter is mild cold, whereas summer is hot.

Agro climate of the state divided in to eight sub regions in respect of rainfall, temperature, humidity and geographical situation.

Sub Region	District	Rainfall (mm)	Types of Soil
Southern Hills	Dang, Valsad, Navsari	1500 and above	Deep black with patches of costal alkali Lateritic and medium black soil
South Gujarat	Surat, Bhrauch, Narmada	1000 to 1500	Deep black clayey soils
Middle Gujarat	Panchmahal, Dahod, Vadodara, Kheda, Anand	800 to 1000	Deep black to loamy sand (Goradu)
North Gujarat	Ahemdabad, Gandhinagar, Sabarkantha, Bansantha, Patan, Mehsana	625 to 875	Sandy loan to sandy soils
North Arid Zone	Kutch	250 to 500	Sandy and saline saols
North Saurastra	Bhavnagar, Jamnagar, Surendranagar, Amreli, Rajkot	400 to 700	Shallow medium black
South Saurastra	Junagadh, Porbandar	645 to 700	Shallow medium black & Calcareous soil
Bhal & Coastal Areas	Khambat, Bhal Coastal Area of Surat & Bhrauch Olpad, Vagra, Hansot, Alater, Dholka, Dhanduka, Vallbhipur, Bhavnagar & Limbadi Talukas	625 to 1000	Medium black poorly drained and saline soil

Table2.7: Climatic Sub Regions of Gujarat

2.7 Cultural Profile

Gujarat is a melting pot of varied cultures, traditions and religions. Gujarat's long coastline had attracted sea-farers through the ages, lured by the rich prospects of trade. The Arabs, Portuguese, Dutch, Mughals, British and Parsis have also left their marks on Gujarat's culture. Gujarati people celebrate all regional and national fairs and festivals with equal fervour. Gujarat's vibrant culture is also evident in the various dance forms, music, art and crafts and cuisine.

2.7.1 Languages

Gujarati is both the official and local language of the State. Surti, Charotari, Kathiawai, Kutchi, Marathi, Sindhi, Punjabi etc. are also spoken in the State.

2.7.2 Costumes

Depending on rural or urban area, varied outfits are worn by people of Gujarat. Generally, men wear trousers and shirts or t-shirts and younger women wear normal western outfits like skirts, dresses, jeans, etc. Older women usually wear saris or *salwar kamiz*. In rural parts, people usually wear dhotis and *kurtas* or *bandis*. Even traditional outfits like *chania choli* for women and *kedia* dress for men are worn in rural areas or during cultural festivals.

2.7.3 Food

Majority of the Gujaratis are vegetarian. The diet mainly consists of cereals, pulses, green vegetables, fruits, milk, ghee, butter-milk, etc. A variety of cuisine sub-ordinates like pickles, chutney, papad, yoghurt, etc serve as fillings on main menu.

2.7.4 Housing

Gujarati urban living offer sophisticated living lifestyles. Well ventilated, furnished, glazed tiled or marbled homes and flats are found in Gujarat. Rural living is flourishing with development. However, the traditional hut dwellings and wooden houses still exist with a rich heritage feel and ethnic living. Wood carved houses with the '*Chabutras*' for bird feeding are the beauty of many traditional homes in Gujarat.

2.7.5 Fairs and Festivals

Festivals in Gujarat signify socio-cultural-religious and even economic aspirations of the people of Gujarat. Gujarat- the 'Land of the Festivals' celebrates more than 3500 fairs and festivals round the year. Among the most popular festivals celebrated are Navratri, Deepavali, Kite Festival, Shivratri, Holi, Janmashtmi, Ganesh Chaturthi and Mohorram-Ramzan. Some of the popular fairs include Bhavnath Mahadev Fair, Chitra-Vichitra Fair, Dangs Durbar Fair, Dhrang Fair, Tarnetar Fair, Shamlaji Fair, Vautha Fair, Modhera Dance Festival, Kutchh Utsav, Ambaji Purnima Fair, etc.

Chapter 3 Hazard, Vulnerability, Capacity and Risk Analysis

3.1 Hazards Analysis

Owing to its geo-climatic, geological and physical features, Gujarat is vulnerable to all major natural hazards namely, drought, flood, cyclone, earthquake, tsunami etc. The State is also under constant threat of various human made hazards like that of industrial (chemical) hazards, transportation accidents, terror attacks, epidemic, road accidents, etc.

GSDMA has developed Gujarat Hazard Risk & Vulnerability Atlas. This is the first geographically explicit Level 1 assessment of its kind outside the United States that integrates six hazards viz. earthquake, flood, cyclone, tsunami, drought and industrial (chemical) accidents, covering the whole State of Gujarat.

Following are the major hazards in the State:

3.1.1 Earthquake

As per Indian Seismic Zone Map, Gujarat region lies in three zones- Zone III, IV and V. Kachchh region (about 300km x 300km) lies in zone V where earthquakes of magnitude 8 can be expected. A belt of about 60-70km width around this zone covering areas of North Saurashtra and areas bordering Eastern part of Kachchh lie in zone IV where intensity VIII can be expected mainly due to earthquakes in Kachchh and some local earthquakes along North Kathiawar Fault in Northern Saurashtra. The rest of Gujarat lies in zone III where intensity VII earthquakes can be expected due to moderate local earthquakes or strong Kachchh earthquakes.

The estimated mean taluka earthquake peak ground acceleration (PGA) zonation for a 100-year return period is presented in the figure 2.1. All of Kachchh, almost the entire coastline of northern Saurashtra that adjoins Kachchh and a small area in Patan district fall into the very sever intensity zone over a 100-year return period. The cities of Ahmedabad, Bharuch, Rajkot, and Bhavnagar fall into the severe intensity zone, while Bhuj and Jamnagar fall in the very severe intensity zone over this time frame.

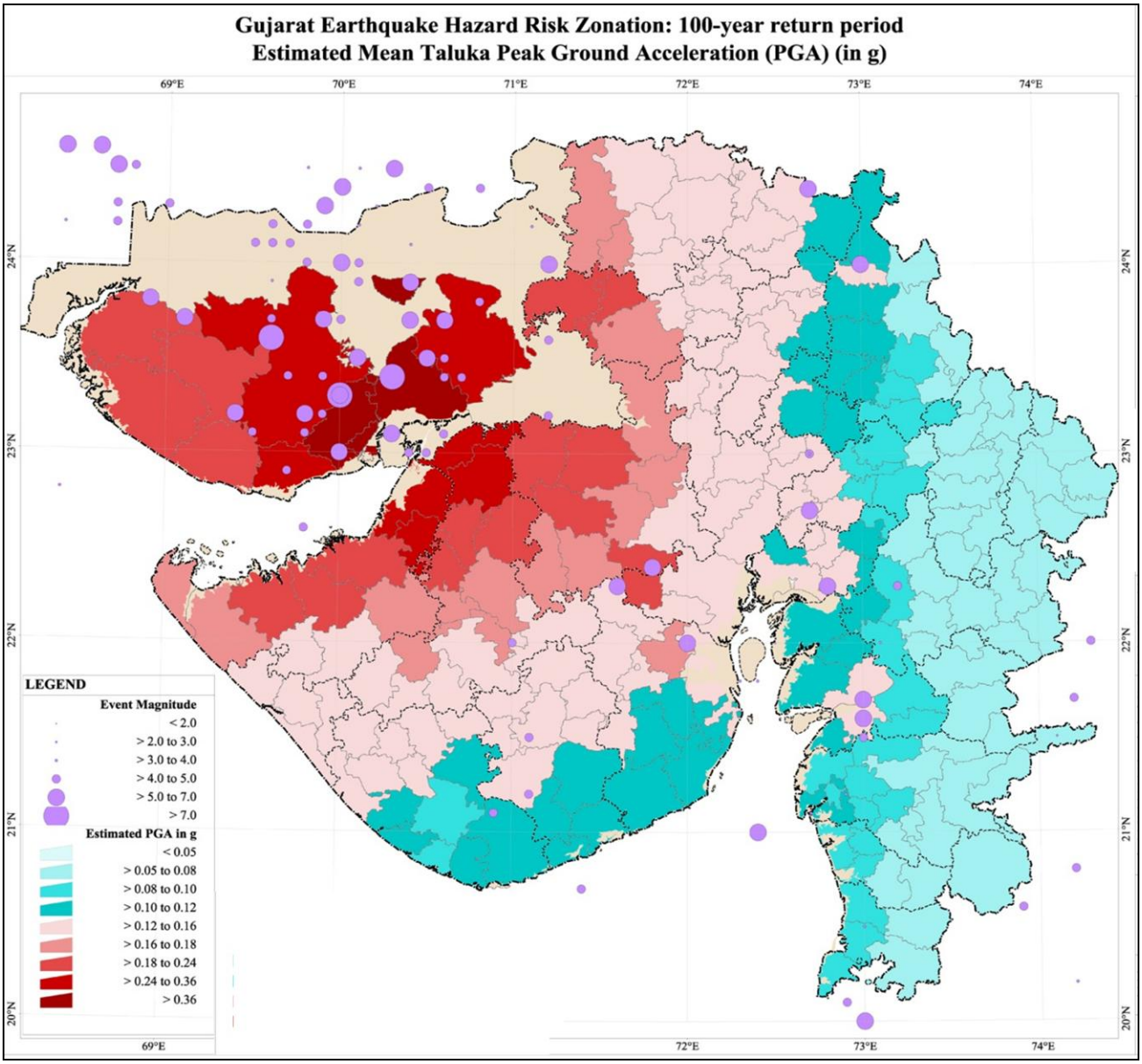


Figure 3.1: Gujarat Earthquake Hazard Risk Zonationn Map

3.1.2 Drought

Daily temperature of the State ranges from a minimum 13°C to 27°C in January to 27°C to 41°C in the summer during May. The South-West winds mostly bring rain between June to September and approximately 90 to 95% of precipitation is registered in these three months. From the North-West areas to South Gujarat areas, the rainfall varies from 300 mm to 2000 mm per annum. In Gujarat, 60% of rainfall is uncertain, unprecedented and unequal and the regions of Saurashtra, Kutch and North Gujarat face famine every third year. Since 1900, the state has faced scarcity of water and food almost 30 times.

Gujarat is one the chronic drought prone state of India, with an average annual rainfall about only 700 mm with more than half of the Talukas of Gujarat receiving rainfall within the range of 200-400 mm.

Substantial portions of the State are arid to semiarid. With large parts of North Gujarat and Saurashtra having

no source of alternate irrigation, groundwater exploitation is leading increased threats of droughts. Falling water tables have added stress on crops and water supplies.

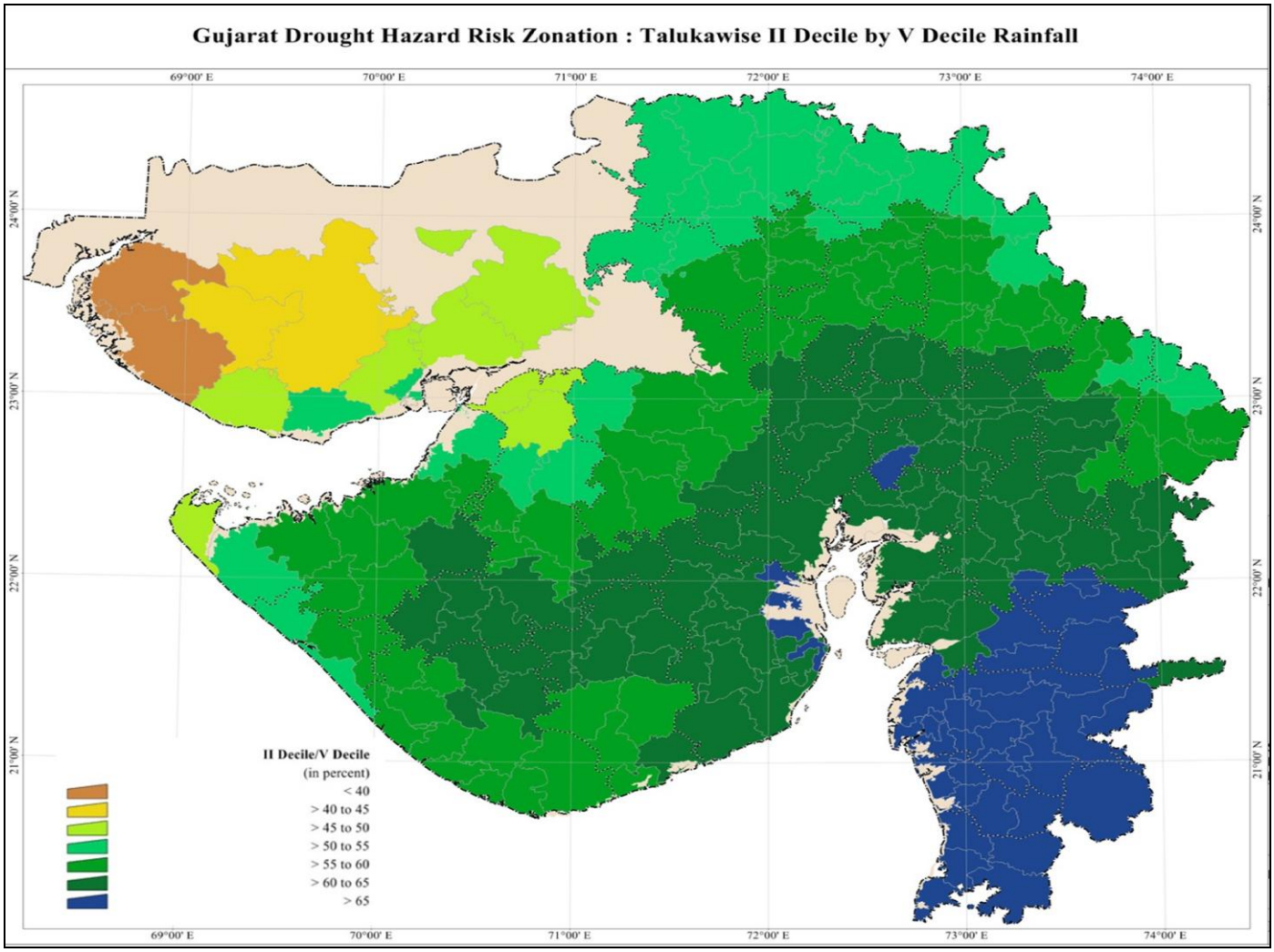


Figure 3.2 : Gujarat Drought Hazard Risk Zonation Map

3.1.3 Cyclone

Gujarat falls in the region of tropical cyclone. With the longest coast line of 1600 km in the country, it is highly vulnerable to cyclone and its associated hazards such as floods, storm surges, etc. Most of the cyclones affecting the state are generated in the Arabian Sea. They move North-East and hit the coast particularly the Southern Kutch and Southern Saurashtra and the Western part of Gujarat.

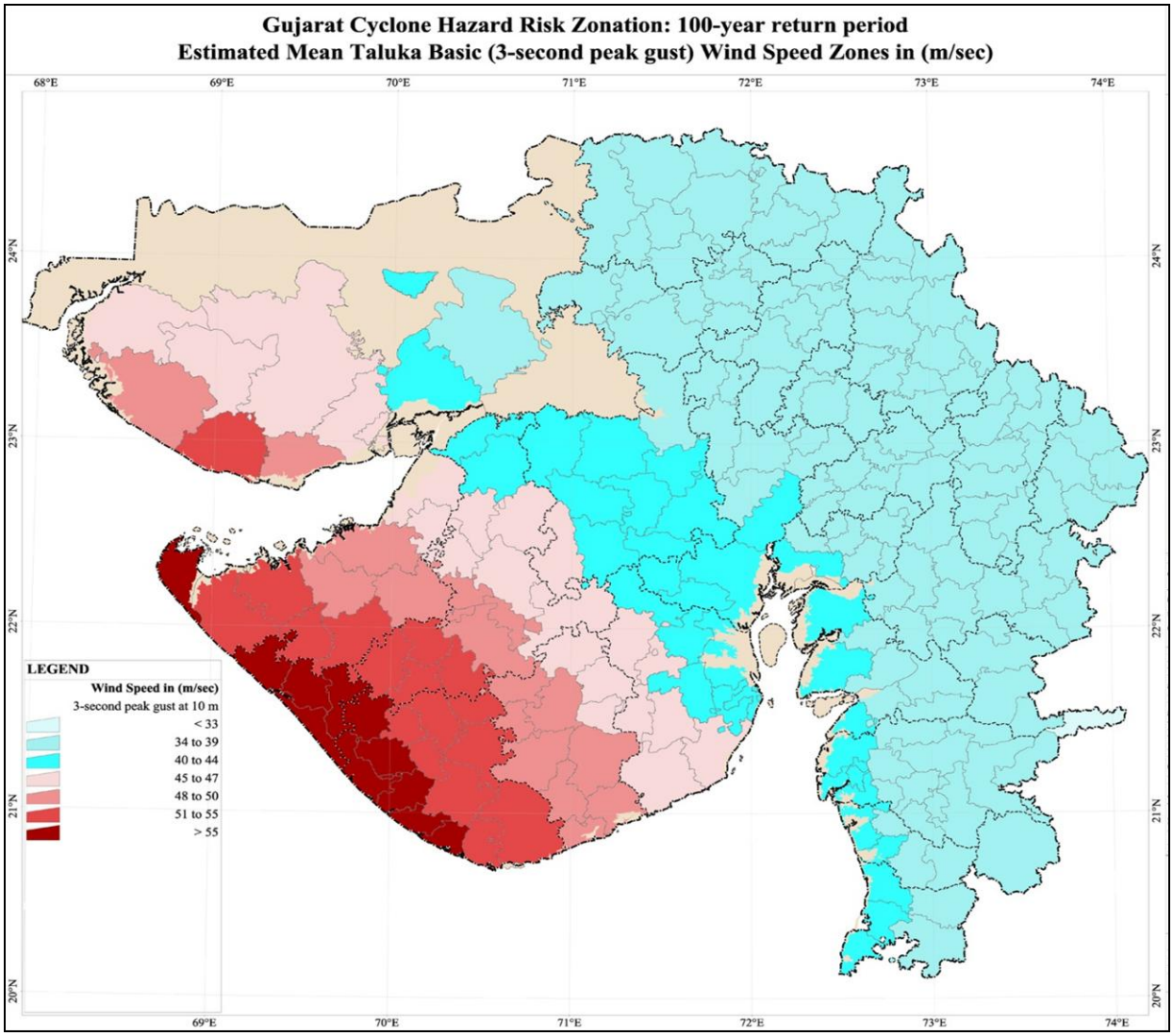


Figure 3.3: Gujarat Cyclone Hazard Risk Zonation Map

Two cyclonic storm seasons are experienced in Gujarat: May to June (advancing southwest monsoon) and September to November (retreating monsoon).

Over 120 cyclones originating in the Arabian Sea had passed through Gujarat over a period of 100 years. Figure 2.3 shows a maximum wind speed class of more than 55 m/sec along the Saurashtra coast, specifically in Porbandar, Jamnagar and Junagadh districts, which are exposed to high intensity cyclonic and storm impact. The 51 to 55 m/sec class extends further inland to cover much of Jamnagar, part of Rajkot, Junagadh and Kutch districts. The 48 to 50 m/sec class extends to most of Rajkot, part of Amreli and Jamnagar districts including Jamnagar, Rajkot cities and parts of Kutch. The 45 to 47 m/sec class covers much of Saurashtra and all of Kutch. This is followed by the 40 to 44 m/sec class that gets its swathe from Kutch through northern Saurashtra all the way to the coast of Gulf of Khambhat and southern Gujarat. The rest of the State falls into the 34 to 39 m/sec class.

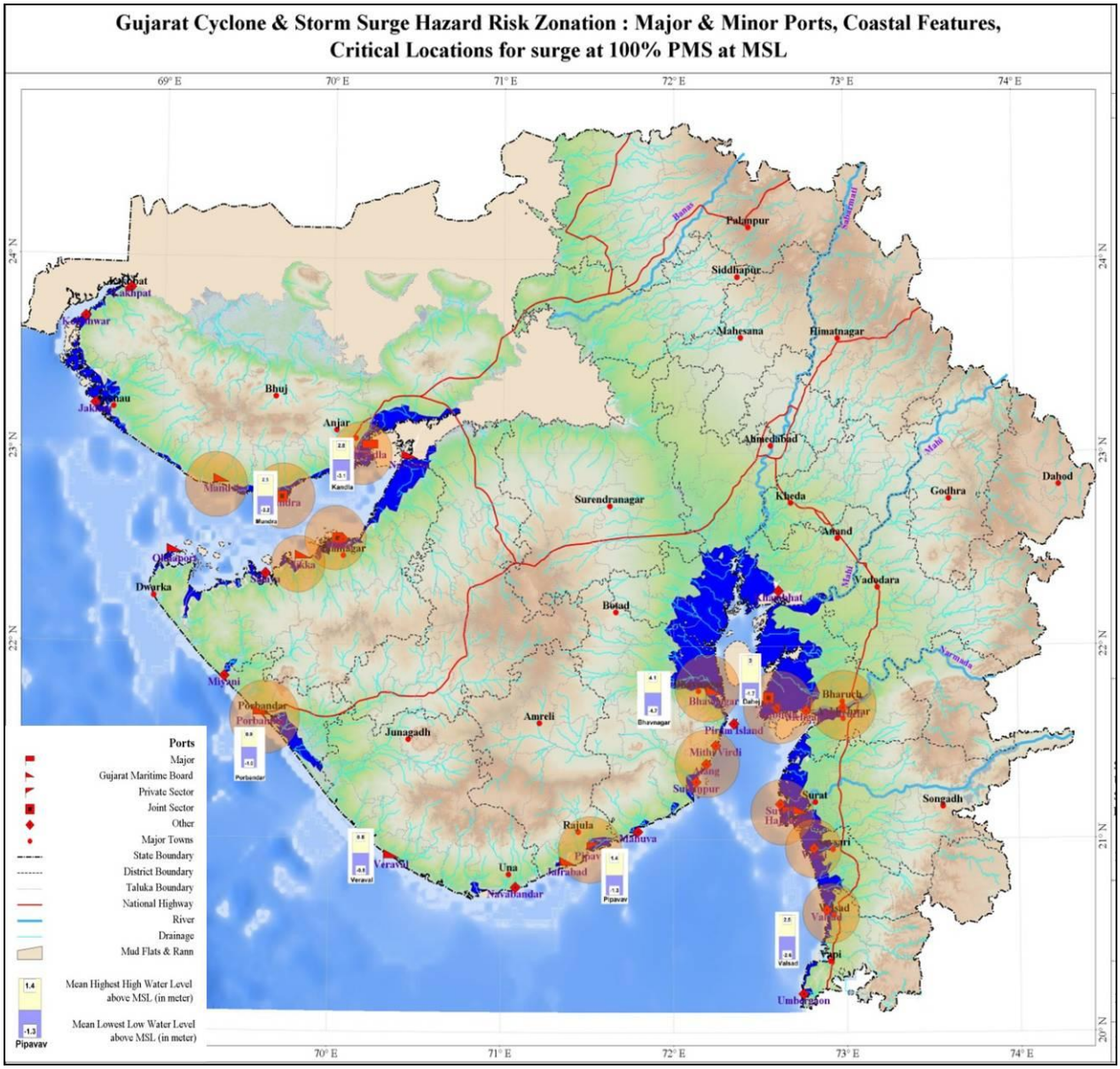


Figure 3.4: Gujarat Storm Surge Hazard Risk Zonation Map

3.1.4 Flood

The climatology of Gujarat is influenced by the Arabian Sea in the West and three hill ranges along its Eastern border. A long coastline makes parts of arid Saurashtra and Kutch occasionally experience very high rainfall. These occasional heavy rainstorms are responsible for most of the floods in the State. While the Northern part of the State is mostly arid and semi-arid, the Southern part is humid to sub-humid. Extremes of climate, be it rainfall or temperatures are quite common in this region. All major rivers in the State pass through a wide stretch of the very flat terrain before reaching the sea. These flat lowlands of lower river basins are prone to flooding. Cities like Ahmedabad, Surat and Bharuch are located on the flat alluvial plains of large rivers.

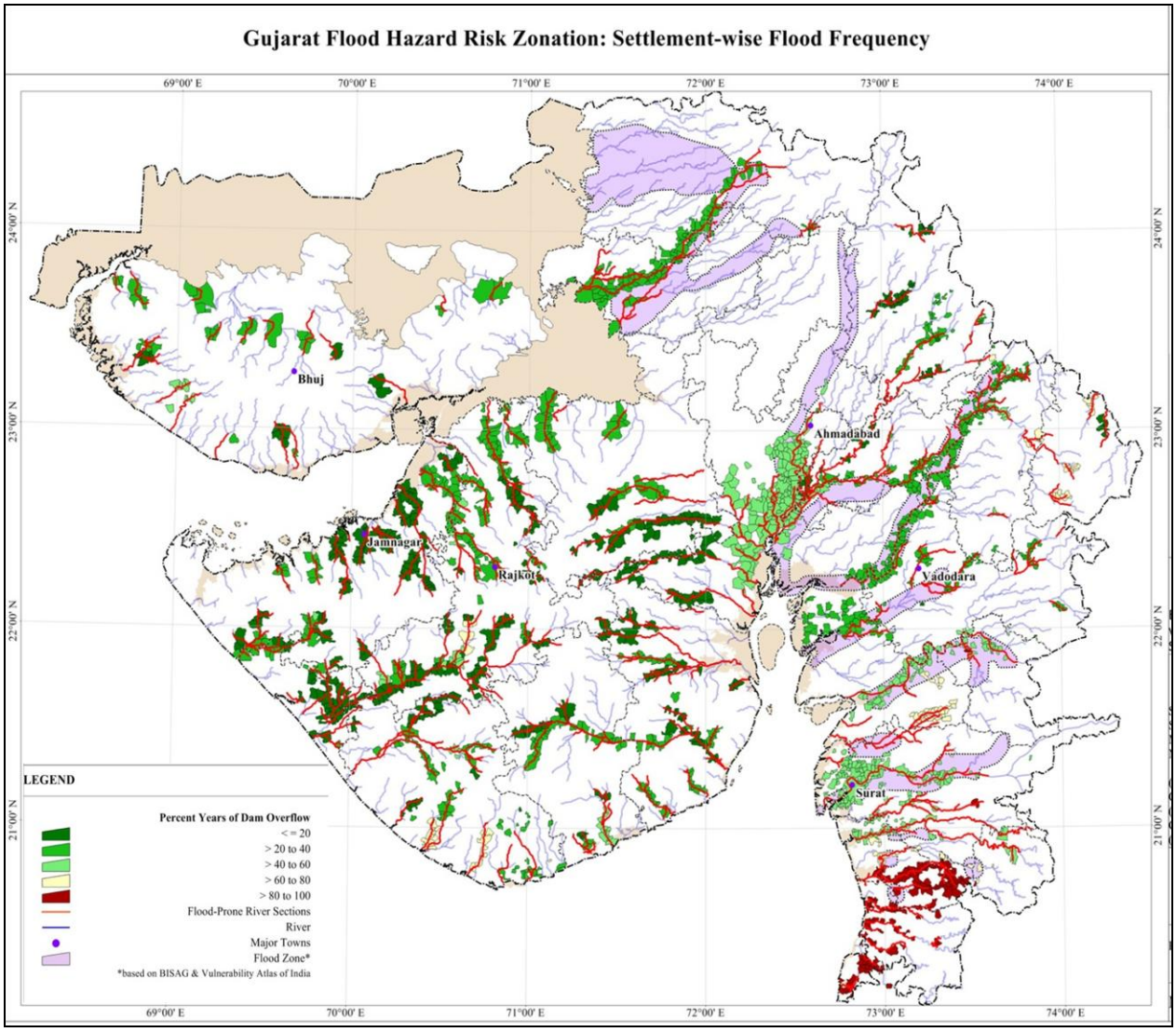


Figure 3.5: Gujarat Flood Hazard Risk Zonation

Concentrated runoff resulted by heavy rainfall cause flash floods in the small river basin of Saurashtra and Kutch because of their fairly impervious catchments (rocky or black cotton soils) and steep sloping upper catchments.

The flood prone river sections were identified from settlement level analysis. Flood prone river sections in Saurashtra extend to the upper basins due to the presence of dams which have to resort to emergency discharge during heavy rainstorms. Even small valleys in Saurashtra are used for agriculture. Hence flooding in these zones impacts both residents and settlements.

Figure 2.5 shows the majority of the area of Gujarat is flood prone, irrespective of the size of the catchment. The flood risk in Saurashtra is lower than that of the South Gujarat plains. The relatively flat plains in the lower basic areas with hilly catchments in upper parts of South Gujarat accentuate flood risks. Few villages in the North Gujarat are flood prone too.

3.1.5 Tsunami

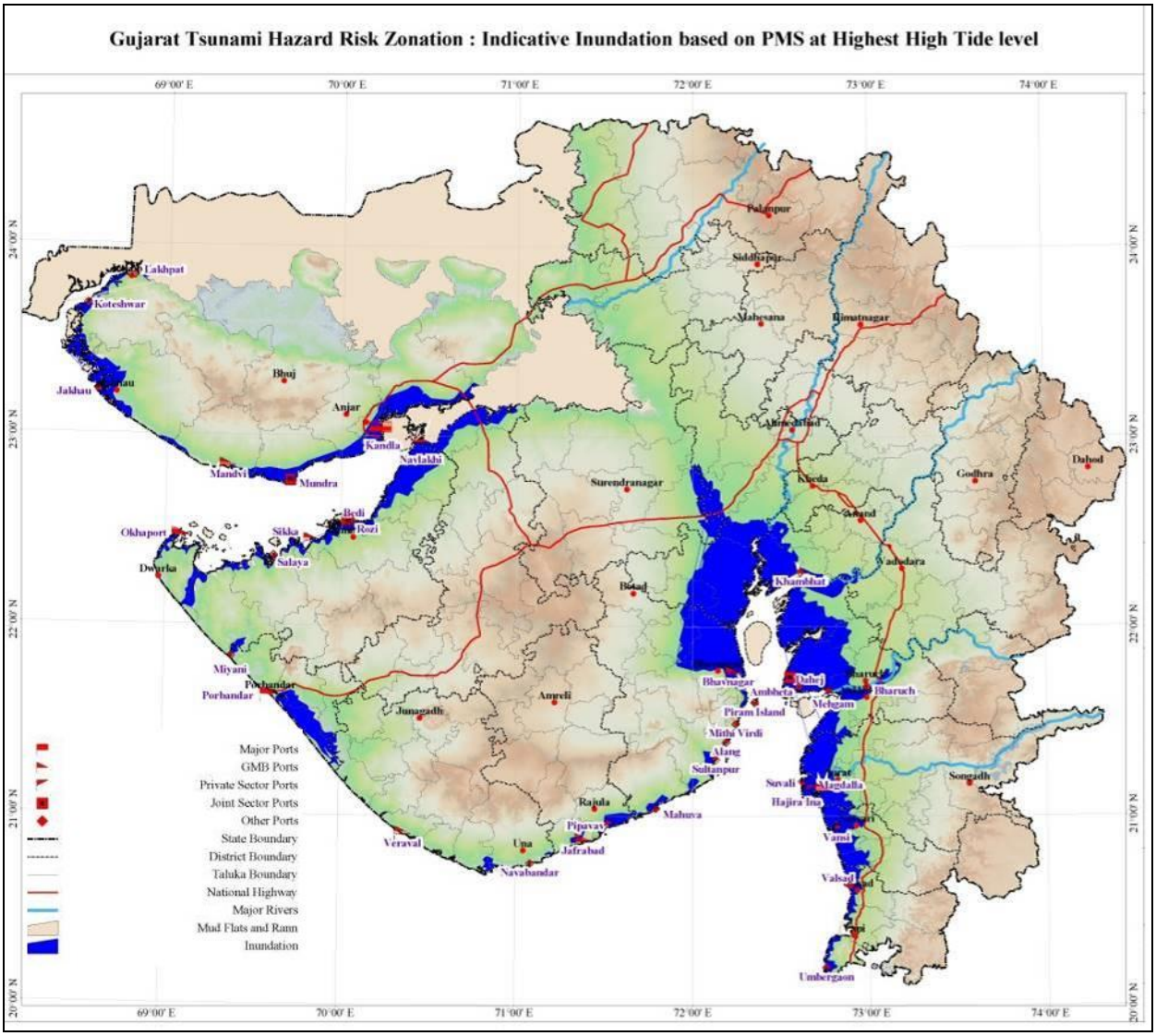


Figure 3.6: Gujarat Tsunami Hazard Risk Zonation

Gujarat is prone to tsunami risk due to its long coastline and probability of occurrence of near and offshore submarine earthquakes in the Arabian Sea. Makran Subduction Zone (MSZ) - South West of Karachi is an active fault area which may cause a high magnitude earthquake under the sea leading to a tsunami.

In past, Kandla coast was hit by a Tsunami of 12 mtrs height in 1945, due to an earthquake in the Makran fault line. Tsunami prone areas in the State include coastal villages of Kutch, Jamnagar, Rajkot, Porbandar, Bhavnagar, Anand, Ahmedabad, Bharuch, Surat, Navsari and Valsad districts.

The Hazard Risk and Vulnerability Atlas prepared by GSDMA shows the estimated inundation based on Probable Maximum Surge (PMS) at highest high tide level in figure 2.6.

3.1.6 Fire

There are many cause of fire in the state such as accidents, electrical

short-circuit, carelessness, gas leaks, mishandling of flammable chemicals and products, etc. Further, Gujarat being highly industrialized state there is increased threat of fire incidents. Fire causes huge losses of life and property every year.

3.1.7 Industrial & Chemicals Disasters

Around 35% of the total Major Accident Hazard (MAH) units of the country are located in Gujarat at Vapi, Hazira, Ankleshwar, Dahej, etc. Gujarat presently has 402 Major Accident Hazard (MAH) prone industrial units, of which 331are operational.

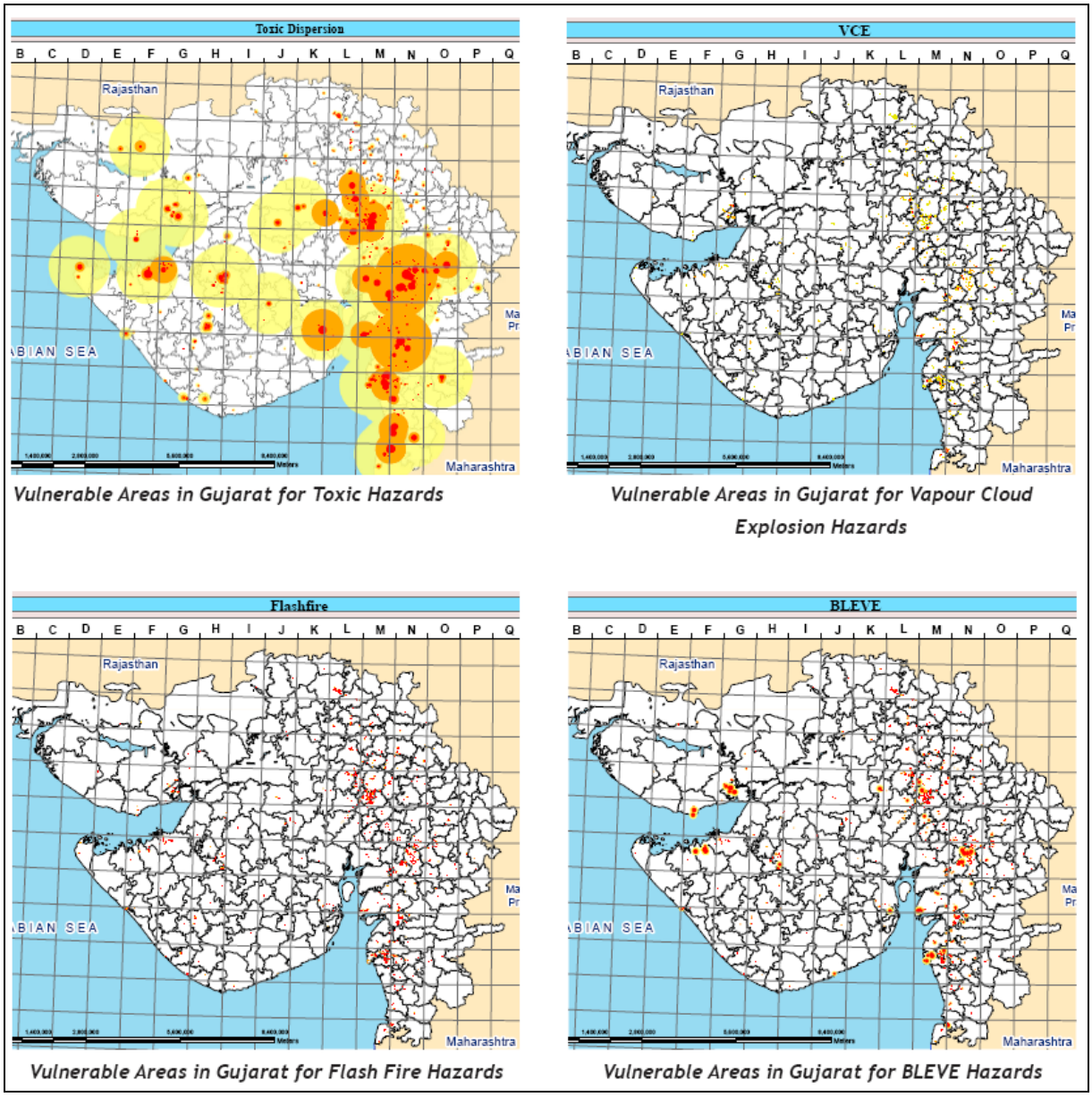
All these pose toxic leak risks and over 80% are also prone to fire or explosion risks. Almost the entire range of the chemical process industry exists in Gujarat, including hydrocarbon processing/ refining products, petrochemicals-polymers and man-made fibres, fertilizers, health care products, plant protection chemicals, dyes, pigments and intermediates, fine chemicals, surface coating products, salt and salt-based products, ceramics, glass, cement, vegetable oils, fats, and detergents.

A stretch of 400 kilometres from Ahmedabad to Vapi is known as the 'Golden Corridor'. Ankleshwar (in Bharuch district) situated on the Narmada estuary is Asia's largest chemical zone. Some toxic chemicals with more than 5,000 metric tonnes storages in Gujarat are acrylonitrile, ammonia, benzene, chlorobenzene, chloroform, cyclohexanone, ethylene dichloride, hydrogen, cyanide, P-xylene, styrene monomer and toluene.

In addition to the manufacturing industries, there is significant infrastructure for handling chemicals such as pipelines, transportation (rail and road), and isolated storages. 70% of country's oils and gas imports are transported through Gujarat via road/rail routes or gas/oil pipelines.

A cross-country 2,300 km Hazira-Bijapur-Jagdishpur (HBJ) gas pipeline originates from Hazira. A hydrocarbon supply pipeline runs from Kandla to Bhatinda (Punjab). A pipeline network of more than 17,000 km is present in the State. This has further increased the incidence of chemical accidents during transportation.

Owing to the presence of most of chemical industries in earthquake prone areas and port based industries in areas prone to tsunami, storm surge and flood, the State is also vulnerable to chemical or industrial disasters in aftermath of a natural disaster.



Vulnerable Areas in Gujarat for Toxic Hazards

Vulnerable Areas in Gujarat for Vapour Cloud Explosion Hazards

Vulnerable Areas in Gujarat for Flash Fire Hazards

Vulnerable Areas in Gujarat for BLEVE Hazards

Figure 3.7: Areas of Gujarat Vulnerable to Industrial and Chemical Hazard

The Government of Gujarat has categorised districts on the basis of chemical and industrial hazard category such as:

- AA Category (Highly Hazardous)
- A Category (Hazardous)
- B Category (Less Hazardous)
- C Category (Much less Hazardous)

Bharuch and Vadodara districts fall in AA Category (Highly Hazardous) which has large volumes of stored toxic gases such as chlorine and ammonia. The density of MAH installations suggests that Ahmedabad, Bharuch, Vadodara, Valsad and Surat have the largest concentration of MAH units. Vadodara, Dahej, Hazira and Jamnagar have major petrochemical complexes.

3.1.8 Accidents

A total of 4,00,517 accidental deaths were reported in the country during

2013 and Gujarat accounts for 6.6% of this. It includes road accidents, rail-road accidents and other rail accidents. The figure has ever been increasing due to an ever-increasing number of vehicles, rage driving, smooth highways and road infrastructure that allows over speeding, non- adherence of traffic rules, etc.

Gujarat falls under the jurisdiction of the Western Railways Division of Indian Railways. The major railway stations in Gujarat are Ahmedabad Railway Station, Surat Railway Station, Vadodara Railway Station and Rajkot Railway Station. Vadodara Railway Station is the third busiest railway station in the country. The State has around 241 railway stations and a dense railway network.

Other accidents include building or bridge collapses, failure of dam or levee, breaks in water, gas, or sewer lines, oil spill, etc.

3.1.9 Epidemic

In the past, Gujarat has faced severe epidemic or epidemic like situations which includes Swine Flu breakout during 2015 and 2010, Hepatitis B outbreak during 2009, Plague Epidemic of 1994, etc.

Additionally, there are also high chances of outbreak of epidemic in the aftermath of any disaster due to overstressed health resources, infrastructure and compromised conditions of hygiene and sanitation. This is particularly seen in case of hydrological disasters like flood leading to threats of water borne diseases and epidemic.

3.1.10 Heat Wave

During summer the maximum temperature often peaks to 45 degrees Celsius leading to severe heat wave conditions. This results in loss of life of many people particularly, homeless, gardeners, daily wagers who work out under direct sun, auto drivers, etc.

3.1.11 Stampede

Gujarat is a culturally vibrant state; it celebrates and hosts many national and regional festivals and fairs with huge enthusiasm. This attracts large number of people at one place. Apart from it, Gujarat attracts large number of religious and other tourists from across the world. This makes it prone to stampede like incidents if proper arrangements of crowd management are not put in place or in case of any rumour or any disaster.

3.2 History of Disasters

As discussed above, Gujarat is prone to large number of natural and human made disasters. Below are some of the major disasters faced by the State:

Date	Disaster	Damage/ Loss
1945	Tsunami	Kandla coast was hit by a Tsunami of 12 mtrs height, due to an earthquake in the Makran fault line.
21/07/1956	Earthquake Mw 6.1	Anjar, Kutch - 115 people killed and hundreds injured. 1350 buildings destroyed at Anjar alone. *(Source: GSI)*
23/03/1970	Earthquake Mw 5.4	Bharuch - 26 people killed and 200 people injured in Bharuch and neighbouring villages. Heavy damage in

		Bharuch city. *(Source :ANSS/ ASC)*
1972-1973	Drought	*[Source: Revenue Dept – DoR]*
22/10/1975	Cyclone 160 -180 km/h	15 km NW of Porbandar - 85 people died; damage to property estimated at Rs. 750 million *[Source: IMD (1999)]*
03/06/1976	Cyclone 167km/h	Saurashtra coast - 70 people died. 51 villages badly affected; 25,000 houses damaged: 4,500 cattle died; damage to property estimated at Rs. 30 million. *[Source: IMD (1999)]*
11/08/1979	Flood	Morbi – Heavy rainfall followed by breakdown of one dam- About 12000 people died in this flood *(Source: Morbi City Web Site)*
01/11/1981	Cyclone 125 km/h	West of Veraval & Porbandar - 13,942 animals dead; 1,128 huts and 677 houses collapsed; 8,686 huts and 6,034 houses damaged; 1.18 m Ha crops damaged with a loss of Rs. 836 million. One ship sinks off Veraval *[Source: Gujarat State Gazetteer (1989)]*
08/11/1982	Cyclone 200 km/h	5 km west of Veraval - Surge of 6 to 8 m; 544 dead; 0.2 million animals dead – loss Rs. 125 million; 60,000 huts collapsed; 0.22 million huts damaged; 45,000 houses collapsed; 0.11 million damaged; 2,800 km of roads damaged – Rs. 356 million loss; 70 dams affected – Rs. 175 million loss; 2,530 settlements deprived of power – loss Rs. 103 million; 1,036 SSI and 27 large industrial units affected; 1,359 fishing vessels damaged; Port loss Rs. 19.1 million; agriculture and orchards loss Rs. 1,050 million *[Source: Gujarat Planning Atlas (1987); Gujarat State Gazetteer (1989)]*
June 1983	Cyclone	Heavy rain (70 cm in two days) in Saurashtra *[Source: Gujarat Planning Atlas (1987)]*
1984-1987	Drought	Faced continuous rainfall deficiency, with 1987 being the worst drought year (rainfall deficits of -42% for Gujarat and -74% for Saurashtra/ Kutch). In 1985, a dry spell of 12–14 weeks affected more than 75% of the crops. During 1986 and 1987, India as a whole suffered from drought, but it was a chronic drought for Gujarat and the Saurashtra/Kutch regions. *[Source: Revenue Dept. DoR]*
1994	Epidemic	Plague- 49 deaths in Surat
18/06/1996	Cyclone	Diu - 14 people died, 1611 houses damaged *[Source: IMD (1999)]*
1993, 1994, 1996, 1997, 1998	Flood	Different regions of the Gujarat State (Revenue Dept. DoR)
09/06/1998	Cyclone	North of Porbandar - 1,173 people died, 1,774 missing. Losses estimated at Rs. 18.65 billion *[Source: IMD (1999)]*
20/05/1999	Cyclone	International border with Pakistan - 453 died; 5,153 buildings damaged and estimated loss to property Rs 800 million *[Source: IMD (1999)]*
1999-2000	Drought	9449 villages in 155 taluks of 17 out of 25 districts with a population of 250 lakhs were affected. The failure of fodder crop affected livestock population of 71.33 lakhs.

		Banaskantha, Jamnagar, Kutch and Patan districts were severely affected. Food-grain production is estimated to be lower by 29.45% compared to that of last year. Oilseeds production is estimated to be lower by 49.23% as compared to that of last year. The crop area under food-grains, oilseeds and cotton has gone down by 4.27 lakh ha during the last kharif and Rabi seasons. *(Source: MoA-GoI)*
26/01/2001	Earthquake Mw 7.9	Kutch - Over 13000 people killed. A total of about 1.3 million houses, lifeline infrastructures were damaged to variable extent. *(Source: IRIS/NEIC/TARU/GSI)*
2001-2002	Drought	40% damage of crops sown after the first rains due to delayed and scanty rains. *(Source: Relief Web)*
July 2005	Flood	About 125 people died *(Source: Indian Red Cross Gujarat state branch)*
July-August 2006	Flood	Surat city and south and central Gujarat - Nearly 150 people had died in the floods while over 100 others had died in post-flood epidemic of leptospirosis. Direct and indirect monetary losses has been estimated at Rs 16,000 crore, of which Rs 9,500-cr was in form of direct damages and Rs 6,500 crore in form of lost production. *(Source: WSEAS-Issue 2 – Vol. 3)*
2009	Hepatitis B Outbreak	Sabarkantha district- 456 cases and 89 deaths
2012-2013	Drought	Severe deficiency of rainfall in Gujarat during the Monsoon-2012. As on 02.08.2012, Saurashtra & Kutch Regions of Gujarat had -79% departure from Long Period Averages (LPAs) while Gujarat region had -55% departure from LPA. All the districts of the State were deficient in rainfall, ranging from -24% to -91%. Drought was declared in 132 Talukas of 17 Districts of the State. (Drought Memorandum - Revenue Department)
5th January, 2013	Fire	A major fire broke out with an explosion at IOC – Hazira on 05/01/2013 at about 12:41 hours in the tank having 5004 KL petrol; 5 workers lost their lives. 71 Nos. of fire tenders from different Municipal Corporations, Municipalities and Industries were applied for fire fighting and transportation of water. The fire completely doused at 11.30 am on 07/02/1013 and all-clear message has been given to concerned authorities (CFO-Surat report).
2013-14	Flood	In the month of August, due to heavy rainfall in the catchment area of Narmada river and release of water from Narmada Dam, Bharuch, Narmada and some part of Vadodara districts got affetced. During rescue operation in Bharuch, Narmada and Vadodara districts about 8159 persons and 3588 cattles were evacuated. The State experienced extremely heavy rainfall from 21st to 28th September 2013, almost in all the districts. 14 districts that received unprecedented rainfall during this period and were worst affected include Surat, Vadodara, Bharuch, Navsari, Narmada, Rajkot, Junagadh,

		Porbandar, Jamnagar, Kutch, Patan, Banaskantha, Sabarkantha and Mehsana. The rains impacted more than 50% of the geographical area of the state. More than 1500 villages were severely affected. 27 persons lost their lives. Infrastructure including power, water supply and roads were badly hit. Agriculture and cultivation were also severely affected. Over 2.23 lakh persons were evacuated by administrative efforts and were shifted to safer locations.
Oct 2014	Cyclone	Nilofar- Rapidly weakened into cyclonic storm before the landfall
2015	Swine Flu	6593 cases and 439 deaths (till March 2015)
June 2015	Flood	70 human deaths; 443563 persons affected; loss of thousands of cattle & wild animals; destruction in 390 villages. Affected districts include Amreli, Bharuch, Bhavnagar, Gir Somnath, Jamnagar, Junagadh, Porbandar, Rajkot, Surat, Valsad.
July 2015	Flood	86 human deaths and 89373 animal's deaths. Worst affected districts include Banaskantha, Patan, Kutch and Mehsana
2016	Drought	1115 villages of 6 Districts (Banaskantha, Dwarka, Kutch, Jamnagar, Porbandar and Rajkot) declared drought affected

Table 3.1: History of Disasters

3.3 Seasonality of Hazards

By understanding the approximate occurrence of hazard, the state may remain prepared for the respective hazards by activating the relevant departments for the same. The table below is only indicative of the occurrence.

Hazards	**Jan**	**Feb**	**Mar**	**April**	**May**	**June**	**July**	**Aug**	**Sep**	**Oct**	**Nov**	**Dec**
Cyclone												
Drought												
Earthquake												
Epidemic												
Fire												
Flood												
Heat Wave												
Industrial/ Chemical												
Road/ Train Accidents												
Stampede												
Tsunami												
Legend	**High Occurrence**				**Moderate Occurrence**				**Low Occurrence**			

Table 3.2: Seasonality of Hazards

3.4 Vulnerability Analysis

3.4.1 Social Vulnerability

The state comprises of 40,74,447 schedule caste persons and a total of 8,917,174 tribal populations as per Census 2011. Among these five tribal groups are identified as particularly vulnerable tribal groups or primitive tribes. These are mentioned in table 2.4.

Primitive Tribe Name	District of Concentration	Population as per Census 2011	Traditional Activities
Kotwalia	Surat, Valsad, Dangs, Bharuch, Navsari	24,249	Making Bamboo baskets
Kolgha	Surat, Valsad, Dangs, Navsari	67,119	Animal grazers
Kathodi	Surat, Dangs, Sabarkantha, Narmada, Navsari	13,632	Collect Kattha for Betel-leaves
Siddi	Junagadh, Bhavnagar, Amreli, Porbandar, Rajkot	8,661	-
Padhar	Ahmedabad, Surendranagar	30,932	Collect root vegetable and fish

Table 3.3: Details of Particularly Vulnerable Tribal Groups

3.4.2 Structural Vulnerability

As per Census 2011, the following is the state of housing in Gujarat:

	Total	Good	Livable	Dilapidated
Total	1,17,67,057	79,73,324	36,11,222	1,82,511
Rural	64,36,493	38,87,921	24,12,055	1,36,517
Urban	53,30,564	40,85,403	11,99,167	45,994

Table 3.4: Status of Residential Households

	Total	Good	Livable	Dilapidated
Total	4,14,661	2,19,852	1,90,185	4,624
Rural	3,28,910	1,60,663	1,64,322	3,925
Urban	85,751	59,189	25,863	699

Table 3.5: Status of Residential-cum-other use Households

As per Census 2011, the material of roof and walls of housing also varies widely and include grass/ thatch/ bamboo, mud/unburnt brick, wood, stone, burnt bricks, concrete, etc. Thus the material of housing is adding to the structural vulnerability if proper building codes and other safety guidelines are not adhered to. This would increase the damage and loss during any disaster particularly earthquake, cyclone, floods, etc.

3.4.3 Economical Vulnerability

Gujarat has many economically vulnerable groups. They have limited resources for daily basic needs. The structures they dwell in are mostly not

safe enough to face hazards. Thus the limited resources they have are highly prone to loss and damage in case of any disaster.

These groups include BPL and antoadhya households. According to Census 2011, Gujarat has a total of 247.68 lakhs workers, out of which around 17.8% are marginal workers. Gujarat has around 3.46 lakhs of slum households and around 1.4 lakhs of houseless population. All these groups are economically vulnerable and have limited financial capacity to recover from disaster loss.

Gujarat being developed and industrialised, is a hub of important commercial houses, factories, corporate, etc. Manufacturing sector contributes significantly to the state GDP. Many fuel pipelines also cross the state. With respect to the hazard profile of the state, any significant damage to the infrastructure can cause a major economical set back to the State and would take its development many year back.

Different sectors of economy are also vulnerable due to hazard profile of the State. Thus any damage to related sector or any part of supply chain can have serious impact on economy of the State. Details of various sectors of economy are mentioned in table 1.6.

3.4.4 Environmental Vulnerability

Gujarat is among the most industrialised states. Around 42 % of its population lives in towns and cities and the State has a decade growth rate of urban population as 5.24 % (2001-2011). Urbanisation leading to deforestation, pollution caused by chemical and pharmaceuticals companies to rivers and air, loss of biodiversity, damage to mangroves and coastlines, etc. severely affects local communities and wider ecological systems. Such environmentally degraded area compromises a community's ability to respond to and recover from a hazard event.

3.5 Capacity Analysis

Capacity includes all such resources human, equipment, infrastructure, etc. that aid in responding to any phase of disaster management.

A comprehensive database of disaster management related inventory is essential for an organized response. Lack of proper and adequate information hampers and delays timely response during golden hours.

GSDMA created a web based portal named State Disaster Resource Network (SDRN) which contains a database of resources at the Village, Taluka, City and District level which can come in handy during disaster situations. SDRN, a decision support tool, is layered using the existing IT Wide Area Network (WAN) of the State - GSWAN. From 2015 SDRN has been upgraded into a map-based Geo Spatial Information Systems developed by the Gujarat based organization Bhaskaracharya Institute for Space Applications and Geo-Informatics (BISAG). Currently, the SDRN network is being integrated with the GIS based Decision Support System.

SRDN could be accessed by registered users at:
http://117.239.205.164/SDRN_NEW/

3.5.1 Human Resources

Staff and officials of various line departments form a huge human resource for various critical functions in both pre and post disaster phase. List of various emergency contacts and contact of various line departments are mentioned in annexure 1.

Trainings are regularly conducted at state level by GSDMA, GIDM and SPIPA. Trainings are also delivered at district level under Disaster Risk Management Programme. These trainings include trainings on search and rescue, first responders, EOC management, architect and engineer's training for safe construction, flood rescue and many other training of trainers also. This has created a large trained human resource both in district and at state level.

3.5.2 Equipment

Over the years GSDMA has provided various fire fighting, search & rescue and other emergency equipment to District Collectorate, Municipal Corporations, ERCs and Municipalities, etc. The detail of same in mentioned in Annexure 2.

3.5.3 Infrastructure

Infrastructure acts as great resource during disaster phase as it forms critical part of logistics and supply chain management of responding agencies, relief material, evacuated masses, etc. A brief of infrastructural capacity of the State is mentioned below in table 3.6.

Railways Total Length	5257.22 route kms. (3506.55 kms – Broad-gauge, 1191.77 kms – Meter gauge, 558.90 kms – Narrow gauge)
Roads Total Length	77690 Kms
Motor Vehicles	157.72 lakhs
Ports	• 41 minor and intermediate ports (14 south Gujarat 23 Saurastra and 4 in Kutch) • 1 major port of Kandla is under Administrative control of Central Govt.
Post and Communications	• Post Office/Branches: 8981 • Telephone Exchange: 3226 • GSM, CDMA and SWP wireless segment subscriber base recorded to 2.903 crore • Wire line subscriber base recorded to 0.21 crore
Banking	Total nos. of branches 7485
Education	• Primary 43176 • Secondary and Higher Secondary 10406 • Higher Education Institutions 1857
Health	• Major Hospitals with Education Institute 8 • District Level Hospitals 24 • Sub-District Hospital 30 • Community Health Centres 318 • Primary Health Centres 1158 • Sub Centres 7274

Table 3.6: Infrastructural Capacity

3.6 Risk Analysis

An overall Composite Risk Index for all hazards on a taluka-wise basis has been estimated for prioritization of overall investments, disaster mitigation and related development interventions. The risk index has been computed by stratifying annualized risk estimates by two deciles classes to generate a five point scale (Very High, High, Moderate, Low and Very Low).

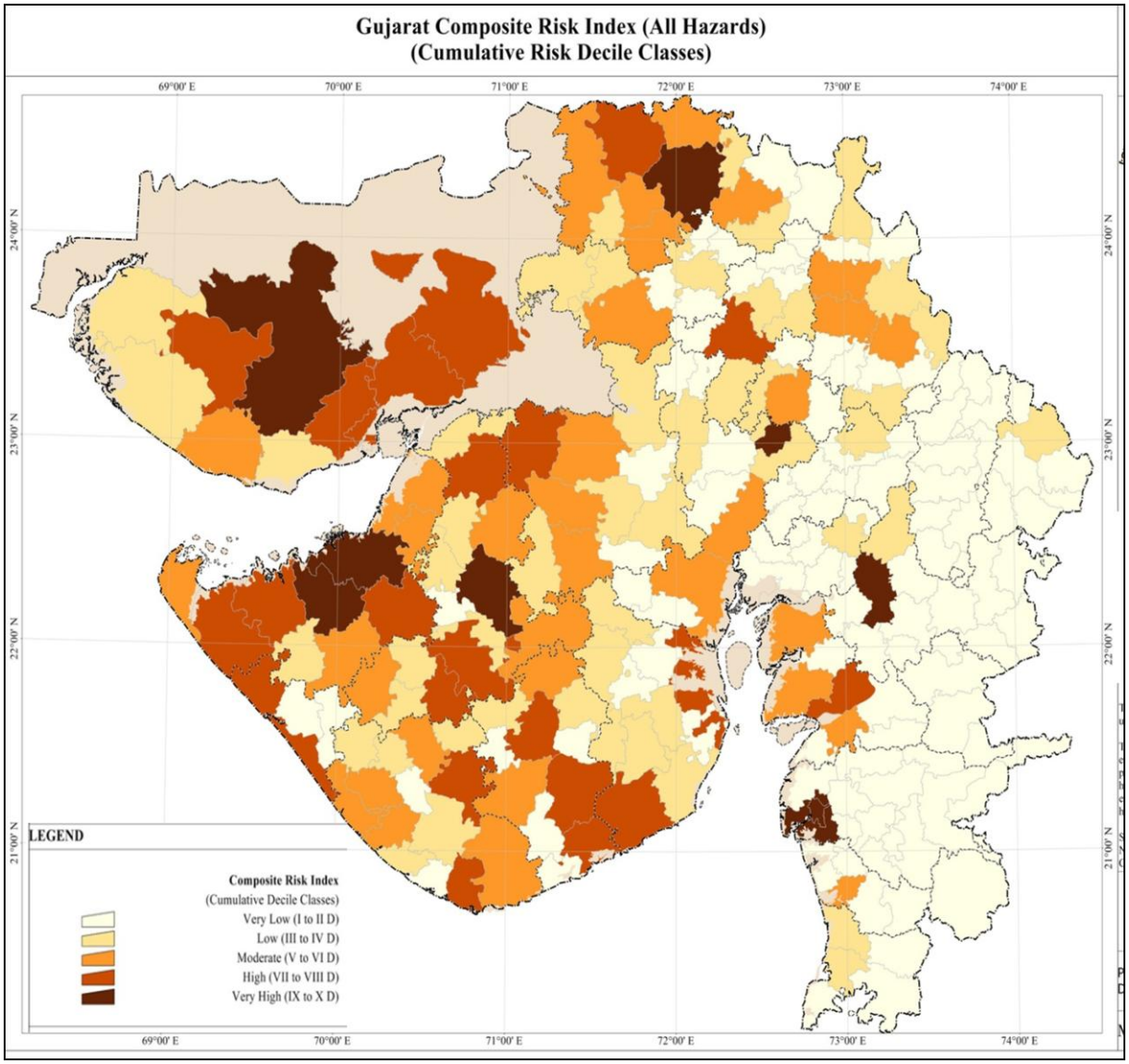


Figure 3.8: Gujarat Composite Risk Zonation Map

Very High Risk

9 Talukas

Surat (Surat City, Chorasi), **Vadodara** (Vadodara), **Ahmedabad** (Ahmedabad City), **Banskantha** (Disa), **Rajkot** (Rajkot), **Jamnagar** (Jamnagar, Lalpur) and **Kutch** (Bhuj)

22 Talukas

Kutch (Nakhtrana, Anjar, Gandhidham, Bhachau, Rapar), **Banskantha** (Tharad), **Mehsana** (Mehsana), **Surendranagar** (Halvad), **Rajkot** (Morbi), **Jamnagar** (Kalavad, Khambhaliaya, Kalyanpur), **Rajkot** (Godal, Jetpur), **Porbandar**(Porbandar), **Junagadh** (Kodinar, Visavadar), **Amreli** (Amreli, Savarkundla, Rajula), **Bhavnagar** (Mahuva) and **Bharuch** (Bharuch)

High Risk

Moderate Risk

33 Talukas

Navsari(Gandevi), **Bharuch (**Ankleshvar, Vagra, Jambusar), **Ahmedabad** (Dholka), **Gandhinagar**(Gandhinagar), **Sabarkantha** (Modasa, Himatnagar, Idar), **Banaskantha**(Palanpur, Dhanera, Vav, Deodar, Kankrej), **Patan** (Sami), **Kutch** (Mandvi), **Surendranagar** (Dhrangadhra, Muli, Sayla), **Jamnagar** (Jodia, Dhrol, Okhamandal, Jamjodhpur), **Rajkot**(Jasdan, Vankaner, Upleta), **Amreli** (Babra, Dhari) and **Junagadh** (Una, Junagadh, Keshod, Mangrol, Maliya)

49 Talukas

Kutch (Mundra, Abdasa, Lakhpat), **Banaskantha** (Bhabhar, Dantiwada, Vadgam), **Patan** (Santalpur, Radhanpur, Patan), **Surendranagar** (Dasada, Wadhwan, Chotila, Limbdi), **Rajkot** (Dhoraji, Jamkandorana, Kotda Sangani, Padadhari, Tankara), **Amreli** (Lathi, Kukavav vadia), **Jamnagar** (Bhanvad), **Junagadh** (Bhesan ,Manavadar, Vanthali, Veraval, Talala) **, Bhavnagar** (Gadhada, Botad, Gariyadhar, Palitana, Talaja, Sihor, Bhavnagar), **Mehsana** (Visanagar, Vijapur, Kadi), **Sabarkantha** (Khedbrahma, Bhiloda, Meghraj, Bayad), **Gandhinagar** (Kalol), **Kheda** (Kapadvanj), **Ahmedabad** (Daskroi, Viramgam), **Dahod** (Jhalod), **Anand** (Anand), **Vadodara** (Savli), **Valsad** (Valsad, Pardi)

Low Risk

Very Low Risk

111 Talukas

Porbandar (Ranavav, Kutiyana), **Junagadh** (Mendarada, Sutrapada), **Rajkot** (Lodhika), **Amreli** (Bagasara, Khambha, Jafrabad, Liliya), **Bhavnagar** (Umrala, Ghogha, Vallabhipur), **Ahmedabad** (Barwala, Ranpur), **Surendranagar** (Chuda, Lakhtar), **Banaskantha** (Amirgadh, Danta), **Patan** (Vagdod, Sidhpur, Harij, Chanasma), **Mehsana** (Satlasan, Kheralu, Unja, Bechraji, Vadnagar), **Ahmedabad** (Mandal, Sanand, Bavla, Detroj), **Sabarkantha** (Vadali, Vijaynagar, Talod, Dhansura, Prantij, Malpur), **Gandhinagar** (Mansa, Dehgam), **Kheda** (Kheda, Virpur, Thasra, Mahudha, Nadiad, Matar, Balasinor, Mehmedabad, Kathlal), **Panchmahal** (Khanpur, Halol, Santrampur, Lunawada, Jambughoda, Ghoghamba, Kadana, Shehera, Morawa, Kalol, Godhara), **Dahod** (Limkheda, Dahod, Degadbariya, Dhanpur, Garbada, Fatepura), **Anand** (Petlad, Tarapur, Khambhat, Borsad, Anklav, Umreth, Sojitra), **Vadodara** (Vaghodia, Padra, Chota Udepur, Dabhoi, Sankheda, Jetpur Pavi, Karjan, Sinor, Nasavadi, Kavant), **Bharuch** (Amod, Hansot, Jhagadiya, Valiya)**, Narmada** (Tilakwada, Nandod, Dediyapada, Sagbara), **Surat** (Olpad, Kamrej, Mangrol, Umarpada, Mandvi, Palsana, Bardoli, Mahuva), **Tapi** (Nizar, Songadh, Uchchhal, Vyara, Valod), **Navsari** (Jalalpore, Navasari, Chikhali, Vansada), **Dang**(The Dangs), **Valsad** (Dharampur, Umargaon, Kaprada)

Figure 3.9: Categorisation of Talukas as per Composite Risk Index (All Hazards)

Chapter 4 Institutional Mechanism & Other Stakeholders

Disaster management structure is in place right from the national to local level. This institutional mechanism plays a crucial role in all activities from policy making to implementation across the entire disaster management cycle.

4.1 National Level

Agencies	Roles & Responsibilities
National Disaster Management Authority (NDMA)	• Apex body in GoI for Disaster Management • Lays down policies, plans and guidelines for disaster management • Coordinates their enforcement and implementation • Takes measures for the prevention, mitigation, preparedness, capacity building or for dealing with a disaster • Oversees the provision and application of funds for mitigation and preparedness measures. • Has power to authorize the departments or authorities concerned, to make emergency procurement of provisions or materials for rescue and relief • Provides support to other countries in times of disasters • States keeps in touch with the NDMA for implementing various centrally funded projects / schemes • States appraises the NDMA about the action taken by the State Government regarding preparation of DM plans and implementation of guidelines issued by NDMA for various hazards from time to time.
National Executive Committee (NEC)	• Executive committee of the NDMA • Assists the NDMA in the discharge of its functions and also ensure compliance of the directions issued by the Central Government • Coordinates the response in the event of any threatening disaster situation or disaster. • Monitors the implementation of guidelines issued by NDMA
National Institute of Disaster Management (NIDM)	• Develops and builds capacity through training, research, documentation • Develops national level information base • Functions within the broad policies and guidelines laid down by the NDMA

National Disaster Response Force (NDRF)	1. Provides specialized response and emergency search & rescue to a threatening disaster situation 2. The general superintendence, direction and control of this force is vested in and exercised by the NDMA 3. Command and supervision of the force is vested in the Director General of Civil Defence and National Disaster Response Force 4. Comprises 10 battalions and 4 battalions are equipped and trained to respond to situations arising out of CBRN emergencies 5. Imparts basic training to all the stakeholders identified by the state governments in their respective locations
Agencies providing Early Warning Information	**1. Central Water Commission (CWC)** o Under Ministry of Water Resources, GoI o Forecasts flood o Initiates, coordinates and in consultation of the State Governments concerned, furthers schemes for control, conservation and utilization of water resources for purpose of flood control, irrigation, navigation, drinking water supply and water power development **2. Indian Meteorological Department (IMD)** o Monitors weather of Indian subcontinent and provides forecasting and other weather services o During the cyclone and flood seasons, the State Government keeps close contact with the IMD – Ahmedabad office for weather related forecasts o Immediately reports to state government all earthquakes of magnitude 3.0 and above on Richter Scale occurring in the state **3. Indian National Centre for Ocean Information Services (INCOIS)** o Under Ministry of Earth Sciences, GoI o Provides the coastal and ocean information services, supporting developmental and operational sectors like ports, fisheries, shipping, meteorology, environment, off shore and coastal zone management and promotes advanced oceanographic research in the country o Provides early warning system for Tsunami o Disseminates critical parameters including wind, wave current, mixed layer depth, heat budget and maps on coral reef, mangroves, shore line change and land use pattern, tracks oil spills, etc.

Table 4.1: Institutional Mechanism at National Level

4.2 State Level

The DM structure in the State is as per the Gujarat State Disaster Management Act, 2003. The National Disaster Management Act, 2005 resembles the State Act with only a few provisions which are not a part of the State Act but are there in the Central Act.

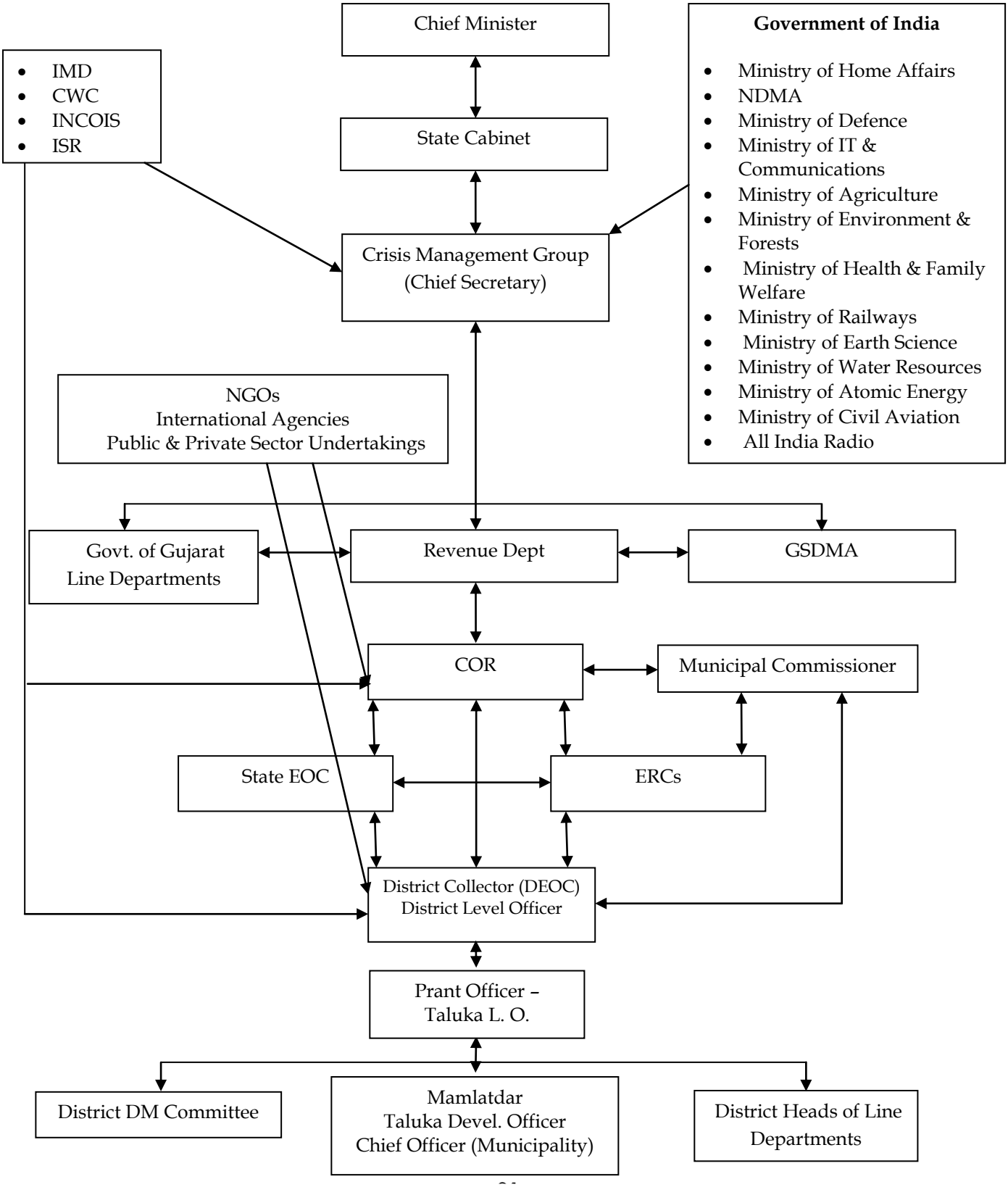


Figure 4.1: Institutional Mechanism at State Level

Those provisions include designating a Vice Chairman to the SDMA, constitution of a State Executive Committee, establishment of a District Disaster Management Authority in each District and creation of a District Disaster Response & Mitigation Funds.

The State has existing institutional arrangements in place for addressing the roles/ responsibilities envisaged through the above provisions and hence does not find it compelling to implement the provisions afresh.

Agencies	Roles & Responsibilities
Gujarat State Disaster Management Authority (GSDMA)	• Promotes an integrated and coordinated system of disaster management including prevention or mitigation of disaster by the State, local authorities, stakeholders and communities. • Collect/cause to be collected data on all aspects of disasters and disaster management and analyze it and further cause and conduct research and study relating to the potential effects of events that may result in disasters. • Acts as a repository of information concerning disasters and disaster management • Lays down the policies and plans for disaster management in the State. • Promotes or causes to promote awareness and preparedness, advices and trains the community and stakeholders
Gujarat Institute of Disaster Management (GIDM)	• Provides training related to disaster management in close coordination with NIDM. • Undertakes activities for human resource development, public education and community awareness, safety etc. in disaster education and management
State Fire & Emergency Services	• Provides crucial immediate response during any disaster • Provides regular training to the fire staff in using and maintaining the equipment
State Crisis Group	• Apex body in the state to deal with major chemical accidents and to provide expert guidance for the same • Review all district off-site emergency plans in the State with a view to examine its adequacy in accordance with the Manufacture, Storage and Import of Hazardous Chemicals, Rules and forward a report to the Central Crisis Group once in three months • Assist the State Government in the planning, preparedness and mitigation of major chemical accidents in state • Continuously monitor the post accident situation arising out of a major chemical accident in the State and forward a report to the Central Crisis Group *Composition of State Crisis Group in mentioned Annexure 3*

Institute of Seismological Research (ISR)	• Engaged in dedicated seismological research • Monitors seismic activity of Gujarat round the clock through a dense network of 50 broadband seismograph station (20 connected by VSAT) and 50 Strong Motion Accelerograph in Gujarat • Reports earthquake location along with magnitudes within 10 minutes of the arrival of seismic waves • Engaged in seismic microzonation of areas prone to earthquakes • Provide consultancy services to various private companies in feasibility studies related to seismicity of the area prior to establishing a major project
Bhaskaracharya Institute for Space Applications and Geo-Informatics (BISAG)	• State level nodal agency to facilitate the use of spatial and geo-spatial technologies for the planning and developmental activities pertaining to agriculture, land and water resource management, wasteland development, watershed development, forestry, disaster management, infrastructure and education. • Provides specialized services and solutions in implementing map-based Geo-Spatial Information Systems. • Provides GIS solutions for disaster management and specialized needs of Public Safety agencies like police, fire and ambulance services. • Provides e-governance solutions to address varying GIS and MIS needs of governments and municipal corporations.
State Disaster Response Force (SDRF)	• GSDMA, through the Home Department, has created 11 State Disaster Response Force (SDRF) Companies with a total strength of around 1000 personnel • 11 Companies of SDRF are stationed at Vadodara (2 Companies), Ahmedabad, Madana, Godhra, Nadiad, Gondal, Valiya, Vav, Gandhinagar and Rajkot. • A list of equipment to be procured for providing training to the SDRF teams has also been finalized with inputs from NDRF Gandhinagar • Training of SDRF has started in Basic Course; two teams of 77 personnel have been trained so far. Personnel trained in Basic Course will further be trained in Specialized Courses through NDRF and other training Institutes

Table 4.2: Institutional Mechanism at State Level

4.3 District and Local Level

There are District and Local Crisis Group which cater to major chemical accidents in the district and at local level. Their location is mentioned in table 4.3. The key functions of District and Local Crisis Groups are mentioned in table 4.4.

District	Headquarters of District Crisis Groups	Local Crisis Group
Ahmedabad	Ahmedabad	Vatva,Narol
		Naroda
		Odhav
		Sanand
		Dholka, Dhandhuka
		Viramgam
Gandhinagar	Gandhinagar	Gandhinagar
		Kalol
Mehsana	Mehsana	Mehsana
		Kadi
		Visnagar
Sabarkatha	Himatnagar	Himatnagar
Patan	Patan	Siddhpur
Kheda	Nadiad	Matar
Anand	Anand	Khambhat

Table 4.3: Location of District & Local Crisis Group

Crisis Group	Functions
District Crisis Group	• Apex body in district to deal with major chemical accidents and provide expert guidance • Assists in the preparation of the district off-site emergency plan • Reviews all the on-site emergency plans prepared by the occupier of Major Accident Hazards installation • Assists the district administration in the management of chemical accidents within the district • Ensures continuous information flow from the district to the Centre and State Crisis Group regarding accident situation and mitigation efforts • Conducts at least one full scale mock-drill of a chemical accident at a site each year and forward a report of the strength and the weakness of the plan to the State Crisis Group *Composition of District Crisis Group in mentioned Annexure 4*
Local Crisis Group	• A body in the industrial pocket to deal with chemical accidents • Coordinates efforts in planning preparedness and mitigation of a chemical accident • Prepares local emergency plan for the industrial pocket • Trains personnel involved in chemical accident management *Composition of Local Crisis Group in mentioned Annexure 5*

Table 4.4: Functions of District & Local Crisis Group

4.4 Other Stakeholders in Disaster Management

There are various agencies, organizations, departments and authorities that constitute a core network for implementing various disaster management related functions and activities. It also includes academic, scientific and technical organizations, media, community, etc. which play important role in various facets of disaster management. List of various NGOs in the state are mentioned in Annexure 8 and contact details of other stakeholders are in Annexure 1.

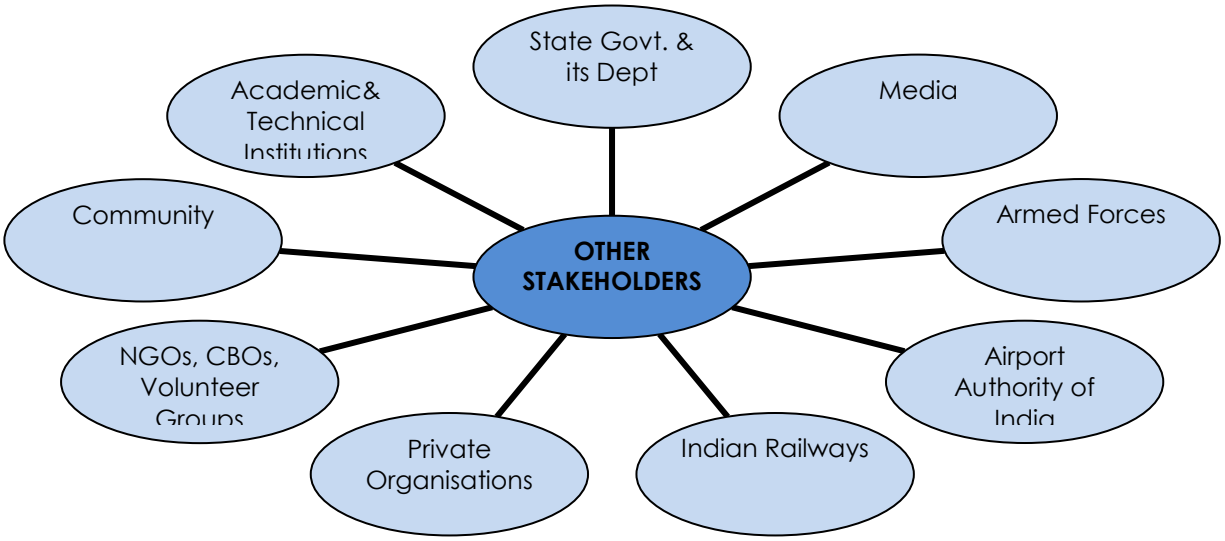


Figure 4.2: Stakeholders in Disaster Management

Chapter 5 Prevention and Mitigation Measures

5.1 Prevention & Mitigation Strategy

Keeping in view the hazard and risk profile of the State and its disaster history, Gujarat has the following prevention and mitigation strategy:

a. Creating State Disaster Mitigation Fund

b. Creating awareness for disaster risk reduction at all level

c. Appropriate amendments in the legislative and regulatory instruments along with strengthening of the enforcement mechanisms at different levels

d. Conducting micro-zonation surveys

e. Ensuring use of disaster resistant construction techniques, codes and guidelines in all sectors of the society by law and through incentives and disincentives

f. Incorporating the study of disaster engineering subjects in architecture and engineering curricula

5.2 Prevention and Mitigation Measures

Broadly the prevention and mitigation measures could be divided into structural and non-structural measures.

a. Structural mitigation measures generally refer to capital investment on physical constructions or other development works. These include engineering measures and construction of hazard resistant and protective structures.

b. Non-structural measures refer to awareness and education, policies, techno-legal systems and practices, training, capacity development etc.

These measures are diverse in nature and hence the inter department participation plays a crucial role in their implementation. Each department is required to prioritise and implement these measures.

5.2.1 Earthquake

Task	Activities	Responsibility
	Structural Measures	
Micro-zonation	1. Undertake micro zonation study according to priority area 2. Provide or make available seismic micro-zonation map 3. Provide vulnerability and risk assessment map	• Revenue Dept. • COR • DST • ISR • GSDMA
Earthquake Resistance	1. Develop earthquake resistant design features for the construction of public utility	• Revenue Dept., • COR

Design for Different Earthquake Zones	structures 2. Develop earthquake resistant design features for the construction of residential structures 3. Provide earthquake resistant design for incorporating in different types of structures of the line departments	• R & B Dept.
Retrofitting of Existing Structure	1. Create a database of existing structure (both public and private) in the state 2. Identify the available resources 3. Identify structures that require retrofitting 4. Prepare a scheme/programme for retrofitting 5. Identification and removal of unsafe buildings/structure	• Revenue Dept. • R & B Dept. • UD & UHD Dept. • Panchayat & Rural Housing Dept.
Non Structural Measures		
Monitoring of Seismic Activities	1. Establish seismological network and round the clock monitoring 2. Dissemination of information and reporting 3. Conduct seismological research	• Science & Technology Dept. • ISR
Capacity Building	1. Prepare departmental earthquake contingency plan 2. Ensure earthquake related departmental action plan and SOP 3. Include earthquake engineering topics in curriculum 4. Provide professional training about earthquake resistance construction to engineers and architects 5. Provide training to masons. 6. Encourage soil and material testing in laboratories	• Education & technical Education Dept. • Revenue Dept. • GSDMA • State Training Centre (R&B) • Labour & Employment Dept. • Line dept.
Safety Audit	1. Carry out structural safety audit of all critical lifeline structures	• Revenue Dept., • R & B Dept. • UD & UHD Dept • Panchayat & Rural Housing Dept. • Other line Dept.
Awareness	1 Disseminate earthquake risk to general public residing in earthquake prone zones 2 Campaign for Earthquake safety tips	• GSDMA • Information Dept.

Table 5.1: Mitigation Measures for Earthquake

5.2.2 Cyclone, Storm Surge and Tsunami

Task	Activities	Responsibility
	Structural Measures	
Shelter Belt	1. Ensure shelter belt plantation and mangrove regeneration	• Revenue Dept. • COR • Forest Dept.
Providing Cyclone Shelters	1. Construct cyclone shelters in cyclone prone areas.	• Revenue Dept. • COR • R & B Dept.
Strengthening of Infrastructure	1. Construct missing roads and bridges in cyclone prone areas 2. Strengthen /repair of existing roads and bridges in cyclone prone areas 3. Strengthen dams and canals 4. Construct new saline embankment and repair existing ones	• Revenue Dept. • COR • R & B Dept. • Irrigation Dept.
Forecasting and Warning	1. Strengthen and upgrade of existing cyclone and tsunami forecasting system 2. Establish infrastructure for cyclone/tsunami warning and disseminate to the on shore/off shore coastal areas 3. Develop specific warning dissemination system for ports, beach, salt workers and fishermen.	• IMD • Revenue Dept. • COR • Gujarat Maritime Board (GMB) • Tourism Dept.
	Non-Structural Measures	
Capacity Building	1. Prepare departmental cyclone/tsunami contingency plan 2. Develop cyclone/tsunami related departmental action plan and SOP 3. Impart training to the stakeholders involved in cyclone/ tsunami mitigation and management.	• GSDMA • State Training Centre (R & B) • WALMI • Other Line dept. • GIDM
Awareness	1. Disseminate cyclone/tsunami risk to general public residing in coastal areas 2. Campaign for cyclone/tsunami safety tips	• IMD • COR • GMB • Tourism Dept. • Information Dept. • GSDMA
Safety Audit	2. Carry out structural safety audit of all critical lifeline structures	• Revenue Dept., • R & B Dept. • UD & UHD Dept • Panchayat & Rural Housing Dept. • Other line Dept.

Table 5.2: Mitigation Measures for Cyclones/ Tsunami

5.2.3 Flood

Task	Activities	Responsibility
Structural Measures		
Construction	1. Improve design for irrigation and flood protective structures 2. Construct dams, flood protection wall, flood diverting channels etc. 3. Strengthen /repair of existing roads and bridges and other critical infrastructure in flood plains. 4. Strengthen dams and canals	• Revenue Dept. • COR • Irrigation Dept. • Central Design Organization(CDO) • R & B Dept. • All line Dept.
Development of Catchment Area	1. Develop catchment area of the flood plain o Forestation o Land sloping o Small reservoirs/Check dams/ponds etc.	• Revenue Dept. • COR • Irrigation Dept. • Forest & environment Dept.
Flood Proofing	1. Implement specific building by laws for buildings and structures in the flood plains	• Revenue Dept. • COR • Irrigation Dept. • UDD, Panchayat & Rural Housing • Local Bodies
Techno-legal Regime	1. Enact and enforce laws regulating developmental activities in flood plain	• Revenue Dept. • COR • Irrigation Dept. • UDD, Panchayat & Rural Housing • Local Bodies
Forecasting and Warning	1. Strengthen and upgrade existing flood forecasting system 2. Establish infrastructure for flood warning and dissemination	• Revenue Dept. • COR • Irrigation Dept • CWC • IMD
Non-Structural Measures		
Capacity Building	1. Prepare departmental flood contingency plan 2. Develop flood related departmental action plan and SOP 3. Impart training to the stakeholders involved in flood mitigation and management	• Revenue Dept. • COR • Irrigation Dept • Line Dept. • Water and Land Management Institute (WALMI) • GIDM
Awareness	1. Disseminate flood risk to general public residing in flood prone zones 2. Campaign for flood safety tips	• Revenue Dept. • COR • Irrigation Dept • GSDMA • Information Dept.

Safety Audit	3. Carry out structural safety audit of all critical lifeline structures	• Revenue Dept., • R & B Dept. • UD & UHD Dept • Panchayat & Rural Housing Dept. • Other line Dept.
Review of Rules	1. Review operational rules for reservoirs	• Revenue Dept. • COR • Irrigation Dept

Table 5.3: Mitigation Measures for Floods

5.2.4 Drought

Task	Activities	Responsibility
	Structural Measures	
Construction	1. Construct dams, reservoirs, lift irrigation, tube wells and canals for surface irrigation 2. Construct percolation tanks, check dams, farm ponds, etc. 3. Construct warehouses and cold storages for preservation/storage of food grains.	• Revenue Dept. • COR • Irrigation Dept • Agriculture Dept. • Civil Supply Dept.
Repairs, Up-gradation and Strengthening	1. Repairs, up-gradation and strengthening of dams, reservoirs, lift irrigation and canals for surface irrigation 2. Carry out repairs, up-gradation and strengthening of percolation tanks, check dams, farm ponds, etc.	• Revenue Dept. • COR • Irrigation Dept • Agriculture Dept.
Techno-legal Regime	1. Enact and enforce laws regulating ground water level and exploitation of natural recourses	• Revenue Dept. • COR • Irrigation Dept. • UDD, Panchayat & Rural Housing • Local Bodies
Adaption of New Technology	1. Apply advanced Agro-Science technology and agro-engineering inputs to improve agriculture production	• Revenue Dept. • COR • Agriculture Dept.
Forecasting and Warning	1. Strengthen and up-grade existing drought forecasting system 2. Establish infrastructure for drought warning and dissemination.	• Revenue Dept. • COR • Irrigation Dept • IMD
	Non-Structural Measures	
Capacity Building	1. Prepare departmental drought contingency plan 2. Develop drought related departmental action plan and SOP 3. Impart training to the stakeholders involved in drought mitigation and management.	• Revenue Dept. • COR • Irrigation Dept. • Agriculture Dept. • Forest & Environment Dept.

	4. Encourage people to use advance technology of drip and sprinkler irrigation 5. Encourage water harvesting 6. Encourage farmers to understand crop pattern to be adopted in their area 7. Promote rational use of fertilizers and pesticides 8. Encourage the adaptation of technique for preservation of green fodder	• All line Dept. • GIDM
Awareness	1. Disseminate drought risk to general public residing in drought prone zones 2. Campaign for drought tips for agriculture, general public and industries	• Revenue Dept. • COR • Irrigation Dept • Agriculture Dept. • GSDMA • Information Dept. • All line Dept.

Table 5.4: Mitigation Measures for Droughts

5.2.5 Industrial/ Chemical Disasters

Prevention & Mitigation Activity	Primary Responsibility	Secondary Responsibility
Ensure safety of chemical storage vessels regulated by PESO	PESO	DISH
Enforce safety provisions for isolated storages	DISH (Recommended)	GPCB
Ensure overall chemical safety of the unit including process safety, PPE, staff training, etc.	DISH	
Ensure no or minimal environmental impact owing to operations and possible accidents at the site	GPCB	DISH
Ensure safe electrical conditions and that electrical hazards will not trigger chemical accidents	CEI	DISH
Eliminate/ reduce the use of toxic materials and /or use alternative non-toxic materials at each source	Industry	DISH
Reduce use of toxics through minimizing use and/or storage volumes	Industry	DISH
Implement risk management programs and install passive and active mitigation systems	Industry	DISH
Implement land-use restrictions to provide minimum safe distances from hazardous sources to public and sensitive receptors	Industry	DISH

Dovetail structures under MSIHC Rules, 1898, the Gujarat State DM Act, 2003 & National DM Act 2005	GSDMA	SCG, Chief Secretary of State
Ensure onsite emergency plans for MAH units and Type A & Type B industries	DISH, CEI, PESO, GIDC, DoT	Industry
Ensure onsite emergency plan for Hazardous Waste Management Facilities (TSDF)	Treatment, Storage and Disposal Facility (TSDF)	Regional GPCB
Prepare onsite emergency plans and enforce MSIHC rules in intermediate, minor and private ports in addition to major ports	Respective Port Authority	Regional GPCB, DISH
Ensure onsite emergency plans for isolated storage facilities	Isolated storage facility, Regional GPCB	DISH
Prepare emergency response plans for transport of HAZCHEM	DISH	Department of Transport, Western Railways, Traffic Police
Prepare and implement land use policy on 'no population buffer zone' around MAH industries. Carry out vulnerability assessment based locations of chemical industries	State level Land use and town Planning related agencies/ dept	GPCB,GSDMA,DC DCG, Revenue Dept
Implement programmes such as Toxic Risk Reduction Programme	DISH, GPCB ,GIDC, DoT, PESO	
Use Third Party professionals for strengthening enforcement	PESO,CEI,DISH	
Implement e-governance	GSDMA, DISH	DCG,DDMA, LCG (all for data and implementation support)
Develop inspection manuals	All relevant regulatory agencies	
Promote preventive programs in industry	DISH, PPP models like DPMC	GSDMA, DCG, District Collector, collaboration between multiple regulatory agencies
Coordinate between different enforcement agencies	GSDMA	GFASLI, Airport Authority, Western Railways, PNGRB, GMB, PESO, CEI, DISH, GPCB, DOT
Carry out training and capacity building programs	GIDM, SPIPA	Regulatory Agencies, DISH, DCG
Plan sheltering in place and/ or evacuation programs with proper public warning systems	Revenue Department	Information Dept Local Bodies

Maintain basic emergency capability to respond to everyday emergencies such as fire and medical. Maintain a rapid and qualified chemical emergency response capacity to control and reduce the quantity of hazardous chemical leaked and duration of such leak	DISH	Police Fire & Emergency Services Health
Establish plans, develop public warning systems, and conduct public outreach and training on evacuation and shelter in place. The public needs to be trained on what actions are expected of them based on the warning systems.	DISH	Revenue Dept Information Dept.

Table 5.5: Mitigation Measures for Industrial & Chemical Hazards

5.3 Current Projects

5.3.1 National Cyclone Risk Mitigation Program

To mitigate vulnerability in the cyclone hazard prone districts and make community and infrastructure disaster resilient, in harmony with conservation of coastal ecosystems, GSDMA has initiated National Cyclone Risk Mitigation Program (NCRMP) in collaboration with National Disaster Management Authority (NDMA) and World Bank. The components under NCRMP are:

a. Construction of Multipurpose Cyclone Shelters (MPCS)

During cyclones most of the local houses and huts cannot withstand the strong winds; therefore evacuation to safer places in the form of cyclone shelters is necessary. GSDMA has proposed to construct the 128 MPCS at different talukas in 11 coastal districts of the State. The tender for construction of 38 MPCS has been completed till date.

b. Construction of Missing Roads and Bridges

The up-gradation of 43 roads existing in 8 districts has been undertaken to connect the habituations and cyclone shelters and to ensure smooth and safe evacuation process during cyclones. The construction of 20 roads has been completed till date.

c. Underground Cabling of Towns

Underground cabling is the replacement of overhead cables providing electrical power or telecommunications with underground cables. This serves the significant purpose of making the power lines less susceptible to outages during high wind thunderstorms and cyclones. It has been proposed to do the underground cabling of Gandhidham city.

Chapter 6 Mainstreaming Disaster Management in Development

Mainstreaming disaster risk reduction into development planning has been a priority concern for the State Government. It should ensure that development plans and programs do not create new forms of vulnerability.

6.1 Planning Based on Hazard, Vulnerability and Risk Profile of the State

GSDMA has prepared a Hazard Risk & Vulnerability Atlas for integrating disaster management into development planning. Each line department, Municipal Corporation, District Collector and District Development Officer of the State is required to use it for initiating major projects depending on the vulnerability of the project area.

In addition, line departments and even some private industries do seek the advice of GSDMA on vulnerability of the region before finalizing projects that require major investment. Dholera Special Investment Region Project is one such example where GSDMA has provided guidance in carrying out vulnerability studies for flood and seismic activities before finalizing the development plan.

Based on the same each line department and other relevant state agencies should carry out and ensure the following:

1. Plan land use of the State in view of hazard, risk and vulnerability
2. Ensure development schemes of the state are undertaken in view of hazard, risk, vulnerability and micro-zonation
3. Ensure the programme/ scheme/ project is facilitated with the provision for adequate funds of disaster management
4. Apply science and technology and engineering inputs to improve infrastructures including dams and reservoirs, building design, construction, etc.

6.2 Formats for Pre-approval of Projects

In continuation with the efforts to integrate disaster management into development planning especially for new projects that are under preparation stage, the Central Government has revised the formats for pre-approval from EFC (Expenditure Finance Committee) and for preparing the DPR (Detailed Project Report) to address disaster management concerns.

6.2.1 EFC Format

To ensure the implementation of key areas, a check list for EFC format and the responsible departments are as shown in table 6.1:

Activity	Responsibility
1. To ascertain whether project involve any creation/ modification of structural/ engineering assets 2. To ascertain the possible risks, likelihood and impact from disasters due to the location of project sites 3. To ascertain whether probable risks have been prioritized and the mitigation measures being contemplated, both structural and non-structural measures 4. To ascertain whether the design and engineering of the structure has taken into consideration the National Building Code 2005, the appropriate BIS Codes, other applicable sources as per the type of the project and the NDMA guidelines . List of codes/guidelines for safety of building/structures is given in Annexure 6. 5. To ascertain whether the cost of disaster treatment/ mitigation measures been included in the overall project cost 6. To ascertain whether the process of risk assessment has been done based on available information and secondary evidence	• Line Depts. - Irrigation - Power - Water supply - Health - Roads & Buildings - Education - Others • Dept. approving the project o Administratively o Financially o Technically • Urban Development Authorities • R & B Dept • GSDMA • Local Bodies

Table 6.1: Checklist for EFC Format

6.2.2 DPR Format

To ensure the implementation of key areas, a check list for DPR format and the responsible departments are as shown below:

Activity	Responsibility
1. Impact Assessment of project (damage that can be caused to the project by natural disasters, design of the project that could accentuate the vulnerability of the area to disasters and / or lead to rise in damage / loss of lives, property, livelihood and surrounding environment), checklist for natural disaster impact assessment if given in Annexure 7. 2. Risk assessment of project 3. Vulnerability assessment of project (Evaluation of site with regards to parameters such as probable maximum seismicity, probable maximum storm surge, probable maximum wind speed, probable maximum precipitation, probable maximum flood discharge and level, soil liquefaction proneness under probable earthquake intensities) 4. Compliance of o Land Use Management o Building Code o Building Use Regulation	• Line Depts. preparing the project - Irrigation - Power - Water supply - Health - Roads & Buildings - Education - Others • Dept. approving the project o Administratively o Financially o Technically • Urban Development Authorities • R & B Dept • GSDMA

o Directives and Legislation o Maintenance Requirement 5. Details about the location of the project, proneness of the project area to various hazards and analysis of impact on safety of the project 6. Impact of the project on the environment and the surrounding population with respect to the type of the project and adoption of mitigation measures to reduce the impact of the same	• Local Bodies

Table 6.2: Checklist for DPR Format

6.3 Relevant Government Schemes and Projects

Many government schemes targeted at different vulnerable groups could be used in pre-disaster phase as a tool for minimizing their vulnerability and empowering them to better respond to any disaster. Some of the schemes/ subsidies could also be used in post-disaster phase to rebuild their lost infrastructure, housing, to avail basic amenities/ facilities like education, health, to restore livelihood, etc. by availing the entitlement of these schemes.

These schemes include Agri-Implements Subsidiary, Animal Husbandry Aid Scheme, Rastriya Madhyamik Shiksha Abhiyan (RMSA), Targeted Public Distribution System, Annapurna Scheme, Janani Shishu Suraksha Karyakram (JSSK), Rashtriya Swasthya Bima Yojana (RSBY), Welfare Scheme for Salt Workers, Shramik Suraksha Accident Group Insurance Scheme, Sardar Patel Awas Yojna, Indira Awas Yojna, Indira Gandhi National Disability Pension Scheme, Assistance to Disable Widows for House Construction, Vanbandhu Kalyan Yojna, etc.

To ensure that the entitlement of these schemes reach the targeted population, it is necessary that population is well aware of such schemes/ projects and their entitlement.

Inter department coordination is very crucial for these entitlement to reach the affected population especially in a post-disaster scenario.

Chapter 7 Preparedness & Capacity Building

7.1 Preparedness Measures

Preparedness for any probable disaster is an essential and proactive step to deal with any emergency. It is a peacetime phase and provides opportunity to develop and build capacity of the system and society.

Each stakeholder needs to develop and enhance his/her skills and resources so as to be able to perform the respective role and responsibility at the onset of the disaster. The key stakeholders at state level and the respective preparedness measures to be undertaken are discussed below.

7.1.1 State Government

The State Government shall:

1. Ensure that appropriate policies and guidelines are developed
2. Ensure that the State Administration and local authorities take into consideration the guidelines laid down by GSDMA while planning its activities
3. Ensure that State Government, GSDMA, Heads of Government Departments, COR, District Collectors and local authorities take necessary steps to be prepared for all probable disasters
4. Facilitate timely procurement related to disaster management of materials, equipment and services in connection with the disaster management and ensure their quality
5. Ensure preparation, implementation timely updation of disaster management plans by respective state departments, local authorities, communities and stakeholders.

7.1.2 Departments of the State Government

a. Revenue Department

1. Revenue Department is the nodal department for controlling, monitoring and directing measures for organizing rescue, relief and rehabilitation. All other concerned line departments should extend full cooperation in all matters pertaining to the response management of the disaster whenever it occurs.
2. Develop relief norms and packages
3. Arrange with service provider companies for multiple warning messages to community, officials, etc as the need may be
4. Develop and promote insurance, disaster bonds, tax rebate, etc. against the disaster

b. Agriculture & Cooperation Department

1. Identify area prone to droughts, floods and pest attack and monitor them during vulnerable season
2. Spread awareness among farmers regarding various crop diseases, prescribed use of fertilisers and pesticides, crop insurance, alternate cropping pattern in disaster prone areas, proper seed and fodder management, etc.
3. Formulate a trained team for assessing damage to crops, soil and other agricultural damage
4. Ensure a proper mechanism for communicating early warning to farmers regarding rainfall, flood, droughts, cyclone, etc.

c. Animal Husbandry Department

1. Ensure proper mechanism for disease surveillance among animals
2. Prepare a database of veterinary hospitals, clinics and agencies working for animals
3. Identify source for procurement of fodder
4. Identify safe locations for cattle camps
5. Ensure proper administration of de-worming and vaccinations for cattle, sheep and goats, pigs and other relevant measures for disease management
6. Aware rural population regarding management of sick or diseased animals
7. Ensure proper transportation facilities for sick or critically injured animals
8. Identify space for burial of dead animals

d. Civil Aviation Department

1. Ensure that sites for helipads are identified across the state as per the laid guidelines

e. Climate Change Department

1. Promote green technology, CNG usage, use of solar energy, etc.
2. Aware citizens regarding ways to preserve ground water, saving power and reducing carbon footprint in day-to-day life
3. Increase and protect mangrove cover
4. Prepare a comprehensive policy on Climate Change for the state and guidelines to be followed for the same

f. Education Department

1. Organise camps in school and colleges for awareness of do-s and don't s of possible hazards in the state, hygiene and other issues of public health
2. Ensure preparation of disaster management plans and first aid kits in all schools and colleges
3. Identify safe schools and colleges which can be used as relief shelters for short duration of time in aftermath of any disaster

g. Fire & Emergency Services

1. Ensure proper maintenance and functioning of all fire fighting equipments and personal protection equipments
2. Prepare a database of private fire fighting agencies and their resources
3. Keep vigil regarding MAH units and other hazardous installations in the state and prepare for possible emergency situation

h. Food & Civil Supplies Department

1. Prepare for safety of stored food grains in godowns against inundation and water logging, fire and other possible hazards
2. Prepare for out movement of stored food grains to a pre-identified safer location
3. Enlist godowns and cold storage facilities, refrigerated transportation vehicles present in the state along with their storage capacities and facilities available
4. Enlist private retailers and wholesale dealers of food items and packaged drinking water
5. Enlist available kerosene depots, petrol pumps, CNG pumps, diesel depots, LPG agencies, etc.

i. Forest & Environment Department

1. Formulate a team to catch wild animals in case they enter inhabited areas
2. Gujarat Pollution Control Board should ensure that all industries are following proper guidelines for hazardous waste management

j. Health & Family Welfare Department

1. Organise awareness camps for hygiene and other public health issue
2. Develop plan for hospital preparedness and mass casualty management
3. Prepare a database of registered private hospitals, clinics, diagnostic labs, blood banks, etc. along with their capacities and facilities provided
4. Establish paramedic cadre through training programmes and accredit / license them
5. Recognize and accredit trauma centres
6. Establish statewide medical emergency access number
7. Ensure authentic medical database enlisting public and private facilities available in the state. This includes details of manpower, logistics, medical equipments, medicines, antidotes, personal protective equipments, disinfectant, vaccines, etc.
8. Standardize and license ambulance services
9. Ensure availability of adequate supply of life saving equipment and drugs, portable supplies like portable oxygen cylinders,

portable x-ray machines, triage tags, etc.

10. Formulate trained medical first responder, QRMT, stationary and mobile decontamination facilities, identification of poison centres, mobile hospital, antidotes plan and crisis management plan at hospitals for chemical disaster preparedness

11. Prepare trained psychological and psychosocial care teams

12. Impart training to manpower for emergency services

13. Ensure proper and safe management of medical waste

14. Keep at disposal list various hazardous chemicals present in the state and their antidotes

k. Industrial Safety And Health

1. Create awareness for health & safety for workers and factory management

2. Conduct health & hygiene survey and inspection in various industrial sectors

3. Make a database of MAH units and hazardous installations in the state and their safety officers

4. Ensure preparation of onsite emergency management plan by all industrial units

5. Prepare a database of suppliers/ manufactures of antidotes for hazardous chemicals

l. Information Department

1. Display verified Information Education and Communication (IEC) materials for mass dissemination and awareness among the public

2. Prepare a database of popular media channels and media persons (both print and electronic)

3. Ensure proper mechanism/ channels for addressing public so as to avoid and manage rumours with help of various media

m. Narmada, Water Resources, Water Supply & Kalpsar Department

1. Ensure proper early warning mechanism for flood by monitoring water level of surface water bodies

2. Ensure proper and timely inspection of conditions of bunds, embankments, inlet and outlets of lakes, drains--, channels and pump houses

3. Ensure proper functioning of all equipments including dewatering pumps

4. Prepare for arrangement of safe drinking water supply for community in the affected areas, relief camps and shelters

5. Prepare for prompt repair of pipelines supplying potable water

6. Ensure availability of adequate number of water tankers, drums, jerry cans or identify their private suppliers to prepare for supply of

water, in scarcity period and in emergency

7. Ensure availability of water supply/ filling points for fire tenders, water cannons, hospitals and other necessary life saving infrastructure

n. Police Department

1. Ensure proper functioning of all equipment and vehicles
2. Prepare for quick deployment of Home Guards and volunteers for providing safety to affected population and evacuated structures/ houses
3. Prepare plan for management of terrorist attack, bomb blast, stampede, etc.
4. Train police personnel and staff of PCR van in first aid and basic life support
5. Prepare communication plan for uninterrupted communication to all police posts and various control room and emergency centres across the state

o. Port & Transport Department

1. Ensure proper functioning of filling station, vehicles and equipment
2. Prepare for prompt deployment of vehicles at short notice for various purposes like mass evacuation, transportation of response teams, relief items, victims, etc.
3. Prepare mechanical team for prompt repair of equipment and vehicles
4. Train drivers, conductors, crew members, port officials in first aid and basic life saving techniques

p. Road & Building Department

1. Ensure availability and functioning of all equipments like cranes, earthmovers, etc. Prepare a data base of availability of the same with private agencies also
2. Prepare for prompt clearance of debris post disaster
3. Prepare the demolishing squad for prompt demolition of unsafe buildings post disaster
4. Prepare for prompt clearing and repairing of damaged roads, culverts, bridges and flyovers
5. Ensure prompt construction of new temporary roads for diverting traffic from the affected area
6. Prepare for construction of temporary facilities like that of medical post, temporary shelters, etc at short notice.
7. Prepare for prompt establishment of helipad near the affected site for responding teams and VVIP visits
8. Prepare for restoration of government buildings damaged during disaster

q. Science & Technology Department

1. Ensure proper mechanism to issue alert/ warning through SMS through service providers

2. Prepare for providing safety and serviceability of critical communication towers through respective service providers

3. Prepare for prompt establishment of alternate communication links like HF, VHF, HAM, Satellite Phones, etc., in case of failure of primary communication channels during disaster

r. Social Justice & Empowerment Department

1. Prepare and regularly update database of scheduled castes, developing castes, social and economically backward classes, minorities communities, physically and mentally challenged persons, orphans, destitute, beggars, old aged persons and ensure that they are able to avail benefits under respective welfare schemes so as to reduce their vulnerability to disasters

s. Sports Youth & Cultural Activities Department

1. Organise training and awareness camps for youth or first aid, relief and camp management, psycho social care, search and rescue for small incidents, fire fighting and thereby creating a trained volunteer database

t. Tribal Development Department

1. Prepare a database of tribal groups in the state, their population and habitats

2. Ensure they are well covered under all government schemes targeted to them with special focus on the five Particularly Vulnerable Tribal Groups

u. Women & Child Development Department

1. Prepare a database of authentic NGOs working for women and children empowerment/ rights

2. Prepare for prompt action in aftermath of any disaster so as to prevent human trafficking particularly that of women, girls and children

3. Ensure women and children in vulnerable circumstances are well covered under various government schemes targeted to them

7.1.3 Gujarat State Disaster Management Authority (GSDMA)

1. Assist the State Government in formulation of policy for relief, rehabilitation, reconstruction and recovery.

2. Monitor preparation, updation and implementation of disaster management plans

3. Promote awareness and preparedness among all stakeholders regarding potential disasters

4. Assist in development of methodologies for reduction of vulnerability of disasters

5. Publish various guidelines to be followed for various phases of disaster management

6. Inspect existing development plans made by various authorities and recommend measures to be incorporated for disaster management

7. Develop database of key experts, consultants, organisations, agencies, etc working in the field of disaster management

7.1.4 The State Relief Commissioner (COR)

1. Prepare, review and update State level emergency plans and guidelines and ensure that the district level plans are prepared, revised and updated

2. Develop an appropriate relief implementation strategy for the State in consultation with the Authority, taking into account the unique circumstances of each district and deficiency in institutional capacity and resources of the State.

3. Strengthen relief distribution and accounting system at state and district level through identification of centralized system for receipt, storage and distribution of relief and by ensuring rate contract, procurement and stockpile of relief material

7.1.5 Collectors/ Municipal Commissioners

1. Ensure an updated database of critical resources (equipments, life saving facilities, trained personnel, etc.) available in the District/ Corporation is in place

2. Ensure that all critical life saving equipments are maintained and ready to use

3. Ensure that District/ Mahanagarpalika Disaster Management Plans are prepared and are timely updated

4. Ensure that local authorities in the District/ Corporation are involved in developing their own mitigation plans

5. Ensure that disaster management drills are carried out periodically

6. Ensure that District Emergency Operation Centre/ Control Room is fully functional and communication systems are in order

7. Ensure that open and safe places for mass evacuation are identified

8. Ensure that safe buildings are identified for purpose of relief camps

9. Ensure that site for helipad is identified at key locations

7.1.6 Local Authority

1. Provide assistance to GSDMA, COR and Collector in disaster management activities

2. Ensure training of its officers and employees and maintenance of resources so as to be readily available for use in the event of a disaster

3. Ensure that all construction projects under it conform to the standards and specifications lay down

4. Each department of the Government in a district shall prepare a disaster management plan for the district. Carry out relief, rehabilitation and reconstruction activities in the affected area within its jurisdiction

5. Select vulnerable community and most vulnerable groups at risk

6. Advice and issue direction wherever necessary for community disaster prevention, mitigation and preparedness through local resources and participatory approach

7. Take appropriate actions to enhance community preparedness

7.1.7 Indian Railways

1. Ensure proper security and safety measures at each railway station in the state

2. Ensure that do-s and don't-s about relevant hazards are properly displayed at each railway station

3. Ensure proper mechanism for crowd control at each major railway station particularly during festival seasons

4. Ensure that disaster management plan is in place for the railways

5. Ensure proper mechanism for transportation of mass community and proper handling and distribution of relief material

7.1.8 Private Sector

1. The private sector should ensure their active participation in the pre-disaster activities in alignment with the overall plan developed by the GSDMA or the Collector.

2. They should also adhere to the relevant building codes and other safety guidelines prescribed by relevant authorities.

7.1.9 Community Groups and Voluntary agencies

1. Local community groups and voluntary agencies including NGOs should actively assist in prevention and mitigation activities under the overall direction and supervision of the GSDMA or the Collector.

2. They should actively participate in all training activities as may be organised and should familiarise themselves with their role in disaster management.

7.1.10 Citizen

It is a duty of every citizen to assist the Commissioner, the Collector or such other person entrusted with or engaged in disaster management whenever his aid is demanded generally for the purpose of disaster management.

All citizens should also ensure preparedness at family and individual level by being aware and proactive. Indicative components of family emergency survival kit including that of first aid kit are mentioned in annexure 11.

7.2 Capacity Building Measures

Various stakeholders should engage in building their respective capacities by conducting regular trainings to

upgrade their skills, by developing techno- legal regime to better deal with different aspects of disaster management and by taking other proactive measures for the same. Some of the suggestive measures are discussed below.

7.2.1 Techno-legal Regime

1. Formulate of professional Civil Engineers Act
2. Formulate of Emergency Medical Service Act
3. Create of an Emergency Medical Services Authority (EMSA)
4. Create of guidelines for Emergency Care of special section of people like children, elders, BPL beneficiaries, citizens of remote and disaster
5. Review and revise building by-laws
6. Review and revise GDCR/CRZ etc.
7. Review and revise town planning Act & Rules
8. Ensure strict implementation of Code and Rules
9. Monitoring of quality construction
10. Construction/Strengthening of SEOC/ DEOC/ TEOC/ ERC

7.2.2 Training

Training is one of the essential processes to build and enhance capacity to deal with disasters. Training the community ensures skilled and trained first responders during any emergency without panic. Secondly, training the officials and responders ensures rapid and appropriate response from various stakeholders, thus minimising the loss.

Training	Responsibility
1. Training to civil defence personal in various aspect of disaster management 2. Training to Home Guards personal in various aspect of disaster management including search and rescue	• Home Dept. • Commandant General Home Guards • Director Civil Defence • GSDMA/GIDM
3. Training to NCC and NSS personal in various aspect of disaster management	• Education Dep. • Director NCC • GIDM
4. Training to educational and training institutions personal in various aspect of disaster management	• NIDM • GSDMA/GIDM
5. Training to civil society, CBOs and corporate entities in various aspect of disaster management	• NIDM • GSDMA/GIDM • NGOs
6. Training to fire and emergency service personal in various aspect of disaster management	• NIDM • UDD • Municipal Corporation • GSDMA/GIDM
7. Training to police and traffic personal in various aspect of disaster management	• NIDM • GSDMA/GIDM • Home Dept. • Police training Institute

8. Training to State Disaster Response Force (SDRF) Teams in various aspect of disaster management	• NIDM/NDRF • Home Dept. • Addl. DGP (Arms) • Addl. DGP (Training) • GSDMA/GIDM
9. Training to media in various aspect of disaster management	• NIDM • Information Dept. • Information Training Centre • GSDMA/GIDM
10. Training to govt. officials in various aspect of disaster management	• NIDM • GSDMA/GIDM • Departmental Training Institutes
11. Training to engineers, architects, structural engineers, builders and masons in various aspect of disaster management	• Departmental Training Institutes under R & B and Irrigation Dept. • NIDM • GSDMA/GIDM
12. Training at local and regional level for undertaking rapid damage and need assessment	• GSDMA/ GIDM

Table 7.1: Training for Various Stakeholders

7.2.3 Awareness

Awareness in the masses regarding dos and don'ts, vulnerable areas and emergency numbers empower them to do the needful proactively as and when the situation arises. Having aware community also reduces the chances of chaos and panic.

GSDMA regularly undertakes media campaigns through radio, television and newspapers. These include audio-visual campaigns through jingles, pamphlets, videos, etc. The campaigns cover probable hazards and other safety measures as per seasonality of hazards in the State like *Uttarayan*, heat wave, cyclone, Diwali safety, etc.

Similarly, following measures can be taken by respective department towards generating awareness:

1. Create mass awareness through advertisement, hording, booklets, leaflets, banners, etc.
2. Organise awareness camps for children and make use of folk dance and music, plays, painting competition, debate competition, etc. To disseminate the information
3. Organise disaster management exhibition and use scientific tools like shake-table demonstration, etc to disseminate awareness about various hazards and ways to deal with them
4. Arrange for TV Spot, radio spot, audio-visual and documentary,

etc. to reach out to masses at large

5. Media can play a vital role in public awareness and preparedness through educating the public about disasters; warning of hazards; gathering and transmitting information about affected areas; alerting government officials, helping relief organizations and the public towards specific needs; and even in facilitating discussions about disaster preparedness and response

7.2.4 Developing Technical and Computer Aided Databases

1. Update the vulnerability atlas based on new districts created and any change in vulnerability profile of population over the years
2. Develop GIS based information system for different sectors viz. medical and health, civil supply, fire and emergency services, etc.
3. Develop Flood Disaster Management Information System- develop software, collect and feed basic data, train the user and ensure regular updation of real-time data
4. Create and disseminate database of contact details, resources, response agencies, NGOs, trained personnel, most vulnerable groups, evacuation routes, available shelters, relief centres, critical infrastructures, storage godowns, etc.

7.2.5 Knowledge Management

1. Document disasters, their impacts, lessons learnt and make it available in easily accessible format
2. Undertake research studies and apply the outcomes in disaster management practices
3. Document field data, experience and indigenous technological knowledge from local community
4. Share data/ information/ reports/ proceeding of consultation meeting/seminars etc.
5. Use information and communication technology at disaster management centres, state, district, taluka, village EOCs
6. Each department should have in place departmental disaster management plan and hazard wise SOPs
7. Each department should also conduct mock drill at regular interval and update the plan based on gaps identified in the mock drill

7.3 Current Projects/ Programmes

Currently GSDMA is undertaking various preparedness and capacity building projects and programmes at different level. Some of the key projects and programmes are:

7.3.1 National School Safety Programme

The Government of India in June 2011, approved the 'National School Safety Program (NSSP) – A demonstrative project' with a total cost of Rs.48.47 Crore as a 100% Centrally Sponsored Scheme to be implemented by National Disaster Management Authority (NDMA) in collaboration with the Ministry of Human Resource Development (MHRD) and in partnership with State/UT Governments.

NSSP is a holistic project to promote culture of safety in schools and covers 43 districts of 22 States /UTs of the country falling in seismic zone IV & V.

In Gujarat the NSSP project is being implemented in 400 schools of Kutch and Jamnagar districts (200 schools in each district). GSDMA is implementing the project in collaboration with NDMA and in partnership with the district administration.

The program has following components and activities:

i. Preparation of School Disaster Management Plans
ii. Printing and Distribution of IEC Material
iii. Review and Approval of School Disaster Management Plans
iv. Sensitisation Program
v. Rapid Visual Survey (RVS)
vi. Mock Drill in 400 Schools
vii. Disaster Preparedness Kits
viii. Training of Trainers
ix. Training of Teachers
x. Translation into Regional Language and Printing of Teacher Training Module
xi. Non-structural Mitigation Measures
xii. Structural Retrofitting
xiii. Grant-in-aid to State Education Department

Currently procurement of Disaster Preparedness Kit and structural retrofitting of one school is in progress while rest of the components have already been implemented by GSDMA.

7.3.2 School Safety Week

Gujarat State Disaster Management Authority has organized the School Safety Week in 400 selected schools of Kutch, Jamnagar and Devbhumi – Dwaraka districts covered under the NSSP program to aware, educate and build the culture of preparedness among the school children. The key activities include orientation program, creating awareness about disaster through IEC materials, film screening, understanding non-structural risks, basic life saving skill, slogan and drawing competition and project competition for school children. The initiative also includes shakeout drills and mock exercises.

In 2016, it is decided to celebrate SSW in more than 3000 schools of Ahmedabad, Gandhinagar, Vadodara, Surat, Kutch, Jamnagar and Dwarka on similar lines.

7.3.3 Disaster Risk Management Programme

The Disaster Risk Management (DRM) Programme was initiated by Ministry of Home Affairs (MHA), Govt. of India in

collaboration with United Nations Development Programme (UNDP) in the year 2002. Gujarat State Disaster Management Authority was the nodal agency for implementing programme activities in Gujarat state. The DRM Programme was formulated with a goal of sustainable reduction in disaster risk in most hazard prone districts in Gujarat state. The DRM Programme was aiming at strengthening of response, preparedness and mitigation measures over a period of time through a variety of activities at the state, district, taluka and village levels.

Considering the impact of DRM Programme activities, GSDMA included DRMP as a new scheme and made financial provision in state budget since 2008-09. With implementation of exit strategy of UNDP in the year 2008, GSDMA started utilising State Government resources and made necessary arrangements to maintain flow of DRM Programme activities all across the State. After UNDP's withdrawal in June-2009, GSDMA owned the DRM Programme and started implementing programme activities more rigorously.

Currently, GSDMA focuses on all 33 Districts and 8 Municipal Corporations of the State for strengthening of Response, Preparedness and Mitigation measures. In order to ensure effective implementation of programme activities, GSDMA also has appointed District Project Officer/Project Officers at District/ Corporation level who work under direct supervision of respective District Collector/ Municipal Commissioner.

The set of activities under DRM Programme includes:

i. Development of Disaster Management Plan at various administrative levels viz. District, Taluka, Municipality, Villages, etc.
ii. Capacity building through training/ orientation programmes
iii. Updation of National and State level online resource network for Disaster Preparedness and Management
iv. Awareness generation programmes at various levels
v. Manual development for trainers and practitioner at all levels.

7.3.4 Establishment of International Institute of Chemical Safety & Research

GSDMA has established International Institute of Chemical Safety & Research (IICSR) as an institution of excellence for imparting state-of-the-art education, training and research in the fields of hazardous chemical management in general.

The key objectives of the Institute objectives of the Institute are:

i. To provide an educational research, training and extension platform to chemical manufacturers, trade houses, governmental agencies, safety and research experts, insurance companies, transport agencies and end product consumers

ii. To conduct individual and collective research projects on hazardous chemical management
iii. To make necessary policy interventions
iv. To address problems critical to human health and environment arising due to the continuous use of hazardous chemicals
v. To collaborate and facilitate partnerships with willing eminent national & international organizations, universities, institutions, bodies & individuals specialized in chemical safety
vi. To act as a resource centre and clearing house of information on hazardous chemical management by documentation of field experiences including case studies, lessons learnt and best practices and to undertake necessary initiatives to provide a better quality chemical safe and secure environment
vii. To run and award degree/diploma/certificate courses on hazardous chemical management at its own or with the affiliation of any other Institute/ Universities, Local/ National/ International
viii. To do such all other acts and undertake such other activities and to create such infrastructure, institutions and organization for chemical safety

7.3.5 Hospital Safety

Hospitals and medical services are an integral part of response to any unforeseen event whether natural or man-made, biological or chemical. GSDMA, with a view to develop the resilience and to augment efficacy of response for such events, started Hospital Safety project. The project aims at bringing various stakeholders on same platforms through various mock exercises. Conducting Mock-drills exercise involves the following key aspects:

i. Preparation/ review of Hospital Disaster Management Plan with special focus on Hazard Vulnerability Risk and Capacity (HRVC) Analysis of the Hospital and its evacuation plan
ii. Understanding and undertaking structural and non structural mitigation measures
iii. Formulation of Disaster Management teams of Hospital
iv. Training of Teams and staff including doctors, administrations, class IV employees, etc.
v. Safety audits of the Hospital Building (Fire / electrical safety audits etc.) through concerned agencies

GSDMA has conducted mock exercise in two of the most important Government Hospitals that is Civil Hospital Ahmedabad and Civil Hospital, Gandhinagar.

GSDMA also assists private hospitals in reviewing their Disaster Management Plan and in planning and conducting mock exercise with them.

7.3.6 Establishment of Building Assessment and Structural Surveillance (BASE) Centre

It is an initiative by GSDMA to address and facilitate the building assessment

needs of the community. It will suggest appropriate mitigation measures based on the seismicity of the region and facility type.

Building Assessment and Structural Surveillance (BASE) Centre is aimed at attending the needs of the community for safer establishments on request basis. BASE Centre will serve as a node point for structural safety issues of building structures.

The key objectives of BASE Centre are as below:

i. To identify & address the structural safety issues of building pertaining to earthquake
ii. Technical support by suggesting necessary measures that are required to be taken for improving the structural stability of building against earthquake
iii. Training & Capacity building through GIDM by imparting basic training with regards to safe construction & strengthening of buildings to the empanelled agencies
iv. To address any query pertaining to earthquake resistant construction
v. To undertake micro-zonation studies for better planning

Chapter 8 Disaster Response & Relief

8.1 Level of Disasters

L concept has been developed to define different levels of disasters in order to facilitate the responses and assistances to states and districts.

Level	Description	Activities
L0	Normal time	Prevention, preparation and capacity building activities like trainings, preparation and updation of plans, mock drills, procurements of equipments, etc
L1	Can be managed at district level	State and Centre remain ready to assist if need arises
L2	Beyond the capacity of district	Require active participation and mobilisation of resources from State Government
L3	Resources of District and State Government have been overwhelmed	Require Central Government for reinstating the State and District machinery as well as for rescue, relief, and other response and recovery measures

Table 8.1: Levels of Disasters

8.2 Emergency Operations Centres

EOC is an offsite facility which functions from the State / District/ Taluka headquarters. It includes the space, facilities and protection necessary for communication, collaboration, coordination and emergency information management. It is a combination of various line departments of Government and other agencies whose services are generally required during incident response.

There is a comprehensive network for effective disaster management which includes emergency communication, operation and response management. It includes the State Emergency Operation Center (SEOC) at Gandhinagar with 33 District Emergency Operation Centers (DEOCs), 248 Taluka Emergency Operation Centers (TEOCs) and 5 Emergency response centres (ERCs).

So far in Gujarat, there was a State Control Room manned by the Revenue Department situated at Sachivalaya. It has played an important role in emergency response, rescue and relief.

The new State Emergency Control Centre (SEOC) has been made functional. It has the following facilities:

1. Control Room
2. Reception Room
3. Waiting Room
4. Display Room
5. Media Room (with toilets)

6. Room for Hon'ble Ministers and officers (with toilets)
7. Chamber for Relief Commissioner
8. Chamber for Director of Relief
9. VIP Conference Room (with provision for video-conferencing facility)
10. Facility Management Room (with toilets)
11. State Alert & Warning Room
12. Conference Room (Regular video conferences are being conducted by Govt. of Gujarat throughout the State)
13. Staff sitting Room
14. Department Room – 5
15. UPS Room
16. Rest Room (with toilets) – 2
17. Ladies and Gents Toilet Rooms – General
18. Pantry Room
19. Electric Room

The SEOC compound also has the following utilities:

1. Garden
2. Fire Fighting System
3. Parking
4. Generator Room – 160 KVA
5. Security Cabin and main gates
6. Water Harvesting System
7. Sump Room
8. Electric and Transformed Room – 315 KVA

Each room has been provided with air conditioning system and CCTV cameras. The main building also consists of announcing system, fire extinguishers, smoke detectors and sensors. SEOC also has a digital display board to display early warning, rainfall data, relevant information etc. to public.

8.2.1 Activation of EOC

The EOC is a nodal point for the overall coordination and control of relief work. In case of an L1 Disaster the DEOC will be activated, in case of an L2 disaster SEOC will be activated along with the DEOC. Working of EOC can further be understood by following states:

i. **Normalcy (Steady State)-** When full activation of the EOC is not warranted
ii. **Emergency Alerts**- When the EOC is brought into full or partial activation to preemptively reduce the impact of impending incidents and respond to the impact of the incident when it transpires
iii. **Emergency-** When an incident occurs with or without prior warning requiring full activation of the EOC in response to the incident

8.2.2 Command & Control of EOCs

The EOC, its system and procedures are designed in such a way that information can be promptly assessed and relayed to concerned parties. Immediate dissemination of information contributes to quick response and effective decision-making during emergency. Being the main coordination and control point for all disaster specific efforts, the EOC is the place of decision-making, under a unified command.

The EOC in normal circumstances works under the supervision of Relief Commissioner at the State level and under the District Collector at the

district level. It is the nerve centre to support, co-ordinate and monitor the disaster management activities at the district level. In a disaster situation, the EOC will come under the direct control of Chief Secretary or any other person designated by the Chief Secretary as Chief of Operations.

8.2.3 Functions of EOC

1. Receive, monitor, and assess disaster information
2. Monitor, assess, and track response units and resource requests
3. Manage resource deployment for optimal usage
4. Make policy decisions and proclaim local emergencies as needed
5. Provide direction and management for EOC operations through set priorities and establish strategies
6. Coordinate operations of all responding units, including law enforcement, fire, medical, logistics etc
7. Augment comprehensive emergency communication from EOC to any field operation when needed or appropriate
8. Maintain EOC security and access control
9. Keep senior, subordinate and tenant officials informed
10. Keep local jurisdictions (Village/town/City, district and State) informed
11. Operate a message center to log and post all key disaster information
12. Develop and disseminate public information warnings and instructions

8.3 Emergency Response Centres (ERCs)

In order to have speedy response in search & rescue and relief, GSDMA have established ERCs at five strategic locations of the state viz. Gandhinagar, Vadodara, Rajkot, Surat and Gandhidham. The ERCs are equipped with trained manpower and state-of-art equipments to provide support to the District EOCs if the situation becomes worse and goes beyond their control. ERCs perform response related activities and increase the preparedness through capacity building.

8.3.1 Activation

ERC will get activated in case of:

- An event is or has the potential to becoming an L2 disaster or
- Specialist rescue operation is required or
- There are insufficient local emergency rescue resources

8.3.2 Command & Control

The ERCs work under the direct control of Commissioner of Relief (CoR) during response time and under representative, Municipal Corporation/ District Administration during peace time. The ERC is the instrument to provide multi-hazard emergency response to L2 events.

District Collectors/ Municipal Commissioners request the assistance from the ERC team as soon as it is

established that district resources are insufficient to deal with the emergency situation at hand.

They issue instructions regarding exact quantum of resources (in terms of manpower, equipments and essential items from key departments/ stakeholders) that is required, type of assistance to be provided the time limit within which assistance is needed, details of other task/response forces through which coordination should take place.

8.4 Trigger Mechanism

The response mechanism shall be put into action considering the situation prevailing at a given point of time as per the provision made vide Section 2 (h) of the Gujarat State Disaster Management Act, 2003. Response process begins as soon as it becomes apparent that a disastrous event is imminent and lasts until the disaster is declared to be over. Response is triggered on receiving any early warning or at occurrence of disaster as the case may be.

On receipt of alert/ early warning or information about onset of disaster, District Collector or Relief Commissioner assume the role of the Incident Commander (IC) for L1 or L2 level disaster respectively, as the case may be. Immediate access to the disaster site through various means of communications such as mobiles, VSAT, wireless communication and hotline contact is also made. Depending on level of disaster, the required and relevant Incident Response Teams (IRTs) shall be activated. The State Government may publish a notification in the official gazette, declaring such area to be disaster-affected area under GSDMA Act (Section 32 (2) (a)).

The EOCs and ERCs will be put on full alert and will continue to operate as long as the need for emergency relief and operations continue and the longer term plans for rehabilitation are finalised.

Disaster	Agencies
Earthquakes	IMD, ISR
Floods	IMD, Irrigation Dept.
Cyclones	IMD
Tsunami	IMD, ISR, INCOIS
Drought	Agriculture Dept.
Epidemics	Health & Family Welfare Dept.
Industrial & Chemical Accidents	Industry, Labour & Employment Dept., DISH
Fire	Fire & Emergency Services

Table 8.2: Agencies Competent for Issuing Disaster Specific Early Warning

8.4.1 In case of Early Warning

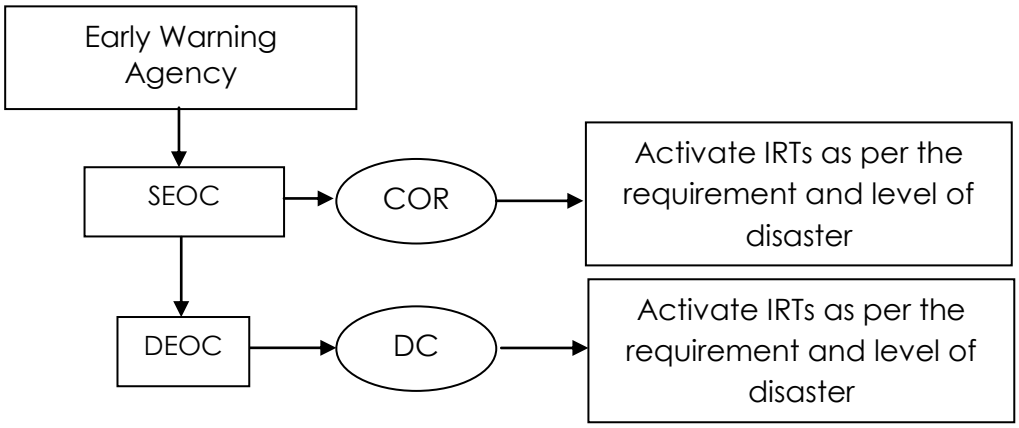


Figure 8.1: Trigger Mechanism in Case of Early Warning

8.4.2 Without Early Warning

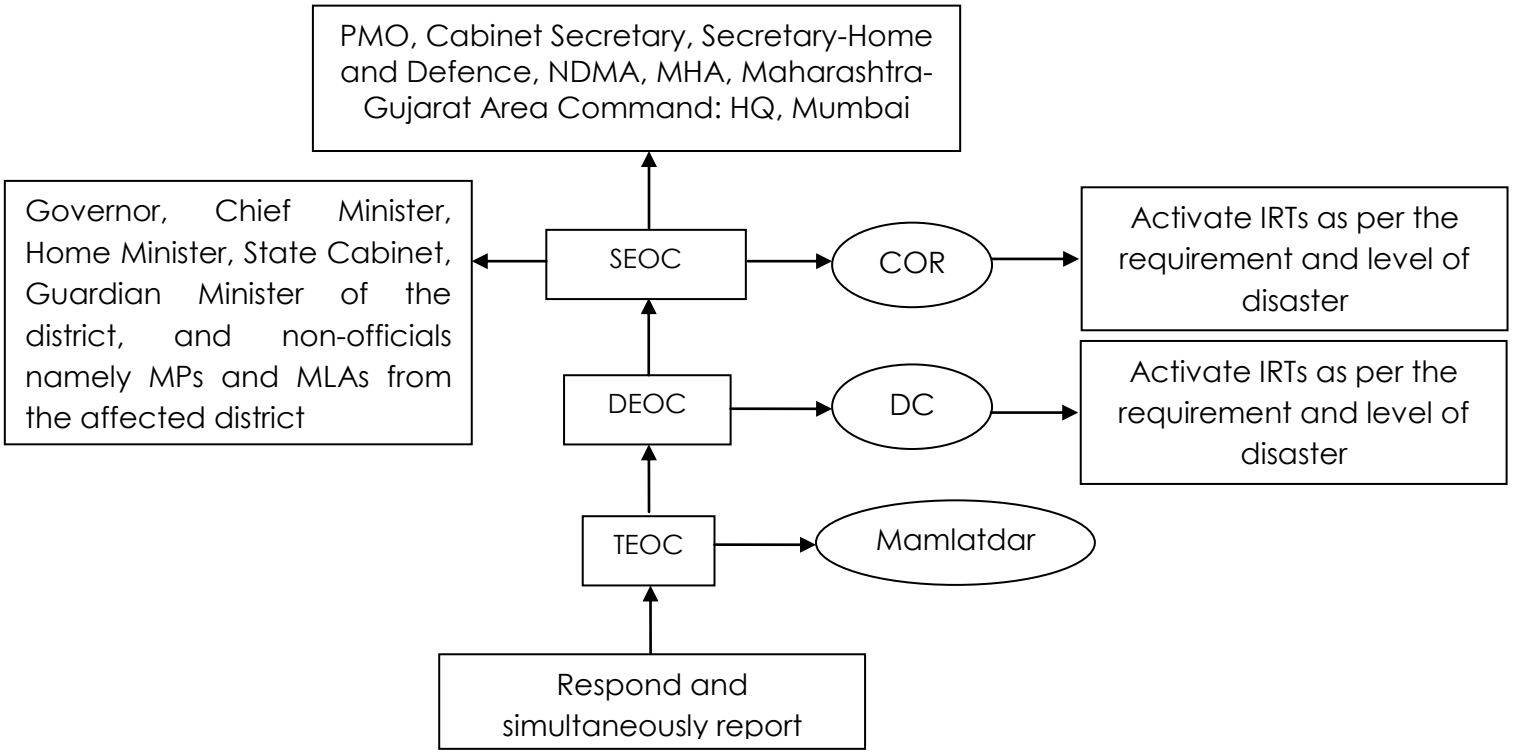


Figure 8.2: Trigger Mechanism without Early Warning

8.5 Incident Response System

Incident Response System (IRS) is one of the crucial tools for coordinated response. The system envisages that the roles and duties are laid down in advance, the personnel earmarked and trained in their respective roles and duties. It fixes accountability of the earmarked personnel and also avoids duplication of efforts by clearly demarcating the area specific task force teams.

It provides a participatory, well structured, fail safe, multi disciplinary, multi-departmental and systematic approach to guide administrative mechanisms at all levels of the government. It also provides scope for private sector, NGOs, CBOs, PRIs and communities to work seamlessly in the response activities.

Flowchart of IRS is depicted in Figure 8.3. The detailed roles and responsibilities of each section, branch and group are mentioned in Annexure 9.

8.6 Emergency Support Functions

Emergency Support Functions (ESF) are critical services which are performed in post disaster scenario to minimise life loss and address various issues in a post disaster situation. The key ESFs are listed in Table 8.3.

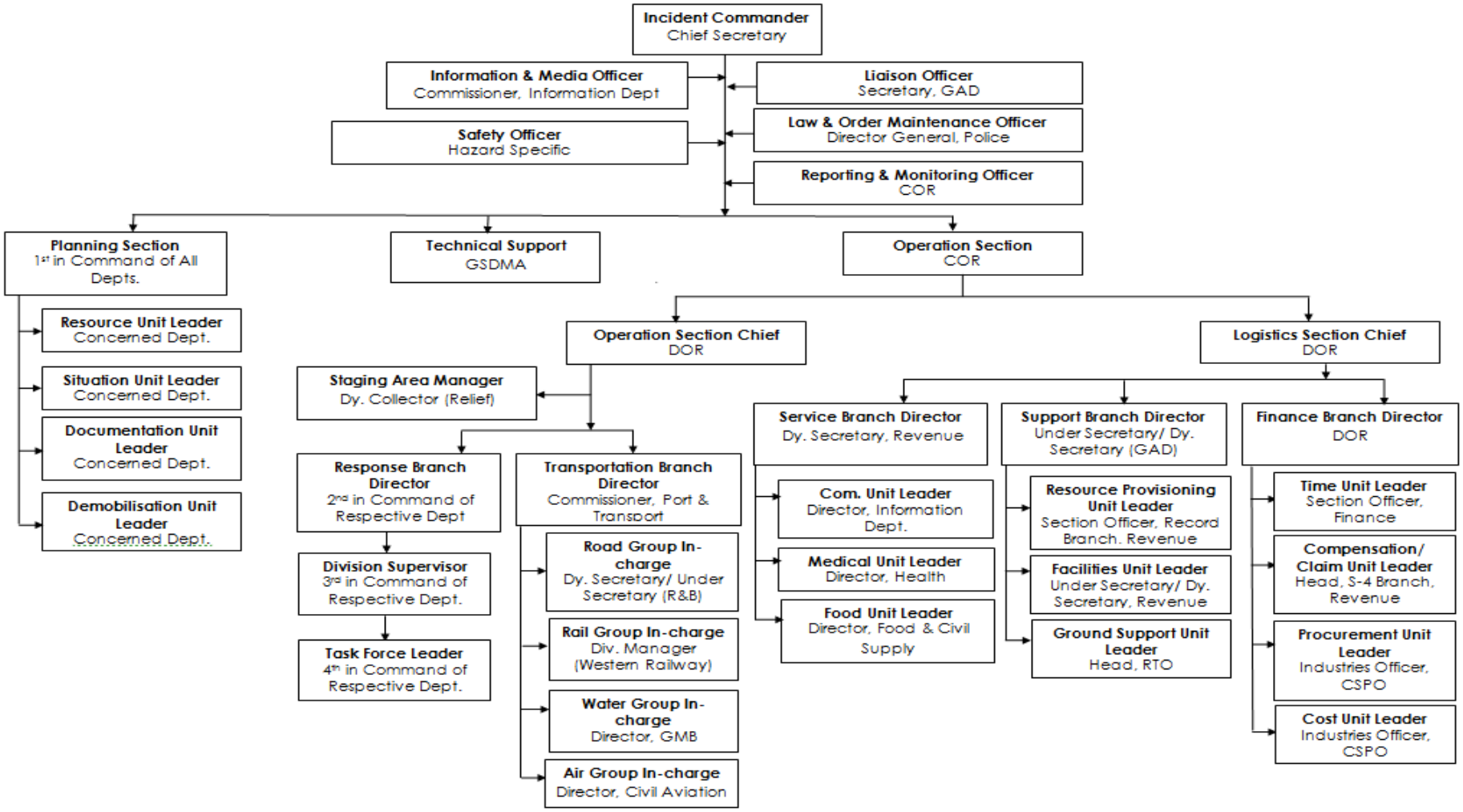


Figure 8.3: Incident Response System

ESF	Aim	Primary Department/ Agency	Secondary Department/ Agency
Early Warning	To warn and alert all stakeholders about an imminent disaster	• Central Water Commission- Flood • Indian Meteorological Department - Flood & Cyclones • Indian National Centre for Ocean Information Services - Tsunami	• District Emergency Operations • GSDMA
Evacuation	To ensure that people at threat are moved to a safe location	Revenue Department	• District Administration
Fire fighting	To control and manage fire incidences	Fire & Emergency Services	• Health • Police
Oil and Hazardous Material Response	To provide expert and technical support in case of release of any hazardous material	Industrial Safety and Health	• Emergency Response Centres • Fire & Emergency Services • Health
Search & Rescue	To provide life saving assistance in aftermath of natural or human made disaster	Police	• Fire & Emergency Services • Home Guards • Health
Medical Services	To provide emergency medical and mental health assistance	Health	• Red Cross Society • EMRI 108
Dead Body Management	To identify and properly record the dead bodies and facilitate the appropriate cremation/ burial	Police	• Revenue • Health • Local Authorities • Municipal Commissioner
Food	To address the food needs of the affected population and responding agencies	Food & Civil Supplies	• Revenue • Police • Women & Child Development
Communications	To provide fail safe communication and last mile connectivity	Department of Science & Technology	• Revenue Dept. • COR • GSDMA • GSWAN • GIPL • District Administration

			• Information Dept. • Local authorities • Municipal Commissioner
Transportation	To provide transport support to responding stakeholders and for various purpose as and when required	Port & Transport Department	• RTA • Railways • Civil Aviation
Temporary Shelter/ Camp Management	To address all basic needs of the affected population in the relief camps and ensure	Revenue	• District Administration • Food & Civil Supplies • Health • Police • Water Supply • Water and Sanitation Management Organisation • Gujarat Electricity Regulatory Commission
Public Works and Engineering	To provide technical support and expertise for repair, restoration and reconstruction of public infrastructure	Roads & Building Department	• Water Supply • Water and Sanitation Management Organisation
Energy	To ensure rapid restoration of power to affected areas particularly to critical facilities on the priority	Energy & Petrochemicals Dept.	• Gujarat Electricity Regulatory Commission
Public Safety and Security	To ensure safety and security of affected population, their property and responding agencies	Police Department	• Home Guards • Women and Child Development • Social Justice & Empowerment Dept.
Media Management	To ensure precise and accurate incident briefing to public and ensure proper rumour and panic management	Information Department	• Police • Health

Table 8.3 Emergency Support Functions

8.7 Disaster Reporting and Assessments

There are three kinds of assessment reports made at different timeframe. Each assessment report has different format for collection of data and reporting of information. These reports are designed to assess:

a. Life threatening situation
b. Need for emergency food, water, shelter and medical assistance
c. Need for restoration of critical facilities and services

The format for Damage and Need Assessment is mentioned in Annexure 10.

8.7.1 Rapid Report

It is aimed at obtaining a broad picture of extent of damage. It should ideally be undertaken within 4-8 hours of all clear. It helps in identifying the immediate actions necessary to be made.

8.7.2 Preliminary Report

Preliminary report is made within first 7 days of all clear. Within these 7 days, interim SITREP should be prepared and submitted at the end of 48 hours followed by SITREPS at the end of each 24 hours period. The objective of this report is to obtain more detailed and specific data regarding damage and needs. The 48 hours report should include wherever possible preliminary cost estimates of damage.

8.7.3 Detailed Report

Detailed report is made within 21 days of all clear. This assessment is conducted sector-wise and is aimed at finding the detailed damage and need of each sector so as to plan recovery and rehabilitation of the sector. The direct costs associated with recovery and rehabilitation of each sector should be mentioned in detailed wherever possible.

8.7.4 Deactivation of the Process

After the process of damage and need assessment is over, the designated authority shall issue the appropriate directive to deactivate the damage and need assessment process.

8.8 Relief and Compensation

Based on various damage and needs assessments, relief packages shall be planned for affected population. The relief packages from external aid agencies should be culturally sensitive and appropriate to the needs of affected population. A brief of culture and state is discussed in Chapter 2 with the same purpose.

In case, external relief and aid is required, GoG shall ensure that need is flashed and published well through various mode of media, so that only required relief material is sent by external agencies. This prevents unnecessary stock of unsolicited relief material at critical facilities like airport, ports, railway stations, State Headquarters, etc.

8.8.1 Finalizing relief payouts and packages

Relief packages would include details relating to collection, allocation and disbursal of funds to the affected people. Relief would be provided all

the affected families without any discrimination of caste, creed, religion, community or sex whatsoever.

If in the opinion of GSDMA the relief provided by the Commissioner or the Collector is not adequate, GSDMA shall recommend the Government to modify the norms followed and whenever necessary would recommend other relief measures.

GoG should also ensure that all government departments, responding agencies and forces are striving to achieve the Minimum Standards for Disaster Relief by GoI/ GoG. These standards deals with various domain like water supply, sanitation, hygiene promotion, food security and nutrition, shelter and medical cover.

8.8.2 Relief Kits

Indicative details of immediate relief kit, household kits and family ration kits are mentioned in annexure 12.

8.8.3 Post-relief Assessment

GSDMA, with assistance from Government departments, district administration and local authorities shall document learning from the relief experience and incorporate the same for relief or rehabilitation and reconstruction plans.

Once the situation is totally controlled and normalcy is restored, the COR declares End of Emergency Response and issues instructions to withdraw the staff deployed in emergency duties.

Chapter 9 Rehabilitation & Reconstruction

Activities relating to rehabilitation and reconstruction are primarily carried out by the local bodies (Gram Panchayats, District, Taluka, Municipal Corporations, Municipalities, etc.) and various Government departments and boards. However, their activities in this phase shall be in accordance with the reconstruction and rehabilitation plans framed by GSDMA, in conjunction with implementing authorities.

On the expiry of a disaster declaration, the Authority shall, where necessary, act as an agency for facilitating and coordinating rehabilitation and reconstruction activities by departments of the Government.

The reconstruction and rehabilitation plan is designed specifically for worst case scenario.

The key activities in this phase are discussed below:

9.1 Detailed Damage and Need Assessment

While a preliminary damage assessment is carried out during disaster phase, a detailed assessment must be conducted before commencing reconstruction and rehabilitation activities (as discussed in 8.7.3 in Chapter 8) The primary objective of any post–disaster damage assessment and need analysis is to provide a clear, concise picture of post disaster situation, to identify damage caused to different sector and to develop strategies for rehabilitation, reconstruction and recovery.

The relevant Government departments and local authorities shall initiate detailed assessment at their respective level for damages sustained in their respective departments and jurisdiction in the affected regions.

For assessing the damage and need of the affected community, the damage and need assessment team should be a composite representation of all the different communities and groups in the affected area. An ideal team would include expert in the related field, government official and representatives from majority and minority communities, females, Scheduled Caste and Tribes, panchayat member or nagarpalika member, etc.

The format for Detailed Damage and Loss Assessment is given in Annexure 10.

9.2 Reconstruction Strategy

Depending on the type of damage and population affected, following measures can be initiated as comprehensive recovery strategy. While the short term reconstruction strategy includes repair, restoration and strengthening of affected structures, long term strategy includes reconstruction and relocation.

9.2.1 Repair and Restoration

GoG, if needed, will formulate a policy of assistance to help the affected to repair and restore damaged houses and dwellings. This should neither be treated as compensation for damage nor as an automatic entitlement.

Respective departments should carry out timely repair and restoration of the related infrastructure, facilities, services, etc. This shall aid in quickly resuming the essential services they provide.

GoG shall coordinate with national and international NGOs, donor agencies and other government bodies to prioritise restoration of critical infrastructure like health institutions, temporary housing, lifesaving facilities, critical government infrastructure, etc.

9.2.2 Reconstruction

GSDMA shall oversee reconstruction and rehabilitation work and ensure that it takes into account the overall development plans for the state. GSDMA shall approve reconstruction and rehabilitation projects based on:

- Identification of suitable projects by relevant departments
- Project detailing and approval by the relevant technical authority

Two essential aspects of reconstruction are:

a. Owner Driven Reconstruction

Reconstruction should be done on the principle of Owner Driven Reconstruction. Here the district administration aids in provision of funds and technical expertise for construction activity. The principle allows active participation of the affected family/ owner in rebuilding their houses and ensures that their houses suit their cultural, occupational and other personal needs and context. It also gives them a sense of ownership and change their mindset from 'being a beneficiary' to 'being am owner' which also aids in psychological rehabilitation.

The active participation of the owner also ensures regular monitoring of the process, quality of material used, etc. which helps in speeding up the reconstruction process.

b. Build Back Better

Reconstruction post disaster also gives an opportunity to build back better. The new construction post disaster should comply of all safety norms, guidelines and building codes. The design of these buildings should be disaster resilient as per the hazard profile of the state.

GoG shall monitor the reconstruction process and ensure that the principle of build back better is followed through disaster resilient reconstruction.

9.2.3 Relocation

The GoG believes that need-based considerations and not extraneous factors drive relocation of people. The local authorities, in consultation with the people affected and under the guidance of GSDMA, shall determine relocation needs taking into account

criteria relevant to the nature of the calamity and the extent of damage. Relocation efforts will include activities like:

- Gaining consent of the affected population
- Land acquisition
- Urban/ rural land use planning
- Customizing relocation packages
- Obtaining due legal clearances for relocation
- Getting the necessary authorization for rehabilitation
- Livelihood rehabilitation measures for relocated communities, wherever necessary

While planning on site reconstruction or relocation, care should be taken to provide the community with all basic amenities in close vicinity of the reconstruction site. This leads to holistic reconstruction process. Some of the basic amenities are as follows:

1. Health
2. Education
3. Proper drainage system
4. Provision to drinking water
5. Provision for proper sanitation
6. Provision for waste collection and management
7. Market place
8. Connectivity to road and railway

9.3 Rehabilitation

Holistic rehabilitation post disaster includes many inter linked aspects. It is critical to address all need of affected population in order to achieve early recovery and to bring back normalcy to their lives.

9.3.1 Socio-economic Rehabilitation

Socio-economic rehabilitation is aimed at revamping the social and economic fabric to the pre-disaster or a better situation. It also addresses issues like that of livelihood restoration and generation. This is done by providing required training, skill, tools and equipment to restart the previous or new livelihood options.

Care should also be taken to address the needs of various socially and economically vulnerable groups like that of women, adolescent girls, old age persons, differently able persons, children, destitute, below poverty line population, scheduled castes, scheduled tribes, particularly vulnerable tribal groups, etc.

9.3.2 Psychological Rehabilitation

Disasters often lead to long time stress and trauma due to loss of near and dear ones, injuries, loss of limbs, loss of housing and related property, trauma generated by facing the disaster and fearful sites, fear of repetition of the disaster, etc. If not addressed appropriately, it may lead to lifelong psychological fear and disorders, thus it is necessary to provide psycho-social

first and psychological care to the affected population.

9.3.3 Environmental Rehabilitation

Environmental impacts of natural disasters can result in serious risk to life and livelihoods if not addressed. Environmental emergencies like uncontrolled, unplanned or accidental release of a substance into the environment not only impact human life in many ways but also damage environment to great extent which may be impossible or may take years to restore to original.

Without proper consideration of the environment, pre-existing vulnerabilities may be re-created or exacerbated. Thus GoG along with other concerned department should ensure measures to decontaminate the affected elements like air, river, water bodies, forests, etc.

9.4 Project Management

Since rehabilitation and reconstruction effort typically involves the co-ordinated efforts of several entities, the GoG shall encourage the respective entities to strengthen program management capabilities to ensure that synergies across and within entities are managed efficiently. In addition, it is also necessary to constantly monitor the activity to ensure that the project is executed on time, in accordance with the technical specifications and to the satisfaction of the beneficiaries. GSDMA, in conjunction with relevant Government departments, will monitor the reconstruction activity that is carried out by various implementation agencies. Typical implementation activities would include:

- Disaster proofing and retrofitting of houses
- Creation/ Retrofitting of structures – including roads, bridges, dams, canals etc that may have been destroyed/ damaged due to the disaster
- Restoration of basic infrastructure facilities, for example, ports, airports, power stations etc.
- Creation of health centres, first aid centres, hospitals, groups of doctors and surgeons etc.
- Restoration of the industrial viability of the affected area.
- Restoration of livelihood.

For managing long-term rehabilitation programmes, such as reconstruction of houses, infrastructure and other social amenities, the responsibilities will be that of respective line departments through a well-structured R & R Programme.

9.5 Information, Education and Communication

Communication activities are necessary to convey to the larger community the scope and nature of the proposed reconstruction and rehabilitation effort so as to increase the stakeholder awareness and buy-in for the ongoing activities. Hence, GSDMA and relevant Government departments, district administration and local authorities shall undertake:

- Ongoing media management/ Public Relations: To ensure accurate communication of the reconstruction and rehabilitation measures being taken to various stakeholders;
- Community management: This includes communicating to the affected communities with a view to appraising them of efforts being made for their relocation/ rehabilitation/ reconstruction;
- Feedback mechanisms: Using the communication network to get feedback on reconstruction and rehabilitation measures.

9.6 Dispute Resolution Mechanisms

GSDMA, in conjunction with relevant agencies, shall institutionalize mechanisms to address beneficiary grievances at various levels, as well as explore innovative ways of dispute minimisation like involving the community in reconstruction initiatives. Appropriate mechanism with penalties for dealing with false claims will be evolved to prevent misuse of assistance.

9.7 Implementing Initiatives for Recovery of Reconstruction Costs

The GoG shall finalise and implement select recovery measures such as:

- Imposing tax surcharge levies (central)
- Imposing local taxes
- Facilitation of funding responsibility sharing by beneficiaries etc.

Chapter 10 Financial Arrangements

10.1 Funding Mechanism at Various Levels

To ensure the long-term sustenance and permanency of the organisation, funds are generated and deployed on an ongoing basis. Financial mechanism for disaster management is already in place at national, state and district level. Additionally there are various projects, programmes and initiatives catering to different phases of disaster management at nation, state and district level.

10.1.1 Centre Level

a. National Disaster Response Fund

This fund has been created under the legal framework of National Disaster Management Act, 2005. Under the existing guidelines, it is available for assistance from avalanches, cyclone, cloud burst, drought, earthquake/ tsunami, fire, flood, hailstorm, landslides, pest attack and frost & cold wave.

In case of calamity of severe nature when State Disaster Response Fund is insufficient to meet the relief requirements, additional central assistance is provided from NDRF to the State Government by following the laid down procedures.

b. Prime Minister's National Relief Fund (PMNRF)

PMNRF provides immediate relief to families of those killed in natural calamities and to the victims of major accidents and riots. The fund is raised entirely by public contributions.

10.1.2 State Level

a. State Budget

GSDMA submits to the State Government for approval a budget in the prescribed form for the next financial year showing the estimated receipts and expenditure, and the sums which would be required from the State Government during that financial year.

The GoG also allocates funds in the State Budget for relief activities. In addition, funds may be available through the State Disaster Response Fund.

b. State Disaster Response Fund

There is a provision for State Disaster Response Fund which is made available to Commissioner of Relief, Revenue Department. The Central and State Government share 75% and 25% respectively in case of Gujarat. This was meant for meeting expenditure for providing immediate relief to the victims of cyclone, drought, earthquake, fire, flood, tsunami, hailstorm, avalanche, cloud burst and pest attack

c. Chief Minister Relief Fund

This provides immediate support to the distressed people affected by the

natural calamities, or road, air or railway accidents.

10.1.3 Other Sources of Funds

a. Public Private Partnership

There are projects/schemes in which funding can be done by a public sector authority and a private party in partnership. In this State Govt. along with Private organizations and with Central Govt. share their part.

b. Grant In Aid

State government may receive a grant in aid from Central Govt., World Bank, other departments, bilateral or multilateral funding agencies, etc. to carry out specific projects/schemes related to disaster management/ mitigation/ capacity building.

c. Loan

Authority may borrow money from the open market with the previous approval of State government to carry out disaster management functions as described in DM Act 2003.

d. Disaster Bonds

State government can also raise funds for major disasters by exploring the options of long term disaster bonds.

e. Donations

As per the provisions of The Gujarat State Disaster Management Act, 2003 the Authority may accept grants, subventions, donations and gifts from the Central or State Government or a local authority or any individual or body, whether incorporated or not.

f. Recovery Measures

The GoG shall finalise and implement select recovery measures such as imposing tax surcharge levies (central), imposing local taxes, facilitation of funding responsibility sharing by beneficiaries etc.

10.2 Funds Disbursement and Audit

The funds raised from funding agencies are usually accompanied by stringent disbursement and usage restrictions. It is therefore important to monitor the disbursement of such funds to ensure that none of the covenants are breached. GSDMA, in conjunction with relevant agencies, shall monitor disbursal of funds by:

- Prioritizing resource allocation across approved projects
- Establishing mechanisms (like a chain of banks, collection centres, nature of accounts, spread etc) for collection of funds
- Ongoing monitoring and control of fund usage throughout actual project implementation

Chapter 11 Plan Maintenance

Plan maintenance is a dynamic process of updating the plan on a periodic basis. The back-bone of maintaining the plan is carrying out mock drills and updating the plan based on the lesson learnt as an outcome of the mock exercise which consists of identifying the gaps and putting in place a system to fill the same.

11.1 Plan Testing

The Commissioner of Relief, Revenue Dept. shall prepare, review and update State Disaster Management Plan as provided for in the GSDMA Act (Section 22 (1) (C)). He shall also ensure that disaster management drills and rehearsals are carried out periodically.

While updating the plan the following aspects need to be considered by the COR every year:

a. Critical analysis of the outcome of exercises & mock drills as part of plan testing.

b. Incorporation of lessons learnt in the updated plan as an outcome of mock exercises through identification of gaps and measures to fill them.

The plan must be thoroughly tested and evaluated once in a year. The plan testing should preferably be organized on the first Monday in the months of March every year.

The main objectives of plan testing are to:

a. Determine the feasibility and compatibility of back up facilities and procedures

b. Identify areas in the plan that needs modification.

c. Identify training needs of key stakeholders.

d. Assess the ability of the organization/department to respond to disasters.

After plan testing and incorporation of lesson learnt, the COR should send a copy of the revised and updated plan to the following officials:

a. Chief Secretary, Government of Gujarat

b. Chief Executive Officer, Gujarat State Disaster Management Authority

c. Principal Secretary, Revenue Dept

d. Head of all line Depts.

e. State EOC

f. District EOCs

g. ERCs

h. IMD

i. CWC/ACWC

All the departments, which have specific roles and responsibilities in State Disaster Management Plan, must have a system to ensure that all officers of their departments who have

a specific role to play are fully up to date with their responsibilities/tasks.

11.2 Mock Exercise

a. Mock exercise debriefing and evaluation is of critical importance that these insights are collected from participants (who participated in the exercise) and used to modify the plan.

b. Hot debriefing is very effective as it is carried out immediately after the exercise. It also includes documentation in terms of recommendations and improvements of the plan.

11.3 Review & Updation of Plan

The State Disaster Management Plan should be reviewed and updated annually. The plan updation process should begin in January in each year and should be completed by month of April, based on inputs from the following:

a. Drills and rehearsals

b. Recommendations from all depts. in their Annual DM Report

c. Lessons learnt from any disaster event in other states and countries

d. Directions from Ministry of Home Affairs, National Disaster Management Authority, Government of India, etc.

GSDMA and all other concerned Depts. should encourage formal and informal interaction with various stakeholders at different levels to learn and document their experiences, so that such experiences can contribute constructively towards updation of State Disaster Management Plan for further improving the capability to deal with future disasters.