सत्यमेव जयते

# CYCLONE BIPARJOY:

## Triumph of Zero Casualty in Gujarat

**NATIONAL INSTITUTE OF DISASTER MANAGEMENT**
(Ministry of Home Affairs, Government of India)

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**Authors:**
**Surya Parkash**
**Rajendra Ratnoo**

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अमित शाह

गृह मंत्री एवं सहकारिता मंत्री
भारत सरकार

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# संदेश

यह हार्दिक प्रसन्नता का विषय है कि राष्ट्रीय आपदा प्रबंधन संस्थान (NIDM) ने आपदा '**बिपरजॉय**' के अध्ययन व प्रबंधन को दस्तावेज का प्रारूप दिया है और इसे '**साइक्लोन बिपरजॉय : ट्राइअम्फ ऑफ जीरो कैजुअल्टी इन गुजरात**' शीर्षक से केस स्टडी के रूप में प्रकाशित कर रहा है।

आपदाएँ न सिर्फ मानव जीवन व संपत्ति को नुकसान पहुँचाती हैं, बल्कि ये मानव विकास के रास्ते में भी बाधा बनती हैं। NIDM ने आपदा प्रबंधन की दिशा में कौशलयुक्त मानव संसाधन का विकास, आपदा प्रबंधन हेतु क्षमता निर्माण, प्रशिक्षण, अनुसंधान, आपदाओं व इसके प्रबंधन के दस्तावेजीकरण और नीति निर्माण में सहयोग से आपदा प्रबंधन में रोकथाम की संस्कृति को बढावा दिया है।

**माननीय प्रधानमंत्री श्री नरेंद्र मोदी जी** ने आपदा प्रबंधन के क्षेत्र में '**जीरो कैजुअल्टी**' का लक्ष्य रखा है। मुझे खुशी है कि लंबी तटरेखा, उच्च जनसंख्या घनत्व और विपरीत भौगोलिक परिस्थितियों के बावजूद मोदी सरकार की नीतियों को जमीनी तौर पर लागू करते हुए समन्वित तरीके से उठाये गए कदमों के कारण हमने बिपरजॉय में 'जीरो कैजुअल्टी' के लक्ष्य को प्राप्त किया।

बिपरजॉय के समय सरकार और संबंधित प्राधिकारियों की कुशलता व कठोर परिश्रम से 'जीरो कैजुअल्टी' की लक्ष्य प्राप्ति निश्चय ही भावी आपदा प्रबंधन के लिए एक जीवंत उदाहरण है। मैं, NIDM के कार्यों की सराहना करते हुए केस स्टडी 'साइक्लोन बिपरजॉय : ट्राइअम्फ ऑफ जीरो कैजुअल्टी इन गुजरात' के सफल प्रकाशन की कामना करता हूँ।

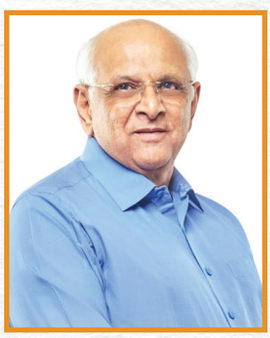
**( अमित शाह )**

कार्यालय : गृह मंत्रालय, नॉर्थ ब्लाक, नई दिल्ली - 110001
दूरभाष : 23092462, 23094686, फैक्स : 23094221
ई-मेल : पसलगम.गल

सत्यमेव जयते

# Bhupendra Patel

## Chief Minister, Gujarat State



Dt. 13-03-2024

## Message

The strong coherent culture of the communities in the State brought all concerned stakeholders together for well-coordinated preparedness, response and recovery measures to deal with the daunting challenges during Cyclone Biparjoy for achieving the **Zero Casualty mission.**

The vision of **Honourable Prime Minister Shree Narendra Modi** and guidance from **Hon'ble Union Minister of Home Affairs and Minister of Cooperation, Shree Amit Shah** during the disaster situation, boosted our confidence and courage to overcome this disaster.

The local communities, public representatives, state level authorities including the Prabhari Mantris and Prabhari Sachivs, Commissioner of Relief, district administration, social volunteers, civil society, corporate world and the local communities etc. all stood together in solidarity to show the unyielding strength, determination and unity in meeting the mission of **Zero Casualty** during the cyclone.

The Government of Gujarat remains committed to serve the society for safety and security of people in the wake of any such disaster risks. I am much pleased to learn that a documentation of cyclone **'Biparjoy'** is being brought out. I take this opportunity to congratulate, appreciate and thank all those, who have contributed directly or indirectly in achieving Zero Casualty mission during Cyclone Biparjoy.

**(Bhupendra Patel)**

आज़ादी का अमृत महोत्सव

अजय भल्ला, भा.प्र.से.
AJAY BHALLA, IAS

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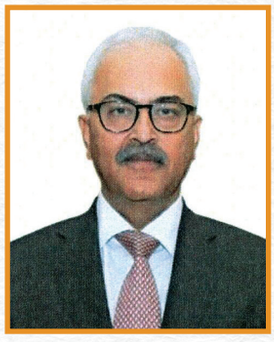
G20 भारत 2023 INDIA
वसुधैव कुटुम्बकम्
ONE EARTH • ONE FAMILY • ONE FUTURE

गृह सचिव
Home Secretary
भारत सरकार
Government of India
नॉर्थ ब्लॉक/North Block
नई दिल्ली/ New Delhi



# Foreword

I commend NIDM for the documentation on Cyclone Biparjoy - Triumph of Zero Casualty in Gujarat. The knowledge and insights gained from this case study will serve as a guiding light in enhancing disaster preparedness and response strategies for a safer and disaster resilient nation.

2. I extend my heartfelt gratitude to all the individuals and organizations that contributed to this endeavor. The collaboration between various government agencies showcases the power of unity when faced with difficult. challenges of nature.

3. Moreover, the success could not have been achieved without the active cooperation, participation and support from different stakeholders including central, state and district administration as well as the local communities of the affected areas, who displayed immense courage and strength during and after the cyclone. Gujarat's resilience is a source of inspiration for all, motivating us to work harder in ensuring the safety and well-being of the people.

4. As we move forward, let us embrace the lessons learned from the Cyclone Biparjoy and apply them proactively. We should strive to promote a culture of disaster risk prevention, mitigation, preparedness, efficient response and recovery assessment to safeguard human lives, livestock, living places, infrastructure, facilities, services and resources from the impact of future disasters

5. This document will serve as a tool for enhancing capacities at various levels from policymakers, disaster managers, field functionaries and communities in the field of disaster risk reduction and resilience Together, let us continue to work towards a safer and resilient India, where the spirit of unity and compassion prevails in the face of any disaster.

**(Ajay Kumar Bhalla)**

Place : New Delhi.
Dated : 04.04.2024

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|---|---|
| **ASHA** | Accredited Social Health Activist |
| **CAP** | Common Alerting Protocol |
| **CDHO** | Chief District Health Officer |
| **CHC** | Community Health Centers |
| **CoR** | Commissioner of Relief |
| **DCRA** | Dynamic Composite Risk Atlas |
| **DDMA** | District Disaster Management Authority |
| **DGH** | Directorate General of Hydrocarbons |
| **DGVCL** | Dakshin Gujarat Vij Company Ltd. |
| **DOR** | Department of Revenue |
| **DOS** | Department of Space |
| **DOT** | Department of Telecommunications |
| **ESCAP** | Economic and Social Commission for Asia and the Pacific |
| **GETCO** | Gujarat Energy Transmission Company Ltd. |
| **GIDM** | Gujarat Institute of Disaster Management |
| **GMB** | Gujarat Maritime Board |
| **GMDSS** | Global Maritime Distress and Safety System |
| **GSDMA** | Gujarat State Disaster Management Authority |
| **GSECL** | Gujarat State Electricity Company Ltd. |
| **GUVNL** | Gujarat Urja Vikas Nigam Limited |
| **GMERS** | Gujarat Medical Education and Research Society |
| **ICG** | Indian Coast Guard |
| **IDRN** | India Disaster Resource Network |
| **IDSP** | Integrated Disease Surveillance Programme |
| **IEC** | Information, Education & Communication |
| **IMD** | India Meteorological Department |
| **INCOIS** | Indian National Centre for Ocean Information Services |
| **IRS** | Incident Response System |
| **ISKCON** | International Society for Krishna Consciousness |
| **MGVCL** | Madhya Gujarat Vij Company Ltd. |
| **MHA** | Ministry of Home Affairs |
| **MMD** | Mercantile Marine Department |

| ACRONYMS & ABBREVIATIONS | |
|---|---|
| **MOIB** | Ministry of Information and Broadcasting |
| **MoP** | Ministry of Power |
| **MoPNG** | Ministry of Petroleum and Natural Gas |
| **MPCS** | Multi Purpose Cyclone Shelter |
| **NCMC** | National Crisis Management Committee |
| **NCRMP** | National Cyclone Risk Mitigation Project |
| **NDEM** | National Database for Emergency Management |
| **NDMA** | National Disaster Management Authority |
| **NDRF** | National Disaster Response Force |
| **NDMP** | National Disaster Management Plan |
| **NGO** | Non-Governmental Organization |
| **NHAI** | National Highways Authority of India |
| **NIDM** | National Institute of Disaster Management |
| **NIMHANS** | National Institute of Mental Health and Neuro Sciences |
| **NRSC** | National Remote Sensing Centre |
| **NVBDCP** | National Center for Vector Borne Diseases Control |
| **PGVCL** | Paschim Gujarat Vij Company Ltd. |
| **PHC** | Primary Health Centre |
| **PIB** | Press Information Bureau |
| **PMO** | Prime Minister's Office |
| **RSMC** | Regional Specialized Meteorological Centre |
| **SDMA** | State Disaster Management Authority |
| **SDRF** | State Disaster Response Force |
| **SEOC** | State Emergency Operation Centre |
| **SSI** | Small Scale Industries |
| **TC** | Tropical Cyclone |
| **UGVCL** | Uttar Gujarat Vij Company Ltd. |
| **UT** | Union Territory |
| **UTC** | Universal Time Coordinated |

# Executive Summary

A comprehensive overview of the management of **"Cyclone Biparjoy"** (pronounced as Biporjoy named after the Bengali word which means "disaster") in Gujarat state, India, has been briefly documented. The cyclone originated over the Arabian Sea and posed significant threats to the Gujarat state due to its long coastline, high population density, intense development, huge infrastructure and geographical location. The document highlights the proactive measures taken by the community, public representatives, functionaries of the line departments, administration and the disaster management authorities in a coordinated manner as a team to achieve the **Zero Casualty Goal** during the cyclone.

Gujarat, the vibrant state on the west coast of India, is highly vulnerable to cyclones and its associated secondary hazards such as floods, storm surges, etc. The Cyclone Biparjoy originated from a low-pressure area that was first noticed and reported by the India Meteorological Department (IMD) on 5th June 2023, before further intensifying into a cyclone. IMD alerted the west coast states about the cyclone from 6th June 2023 onwards with low pressure area becoming a depression on 6th June 2023 early morning. It had peak intensity of about 170 kilometers per hour (kmph) and gusts up to 190 kilometers per hour (kmph) during its life period and 115 to 125 (kmph) gusting to 140 kmph at the time of landfall.

On receipt of the alerts from IMD at the central level, a high-level meeting of the National Executive Committee was called upon by the Union Home Secretary on Sunday, 11th June 2023, to review the preparedness in the face of Cyclone Biparjoy and ensure a coordinated response. The very next day, on Monday 12th June 2023, the Cabinet Secretary convened a meeting of the National Crisis Management Committee to review the preparedness of the Government of Gujarat and Central Ministries/ Agencies pertaining to the impending cyclone.

The **Hon'ble Prime Minister, Shri Narendra Modi,** called a meeting on Monday, 12th June 2023, with Hon'ble Home Minister, Principal Secretary to PM, Cabinet Secretary and other senior officers to review the preparedness of Ministries/Agencies of Centre as well as state of Gujarat to deal with the situation arising out of the impending Cyclone Biparjoy. He underscored the need for a concerted effort to achieve **'Zero Casualty'** and minimize potential damage that may be caused by Cyclone Biparjoy including the livestock and wild life. The Hon'ble Prime Minister's words echoed his commitment to the safety and well-being of every citizen and environment.

The **Hon'ble Union Minister of Home Affairs and Minister**

**of Cooperation, Shri Amit Shah,** conducted a meeting through video conferencing on 13th June 2023 with the Chief Minister of Gujarat state, state level authorities, district collectors and the concerned central agencies to guide and motivate them to achieve the goal of zero casualty during the cyclone with preemptive, coordinated and collaborative efforts as a team.

On 14th June 2023, the National Disaster Management Authority shared the preparedness and response measures to be taken during the cyclone to different stakeholders including concerned ministries and line departments. It recommended immediate establishment of a Unified Command as per Incident Response System and use of Common Alerting Protocol (CAP) and Sachet app.

NDRF teams were pre-positioned at vulnerable locations. At the state level, State Emergency Operation Centre (SEOC) was activated under the directions of the Additional Chief Secretary, Revenue & Disaster Management, Government of Gujarat. SEOC coordinated the preemptive efforts of the districts for pre-positioning and deployment of human as well as physical resources. The Gujarat State Disaster Management Authority (GSDMA) disseminated early warning messages as well as requisite action messages through different media platforms like electronic media (TV, radio and cable channels), print media, social media etc. The State Disaster Response Force (SDRF), Police, Fire and Emergency teams along with the Aapda Mitras and Health professionals were pre-positioned for efficient response during disaster situation. The administration deployed HAM radio, satellite phones, and wireless communication systems to ensure uninterrupted communications. The teachers from the education department were deputed at the District Emergency Operation Centre (DEOC) to cater to the calls from the affected population. Besides this, NDRF also deployed its vehicle mounted Quickly Deployable Antenna (QDA) for satellite-based communications. As the communications could be disrupted due to power failures, adequate necessary arrangements for the Diesel Generator (DG) sets and batteries were provided as power support infrastructure for communications. The Department of Telecom provided **Priority Call Services** and advised various Telecom Service Providers like BSNL, Jio, Vodafone, Airtel etc. to enable **Intra Circle Roaming** facility in the affected area, allowing users to manually switch to another telecom operators in case of no service or temporary interruptions in their subscribed network.

The Ministry of Power along with various power transmission & distribution entities like POWERGRID, GETCO and PGVCL etc., ensured that there should be minimal chances of failure of power supply. They made adequate preemptive arrangements of necessary skilled human and physical resources for quick restoration of power supply. A prior assessment of the likely number of failures in the towers

as well as poles of power supply lines was made before the landfall of the cyclone. Water supply pumps were also supported with the power generators to cater to the water requirements.

The district administration held coordination meetings with the functionaries of different line departments and formed teams to work together to achieve the goal of zero casualty during the cyclone as per the directions given by the Hon'ble Prime Minister on 12th June and Hon'ble Union Minister of Home Affairs & Minister of Cooperation on 13th June 2023. A total of 1,43,053 persons (includes salt pan workers) were evacuated and sheltered in the community buildings, schools and Multi-Purpose Cyclone Shelters (MPCS). The schools were closed prior to the cyclone by the district administration to ensure the safety of students, teachers and staff.

Out of the evacuated 1,152 pregnant women, 828 safe deliveries of new born babies were carried out successfully by the health department in the PHCs, CHCs, SDHs and DHs. The Hon'ble Union Minister of Home Affairs & Minister of Cooperation went to these health centres during his visit in Kachchh on 17th June 2023 and expressed that a wave of happiness seems to have gone through the lives of the parents of the new born babies. As an emotional gesture, one of the new born baby was named as **"Khushi"** by the parents.

It may be worthwhile to mention that the evacuees were provided with freshly cooked food, water and other basic amenities for survival during their as given to the children who required milk and other such items. The milk cooperative societies ensured adequate uninterrupted supply for them. The corporates also distributed food kits to the evacuees at the time of return to their homes after the cyclone, for their survival during the first 4-5 days as there were damages and losses expected in the homes due to the impacts of the cyclone.

The state transport department stopped the public transport services prior to the cyclone and the tourism department announced through the media for inhibiting the visits of tourists, pilgrims and visitors. The pilgrimage attractions including the Somnath and Dwarkadhish Temples besides the attractive beaches along the coast, were closed. The railways stopped, short terminated or short originated the trains to the affected areas. Similarly, the airport authorities of Bhuj & Rajkot airports suspended their operations. The shipping authorities also issued directions to the ships and the vessels to move into deep seas and keep away from the coast while the boats of the fishermen were shifted to safe location and tied together to minimize damages.

The forest department took care of the trees likely to affect the houses/ powerlines and trimmed the branches likely to fall. As per Hon'ble PM's directions during his meeting on 12th June 2023, adequate steps were taken for safety of wildlife too. No wild life

loss happened during the cyclone. However, at the time of cyclone several trees got uprooted which even blocked the highways and other connecting roads. **These were cleared quickly by the forest department.**

The agriculture, horticulture and animal husbandry departments took due care of the farmers. The livestock were evacuated safely to community cattle sheds and kept untied. These communities' cattle sheds were provided with adequate fodder and water supply arrangements for the survival of the livestock. The stray animals in the streets were also taken care by the communities and fed appropriately. The water supply department prefilled the water sumps in the rural areas to cater to the needs of the people and livestock.

The outcome of proactive concerted and coordinated actions led to achievement of zero casualty goal. The resilient communities played a major role as first responder along with administration, public representatives, line departments and response agencies.

Effective interventions, innovations and best practices at right time helped to manage the disaster situation with engagement and active participation of community. The document briefly covers the triumph of zero casualty during the Cyclone *Biparjoy* and tale of community resilience in the state of Gujarat.

# Chapter 1
# Introduction

## 1.1 General Profile of Gujarat State

Gujarat is located on the western coast of India with a rich cultural heritage, vibrant traditions, a thriving economy, and is known for its unique blend of ancient traditions and modern development. It is bounded by the Arabian Sea to the west, Madhya Pradesh to the east, Maharashtra to the south and Rajasthan to the north (Figure 1.1). In addition, it shares an international border with Pakistan on northwest. It lies between latitude 20° 07' and 24° 43' N and longitude 68° 10' and 74° 29' E (NDMA, 2017). It has the longest coastline of about 1669.24 km (excluding Daman- 14.36 km & Diu-18.18km), among all maritime states of India. The state has two Gulfs namely the Gulf of Kachchh and Gulf of Khambhat. The state produce 70% of the country's salt (Census of India, 2011).

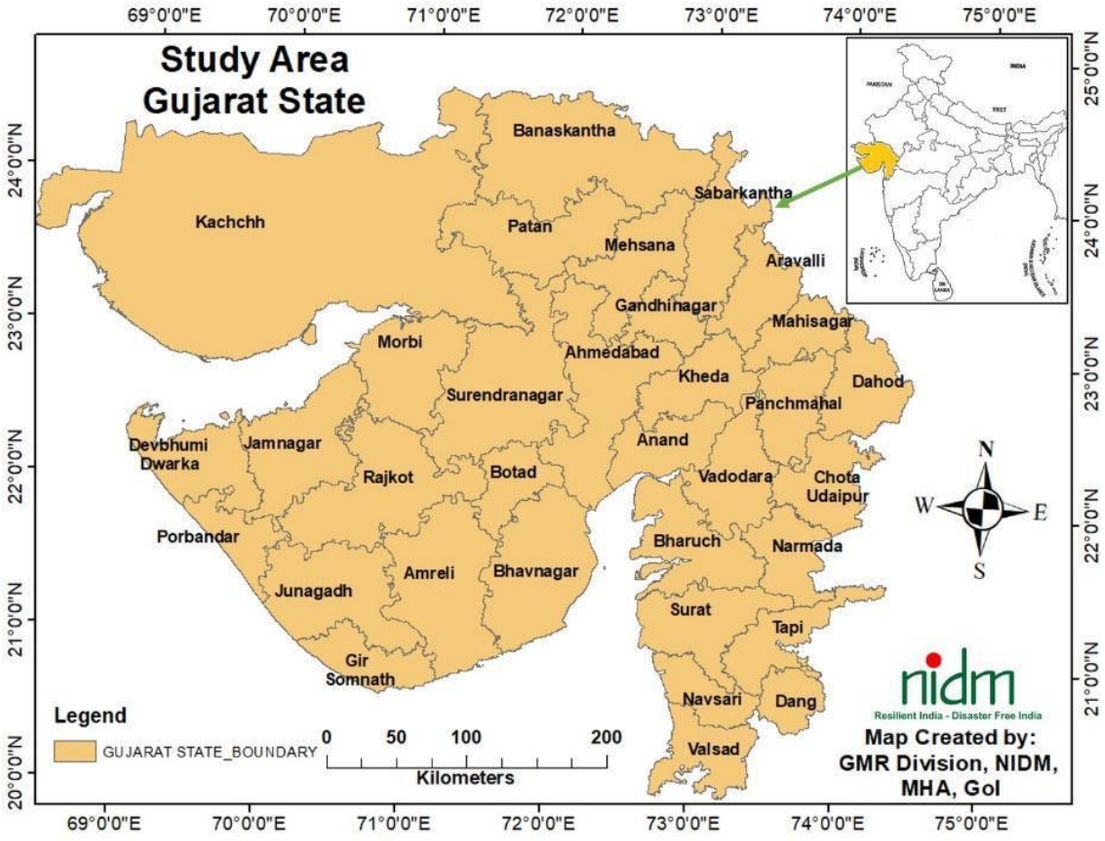
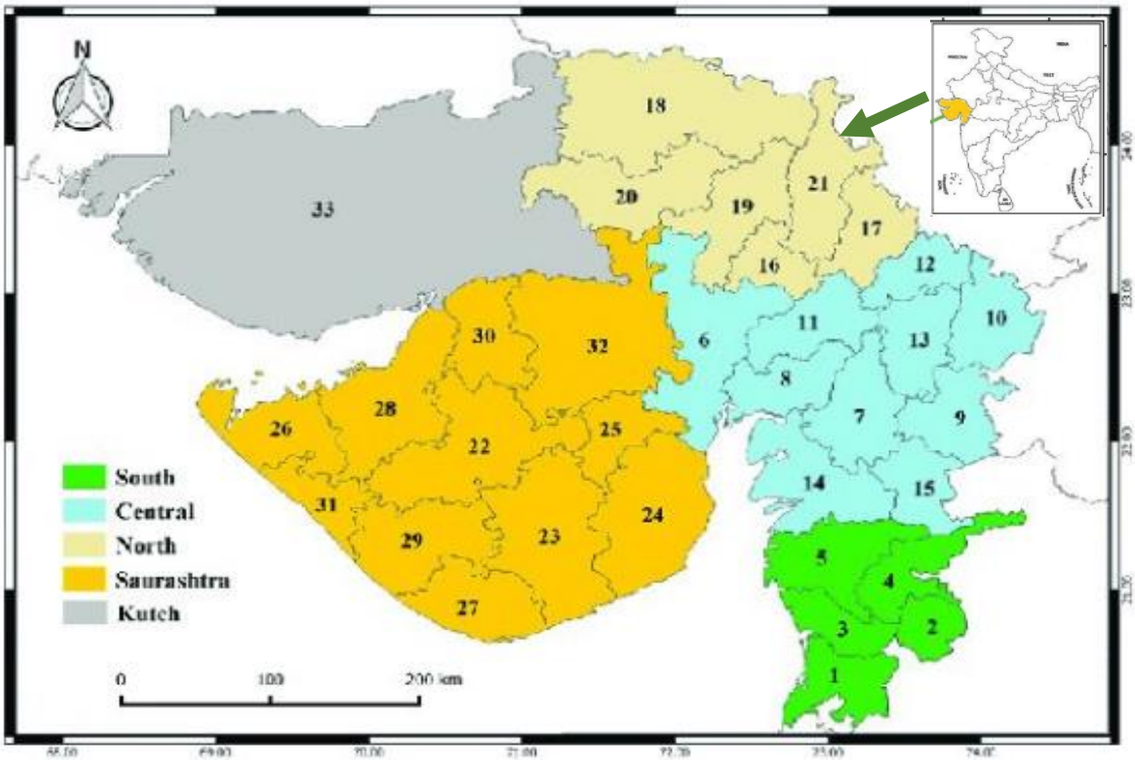



**Figure 1.1: Location map of the study area**

### 1.1.1 Salient Features of Gujarat

Gujarat's geographical area is 196,024 sq km, which is about 6% of total land area of India. Its land area is divided into four sections: (a) Saurashtra-Kachchh, (b) Saurashtra-South Gujarat, (c) Central Gujarat, and (d) North Gujarat. Its physiography features can be categorized into varied landforms such as: (a) Plains, (b) Plateaus, (c) Deserts, (d) Coastal Plains, and (e) Hilly & Mountainous Regions.




Districts of Gujarat

1 Valsad
2 Dang
3 Navsari
4 Tapi
5 Surat,

6 Ahmedabad
7 Vadodara
8 Anand
9 Chota Udaipur
10 Dahod
11 Kheda
12 Mahisagar
13 Panchmahal
14 Baruch
15 Narmada,

16 Gandhinagar
17 Aravalli
18 Banaskantha
19 Mehsana
20 Patan
21 Sabarkantha

22 Rajkot
23 Amreli
24 Bhavnagar
25 Botad
26 Devbhumi Dwarka
27 Gir Somnath
28 Jamnagar
29 Junagadh
30 Morbi
31 Porbandar
32 Surendranagar
33 Kachchh

**Figure 1.2 : Geographical divisions of Gujarat State**

[1]*NDMA (2017): https://ndma.gov.in/sites/default/files/PDF/Reports/gujrat-flood-study-2017.pdf*

The minimum temperature varies from 10.8°C to 27.4°C, and the maximum temperature ranges from 26°C to 45°C. The agro-climate of the state is quite diverse, making up around 20% of the country's dry and 9% of its semi-arid regions. With low and variable rainfall, the wide region of Saurashtra, Kachchh, and North Gujarat is classified as arid to semi-arid. While the summers are hot, and the winters are moderately cold. Gujarat's plains are extremely hot & dry in the summer and chilly & dry in the winter. The high areas and the seashore experience milder summers. With 100% bright days and clear nights, the average daytime temperature in the winter is about 28°C and the average night-time temperature is about 12°C.

## 1.2 Socio-Economic Profile of Gujarat

As per Census 2011, the population of Gujarat is 6.04 crore comprising of 3.15 crore males and 2.89 crore females. Out of this, the rural population is 3.47 crore and the urban population is 2.57 crore. In terms of percentage, Gujarat accounts for 5.94% area of India's land area and 4.99% population of India. The literacy rate in Gujarat is 79.31%.

Its official and primary language is Gujarati. Gujarat is the 5th largest state by land mass in India, and has been the growth engine of the country, attributed to its strong economic fundamentals. With a 4.99 percent population share (Figure 1.3, Table 1.1), Gujarat accounts for 8.36 percent share of the National GDP (Govt. of Gujarat, 2022).

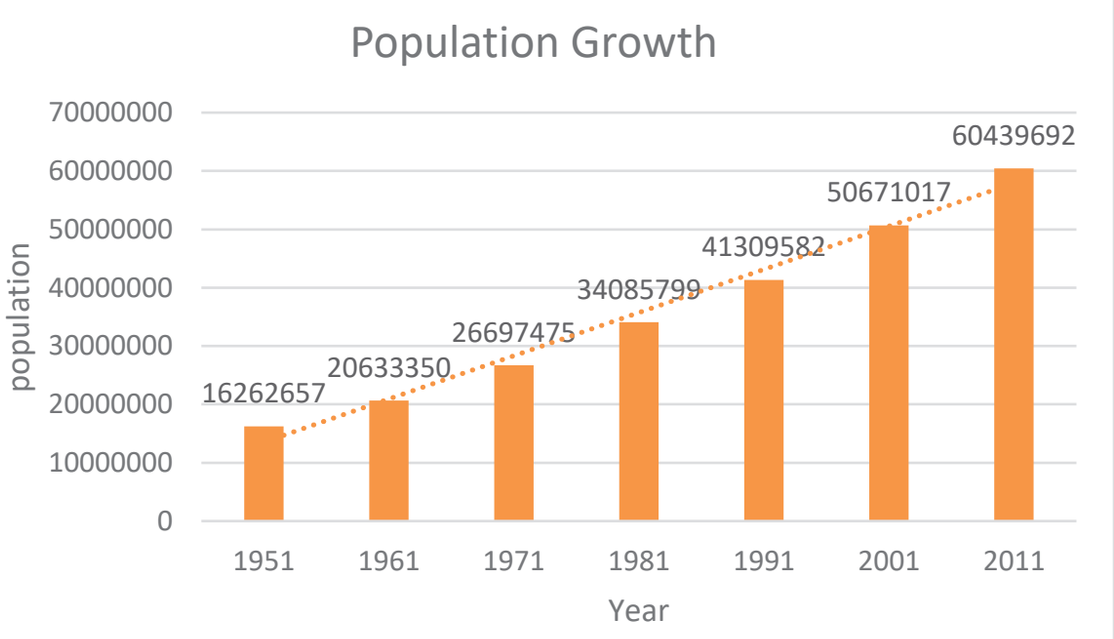



**Figure 1.3: Population growth of Gujarat**

**Table 1.1 : Gujarat Demography 2011[2]**

| | |
|---|---|
| **Population** | 6.04 Crore |
| **Decadal Population Growth** | 19.17% |
| **Area km$^2$** | 196,024 |
| **Density/km$^2$** | 308 |
| **Male** | 31,482,282 |
| **Female** | 28,901,346 |
| **Sex Ratio** | 919 |
| **Percentage of the total population to the Country** | 4.99% |
| **Literacy** | 79.31 |
| **Male Literacy** | 87.23 |
| **Female Literacy** | 70.73 |
| **Total Literate** | 41,948,677 |
| **Male Literate** | 23,995,500 |
| **Female Literate** | 17,953,177 |

## 1.3 Hazards and Vulnerability Profile of Gujarat

Gujarat is inherently susceptible to earthquakes, wind, droughts, cyclones, floods and storm surge (Figure 1.4 (a-f)). The state is also susceptible to heat-waves, tsunami, fires, industrial and chemical disasters. These events are known to happen frequently and pose significant risks to local communities (SDMP, 2021). Its coastal terrain, high seismicity due to its location adjacent to the inter-plate boundary and riverine nature are responsible for its multi-hazard profile to a large extent.

As per Indian Seismic Zone Map, the Gujarat region lies in three zones - Zone III, IV and V respectively [Figure 1.4 (a)]. Kachchh region (about 300km x 300km) lies in zone V where earthquakes of magnitude 8 can be expected. A belt of about 60-70 km width around this zone covering areas bordering the Eastern part of Kachchh lies in seismic zone IV while the rest of Gujarat lies in seismic zone III.

Gujarat is one of the chronic drought prone states of India, with an average annual rainfall of only 700 mm, and more than half of the Talukas of Gujarat receiving rainfall within the range of 200-400 mm [Figure 1.4(c)]. During the summer, the maximum temperature frequently reaches 45 degrees Celsius, resulting in severe heat wave conditions.

On an average, about five to six tropical cyclones are formed in the Bay of Bengal and the Arabian Sea every year, of which two to

[2]*https://gujaratindia.gov.in/state-profile/demography.htm*

three tropical cyclones may have the probability to be of severe intensity. Many districts are prone to cyclone viz., Kachchh, Morbi, Devbhumi Dwarka, Gir Somnath, Junagadh, Narmada, Rajkot, Jamnagar, Porbandar, Amreli, Bhavnagar, Kheda, Surat, Vadodara, Ahmedabad, Anand, Bharuch, and Valsad [Figure 1.4(d)]. The Gulf of Kachchh and Gulf of Khambhat also witness a surge as the funneling effect takes place at both places. The Gulf of Khambhat is the most vulnerable due to recurrent cyclone strikes to the southeastern coast of Saurashtra. The eastern reach of the Gulf of Kachchh is the next most vulnerable region due to its low- lying flat topography and high population density. The state has only contingency plans for cyclones and floods.

### 1.3.1 Seasonality of Hydro-Meteorological Hazards

By understanding the estimated time/season of occurrence of the hazards, the following seasonality of potential hydro-meteorological hazards has been deciphered in Table 1.2 below.

**Table 1.2: Seasonality of hydro-meteorological hazards**

| Hydro-Meteorological Hazards | Jan | Feb | Mar | April | May | June | July | Aug | Sep | Oct | Nov | Dec |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Cyclone | | | | | | | | | | | | |
| Drought | | | | | | | | | | | | |
| Flood | | | | | | | | | | | | |
| Heat Wave | | | | | | | | | | | | |

| Legend | | High Occurrence | | Moderate Occurrence | | Low Occurrence |
|---|---|---|---|---|---|---|

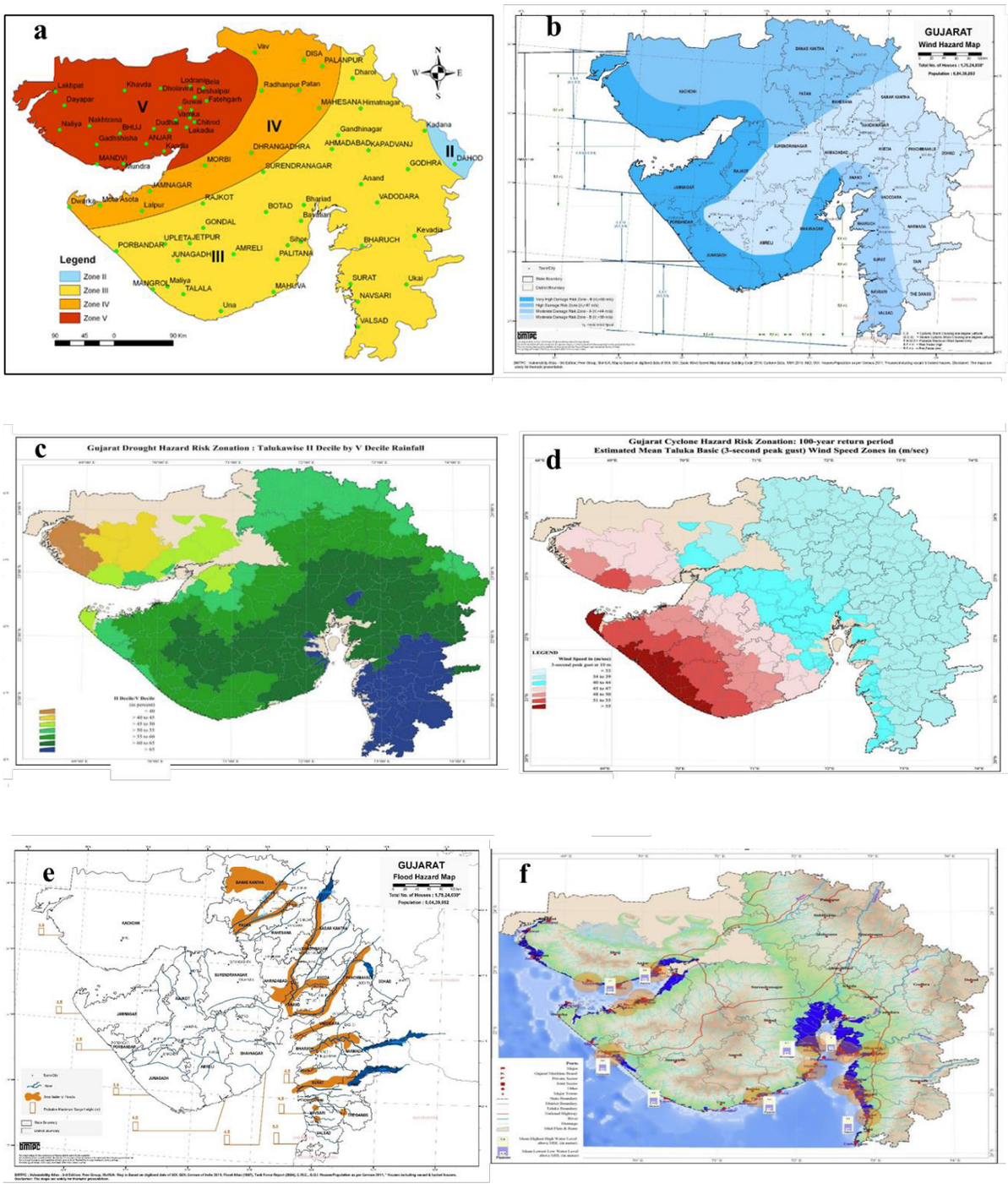



**Figure 1.4:** (a) Seismic zone map of Gujarat (b) Wind Hazard map (c) Drought hazard map (d) Cyclone hazard risk zonation map (e) Flood hazard map (f) Storm surge hazard risk zonation map

### 1.3.2 Cyclone Riskscape

Gujarat has country's longest coastline of about 1669.24 km (excluding Daman -14.36 km & Diu -18.18 km). Hence, it is extremely vulnerable to tropical cyclones and their related risks such as flood and storm surge. Most of these cyclones that affect the state, get generated in the Arabian Sea. They migrate to the northeast and hit the shore, particularly the southern Kachchh, southern Saurashtra, and western Gujarat.

The state faces two cyclone seasons: May to June (advancing southwest monsoon) and September to November (retreating monsoon). Major cyclones that cross the state are mentioned in Annexure 2 and their path is shown in Figure 1.5.

The degree of cyclone hazard proneness of different districts was analyzed, based on the frequency and intensity of land-falling tropical cyclones along with all other hazards like rainfall, wind, and storm surge.

The categorization of proneness of districts is P4 (Low), P3 (Moderate), P2 (High) and P1 (Very high). Out of 16 coastal districts of Gujarat within 100 km from the coastline, 12 districts fall under P2 (Highly Prone) and 2 districts fall under P3 (Moderately Prone) and 2 districts under P4 (Low Prone). The details are given in Annexure 2.

GSDMA has prepared a cyclone hazard zonation map, indicating

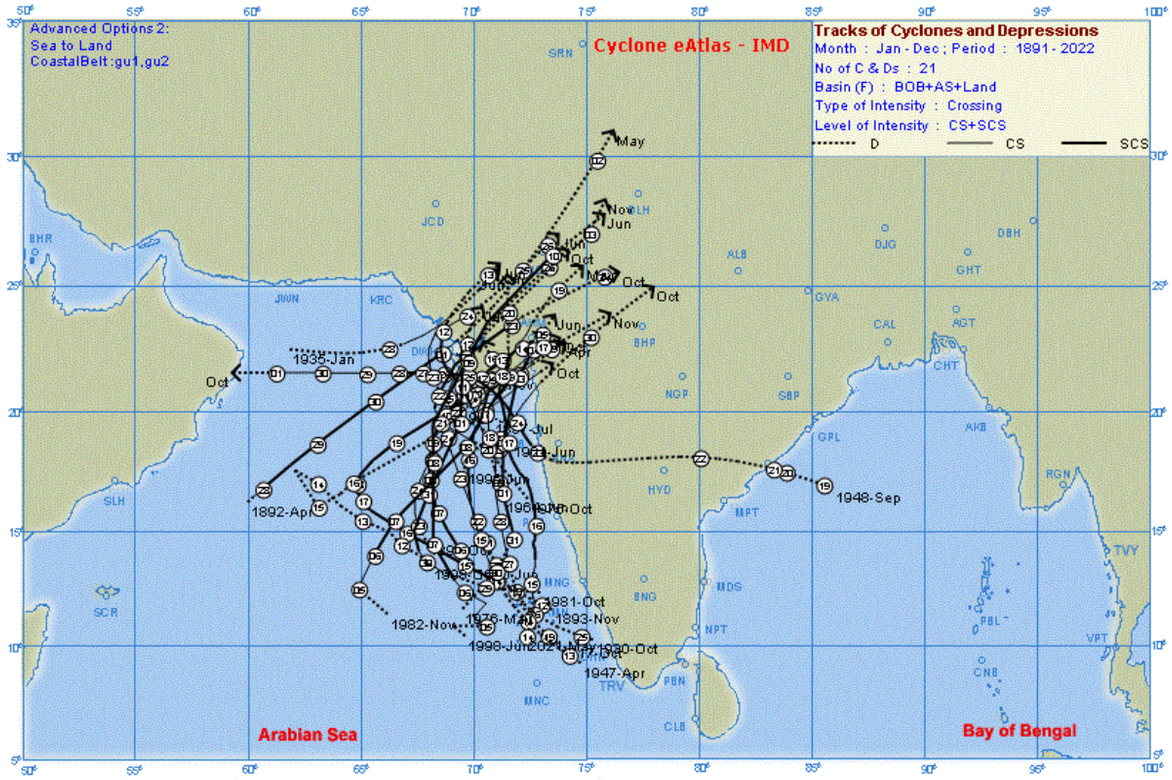



**Figure 1.5: Tracks of Cyclones crossing Gujarat State (Maximum Sustained Wind Speed ≥ 62 kmph) during 1891-2022 (It does not include Cyclone Biparjoy).**

wind velocity in different Talukas of the state (Figure 1.6). The frequency and intensity of cyclones have been reported to increase over the Arabian Sea due to changing climatic conditions. The state had suffered recent cyclonic events of high intensity including Kandla Cyclone (1998), Vayu Cyclone (2019), Tauktae Cyclone (2021).

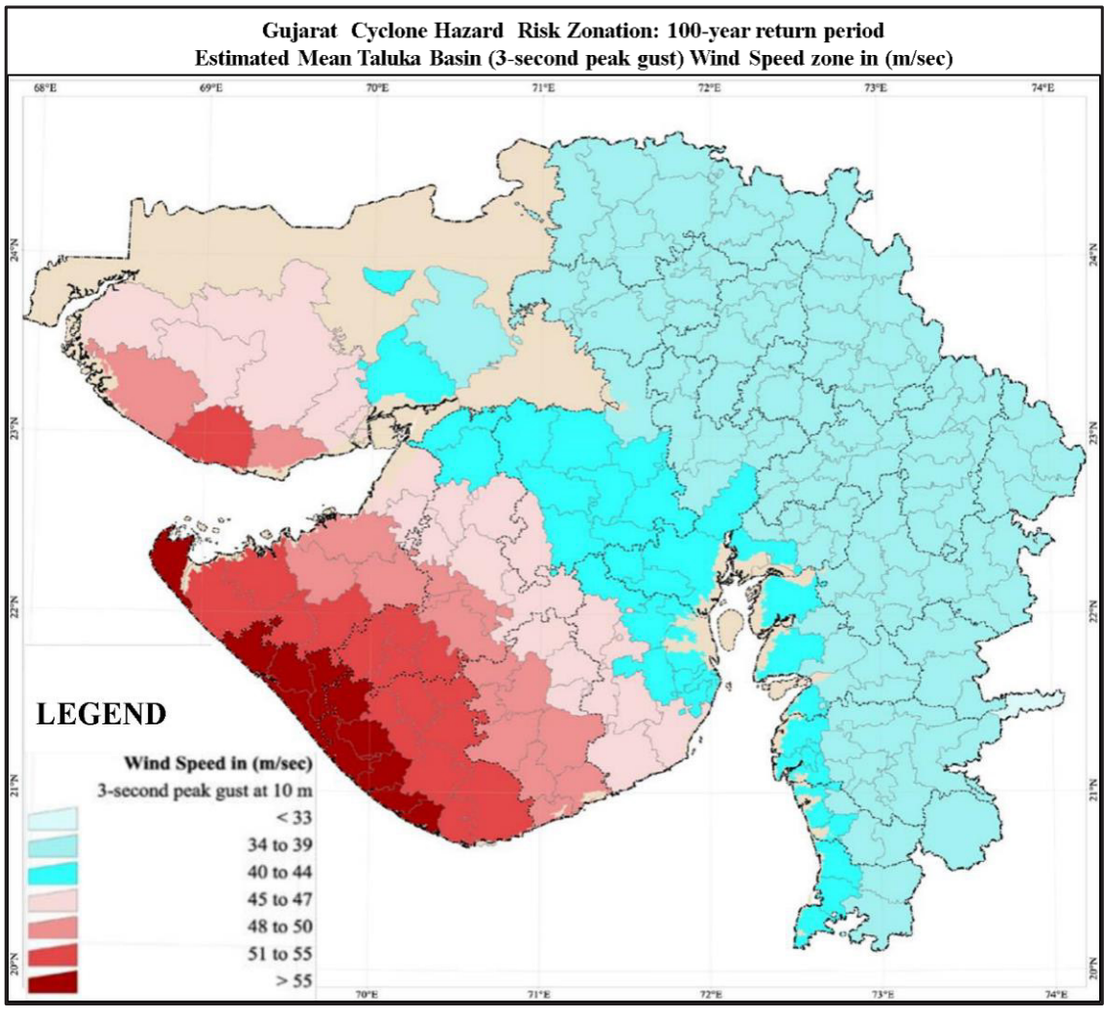



**Figure 1.6: Cyclone Hazard Risk Zonation Map of Gujarat State (Source: SDMP 2021)**

# Chapter 2
# Cyclone 'Biparjoy' 2023

Cyclone *'Biparjoy'* (a Bengali word with literal meaning calamity or disaster) was a powerful tropical cyclone that formed over the east-central Arabian Sea. It developed from a low pressure that formed over southeast Arabian Sea on 5th June 2023. It moved nearly northwards and intensified into an extremely severe cyclone with wind speed of about 170 kmph over the sea on 11th June 2023. From 14th June 2023, it moved gradually northeastwards. The cyclone made landfall near Jakhau Port of Kachchh district between **2230 and 2330 hours** IST on 15th June 2023 as a very severe cyclone with maximum sustained wind speed of 115-125 kmph after landfall. It had a long lifespan which lasted for 13 days 3 hours from 0530 hours of 6th June 2023 to 0830 hours of 19th June 2023.

## 2.1 Formation & Evolution of Biparjoy

IMD continuously monitored the weather system since 1st June 2023 with issue of extended range outlook valid for next two weeks and daily tropical weather outlook valid for next 5 days. A cyclonic circulation started to form over southeast Arabian Sea on 5th June 2023 and under its influence a low-pressure area was formed by the evening (1730 hrs IST) and well-marked low pressure area during midnight (2330 hrs IST) of the same day (5th June 2023). It concentrated into a depression in the early morning (0530 hrs IST) of 6th June 2023 over Southeast Arabian Sea. It moved nearly northwards and intensified into a deep depression over the same region around noon (1130 hrs IST) and into the Cyclone 'Biparjoy' in the evening (1730 hrs IST) of 6th June 2023. It continued to move further nearly northwards and intensified in the early morning (0530 hrs IST) and into a very severe cyclone around noon (1130 hrs IST) of 7th June 2023. While moving northwards, it strengthened into an extremely severe cyclone in the early morning (0530 hrs IST) of 11th June 2023. It then moved north-northwestwards and weakened into a very severe cyclone around midnight (2330 hrs IST) of 12th June 2023.

It continued to move nearly north-northwestwards till 13th June 2023 noon, then northwards till 14th June 2023 forenoon and then northeastwards with gradual weakening in intensity till 15th June 2023 forenoon. It

had a landfall close to Jakhau Port in the Kachchh district of Gujarat between 2230 and 2330-hrs IST of 15th June 2023 as a very severe cyclone with a maximum sustained wind speed of 115-125 kmph gusting to 140 kmph. Later, it weakened into a severe cyclone in the same night (2330 hrs IST) over Saurashtra & Kachchh about 10 km north of Jakhau Port, into a cyclone in the morning (0830 hrs IST) and deep depression in the midnight (2330 hrs IST) of 16th June 2023, depression over Rajasthan in the evening (1730 hrs IST) of 17th June 2023 and a well-marked low pressure over northeast Rajasthan in the morning (0830 hrs IST) of the 19th June 2023. The evolution of the track has been summarized in Table 2.1 and the actual track of the cyclone has been depicted in Figure 2.1.

**Table 2.1: Evolution of Cyclone Biparjoy over the Arabian Sea (5th to 19th June 2023)**

| Date | Classification |
|---|---|
| 5th June/1730 IST | Low pressure area over southeast Arabian Sea |
| 6th June/0530 IST | Depression over southeast Arabian Sea |
| 6th June /1130 IST | Deep Depression over southeast Arabian Sea |
| 6th June /1730 IST | Cyclone 'Biparjoy' over east central and adjoining south east Arabian Sea |
| 7th June /0530 & 1130 IST | Severe cyclone and very severe cyclone over east central Arabian Sea respectively |
| 11th June /0530 IST to 12th 2330 IST | Extremely severe cyclone over east central Arabian Sea |
| 12th June / 02330 IST to 15th 2330 IST | Very severe cyclone over east central Arabian Sea till landfall |
| 15th June / 2330 IST to 16th 0830 IST | Severe cyclone over Gujarat |
| 16th June / 0830 to 16th /2330 IST | Cyclone over Gujarat |
| 16th June / 2330 IST to 17th 1730 IST | Deep depression over Gujarat |
| 17th June / 1730 IST to 19th 0830 IST | Depression over Rajasthan |
| 19th June /0830 IST | Well-marked low pressure over northeast Rajasthan |

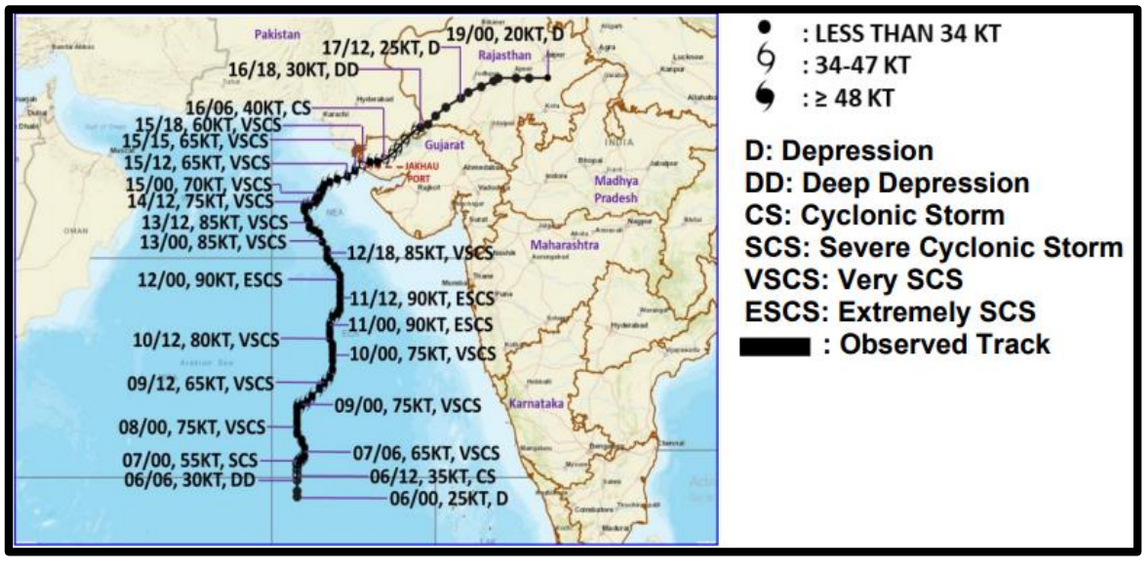



**Figure 2.1: Observed track of 'Biparjoy' over the Arabian Sea during 6th – 19th June 2023**

### 2.1.1 Salient Features of Biparjoy

- **Development and phase of monsoon:** It was the first cyclone over the Arabian Sea in the year 2023 which developed during the onset phase of the southwest monsoon in the Indian region.
- **Long life period:** Biparjoy had been a long duration cyclone over the North Indian Ocean including Bay of Bengal and the Arabian Sea with a total life period of 13 days and 3 hours (depression to depression).
- **Slow speed:** Biparjoy moved very slowly during its lifetime with an average 12 hourly translational speed of 7.7 kmph against the average speed of about 15 kmph for very severe cyclone category during monsoon season over the Arabian Sea.
- **Frequently recurving track:** 'Biparjoy' exhibited a frequently changing track of movement during its life cycle. The movement explicitly depended upon the strength of the driving anticyclones present over central India and Arabian Peninsula. The cyclone changed its path about 9 times resulting in relatively higher difficulty in predicting the path of the cyclone.
- **Track length:** It was 2,526 km (depression to depression stage).
- **Intensity fluctuations:** Biparjoy exhibited rapid intensification in the genesis and growing stage on 6th and 7th June 2023. Intensity also fluctuated during its life period before

landfall in terms of change in associated wind speed. After landfall, it weakened gradually and maintained the intensity of cyclone for 24 hours and depression for 57 hours. It weakened into a well-marked low pressure area on 19th June 2023 morning (0830 IST)

- **Maximum sustained wind speed and estimated central pressure:** The cyclone reached its peak intensity of 160-170 kmph gusting to 190 kmph at 0530 hours IST of 11th June 2023 and maintained its peak intensity till 2030 hours IST of 12th June 2023.
- **Diurnal variation in convective clouds:** The convective clouds associated with the system showed large diurnal variations, picking up intensity twice in the afternoon and early hours.

### 2.1.2 Rainfall

Under the influence of Cyclone Biparjoy, heavy to extremely heavy rainfall occurred in the affected region. The rainfall during 13th – 16th June 2023 was almost equivalent to the annual average rainfall of Kachchh district. Further, other districts also received extremely intense and concentrated rainfall in a very short period of time. This level of rainfall along with high wind speed had significant impacts on the region, including flooding, infrastructure damage, and disruption to daily life.

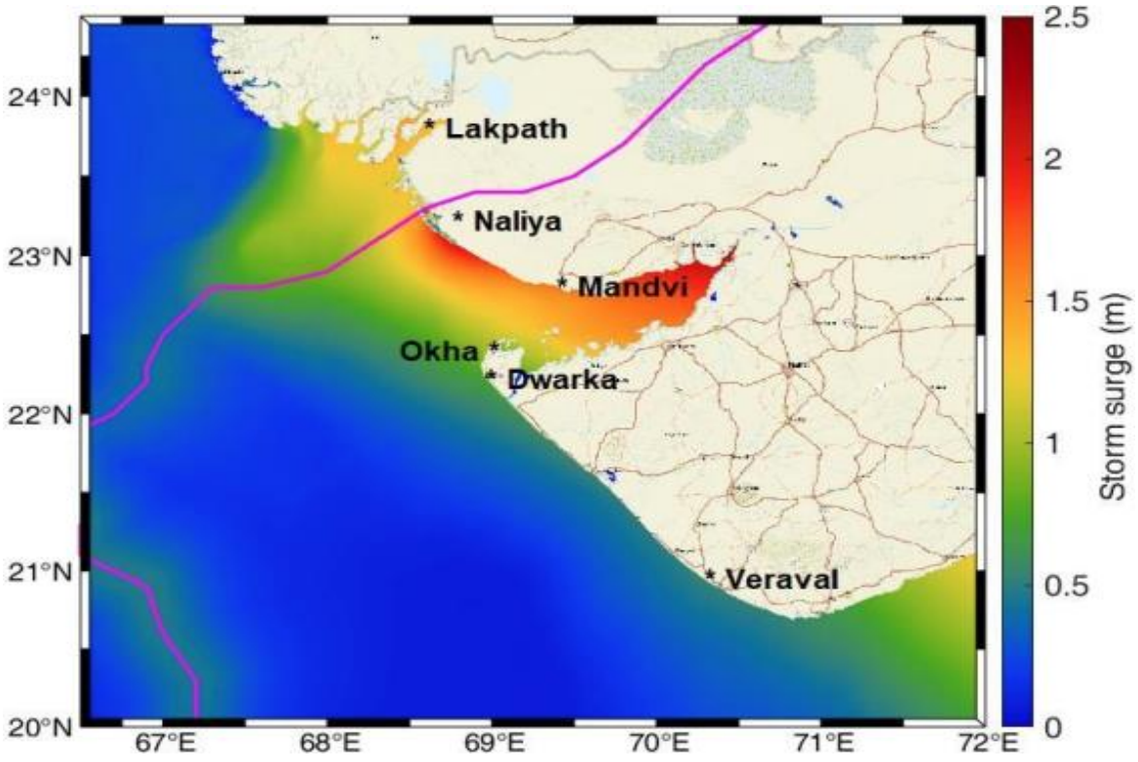



**Figure 2.2: Estimated Storm Surge Map (Source: IMD)**

### 2.1.3 Storm Surge

Estimated storm surge of height 2.0-2.5 m above astronomical tide inundated the low-lying areas in Kachchh and Morbi districts. Peak surge of height 2.1 m was observed at the south of Naliya and 2.2 m near Navlakhi. Estimated storm surge map is presented in Figure 2.2.

## 2.2 Forecast & Warning Services during Biparjoy

The forecast began with continuous monitoring of the weather system from 1st June 2023 and issuance of the extended range outlooks and daily tropical weather outlooks by IMD.

As the cyclone developed into a depression on 6th June 2023, quantitative forecasts were issued for the next five days. These forecasts predicted the intensification of the weather system into a very severe cyclone and its movement towards the central Arabian Sea until 11th June 2023.

During the early hours of 11th June 2023, observations indicated that the weather system would move towards the Gujarat-Pakistan coasts. Consequently, a pre-cyclone watch with yellow message was issued for the Saurashtra and Kachchh regions. In the wake of likely cyclonic event, the Union Home Secretary convened a meeting of the National Executive Committee (NEC) on Sunday, 11th June 2023, with the senior officials from various ministries/departments and the chief secretary of Gujarat state, to review the preparedness and ensure a coordinated response in the face of Cyclone Biparjoy.

From 11th to 15th June 2023, four-stage warning advisories which included Cyclone Watch, Cyclone Alert, Cyclone Warning and Post Landfall Outlook were issued from time to time. The weather bulletins included track and intensity forecasts along with wind speed distributions. Additionally, flood and wind hazard maps generated by the Web Based Dynamic Composite Risk Atlas (Web DCRA), developed under the National Cyclone Risk Mitigation Project (NCRMP) by NDMA were shared in the bulletins by the IMD. Storm surge warnings based on INCOIS model were also made available. These information and maps helped in loss forecasting, risk financing, and response actions during and after the cyclone.

Sector specific warnings were also issued to concerned stakeholders including fishermen, ports, offshore

industries, coast guard and other relevant organizations. It made them well-informed to prepare for the cyclone's impact. Timely warnings and actions also facilitated successful relief and rescue operations.

### 2.2.1 Warning Dissemination

All means of communications were used for timely dissemination of the weather system related to Cyclone Biparjoy to the concerned stakeholders. It included use of CAP-Sachet as well as different social media platforms like Twitter, WhatsApp, Facebook etc., besides the regular periodical dissemination through the news bulletins, print, electronic and audio-visual media.

### 2.2.2 Forecast Accuracy

Despite various unique and diverse characteristics of this weather system, the track, landfall point and the intensity of Biparjoy was well monitored and predicted accurately (Figure 2.3).

The landfall point forecast error for 24, 48, 72 and 96 hours lead period was 17, 23, 15 and 11 km against the long period average (2018-22) of 26, 40, 76, 60 km respectively. The landfall point forecast error was less than 25 km for all lead periods. It is relevant to mention that the diameter of eye (centre) of cyclone was about 50 km. Hence, considering the eye size, there was almost zero error in landfall point forecast.

The track forecast errors for 24, 48, 72, 96 and 120 hours lead period were 69, 104, 152, 194 and 238 km against the long period average (2018-22) of 74, 112, 153, 208, 316 km respectively. Despite, the fact that Biparjoy changed its path about 9 times during its life period, the track forecast error was less than long period average errors for all lead periods.

The intensity (wind) forecast error for 24, 48, 72, 96 and 120 hours lead period was 12.964, 15.5568, 19.26, 24.45 and 31.298 kmph against the long period average errors of 13.704, 19.45, 25.928, 32.2248 and 34.6324 kmph during 2018-22 respectively. Similarly, the cyclone crossed the coast with the wind speed of 115-125 kmph gusting to 140 kmph as per predictions.

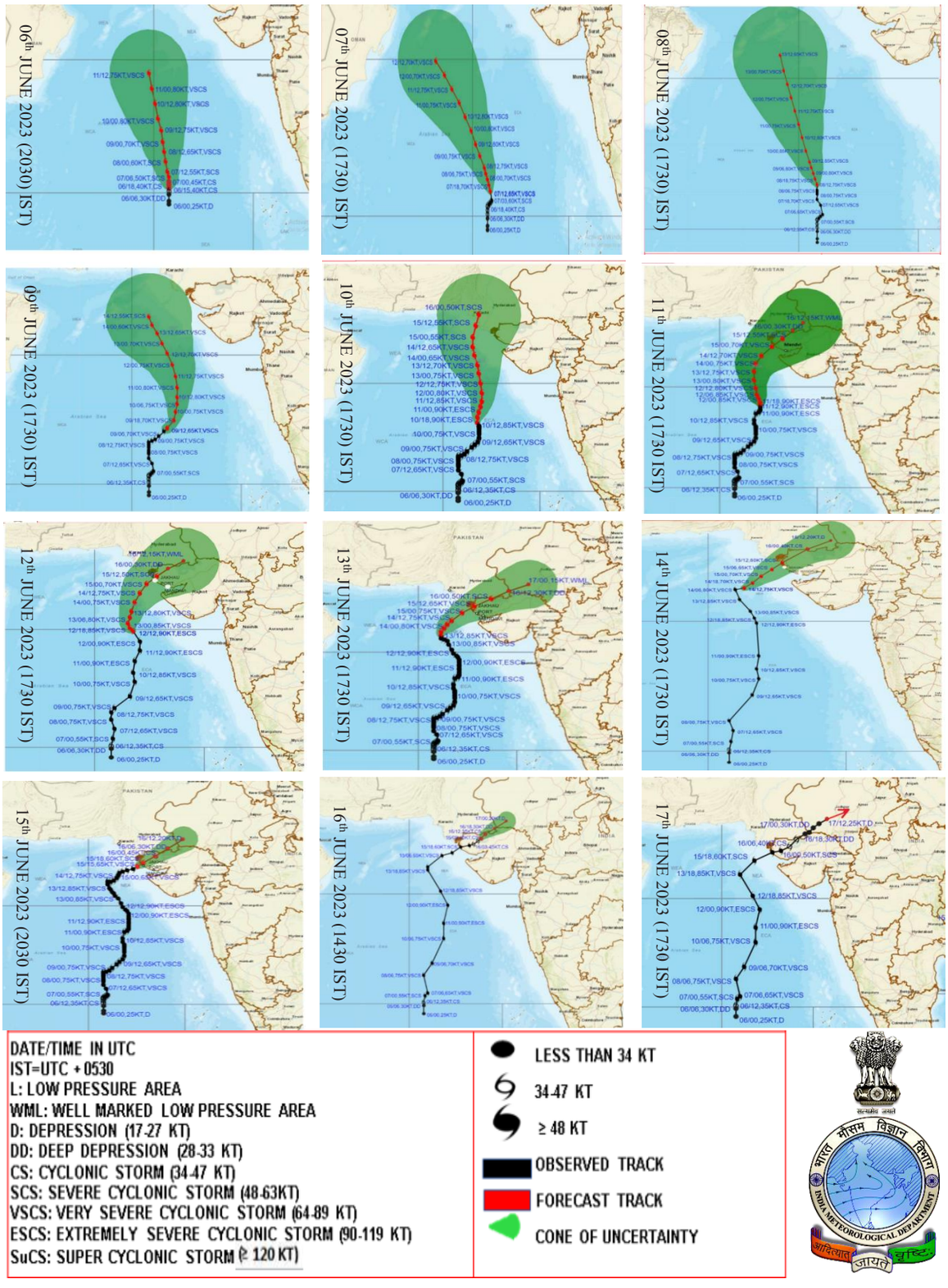



**Figure 2.3: Observed and forecast tracks of Cyclone Biparjoy from 6th to 17th June 2023 (Source IMD bulletins)**

## The Unveiling Efforts:
## Predicting the Unpredictable

*"This cyclone stands as one of the most difficult cyclones in recorded history, posing a significant challenge for tracking its path and intensity"- DG, IMD*

*On 5th of June 2023, a cyclonic circulation materialized. Within hours, a low-pressure area swiftly intensified, transforming into a well-marked low pressure system overnight. By dawn of the 6th June 2023, the system rapidly intensified into a depression that demanded attention.*

*Unyielding, the depression continued its course, transforming into Cyclone Biparjoy by evening of 6th June 2023, stunning the meteorologist with its sudden ferocity. The cyclone embarked on a northward journey, rapidly gaining momentum. It reached severe cyclone status on the 7th June 2023 morning, stirring curiosity among the scientists. Its intensity had heightened further, attaining the status of an extremely severe cyclone.*

*Days turned into a week, and the extremely severe cyclone refused to relent. The vigilant monitoring of the cyclone's every move, provided timely updates ensuring well-being and preparedness for any potential impact.*

*But nature had one more surprise in store. The cyclone suddenly altered its course, moving initial north-northwestwards, shifted its track north-eastwards on 14th June 2023. While its intensity waned, its journey was far from over. On the 15th June 2023, it made landfall near the Jakhau Port in Kachchh district of Gujarat. The coastal regions faced the wrath of the cyclone.*

*This unexpected turn of events served as a powerful reminder of the importance of accurate and timely forecasts. It provided the community with valuable time to evacuate the vulnerable population swiftly. Lives were saved through proactive measures, and the resilience of the people shone through the preparedness, efficient response and quick recovery.*

**2.3 Areas affected by Cyclone Biparjoy**

The districts affected by Cyclone Biparjoy have been depicted in **Figure 2.4.** The severely affected districts included Kachchh, Junagadh, Jamnagar, Porbandar, Devbhumi Dwarka, Gir Somnath, Morbi and Rajkot respectively.

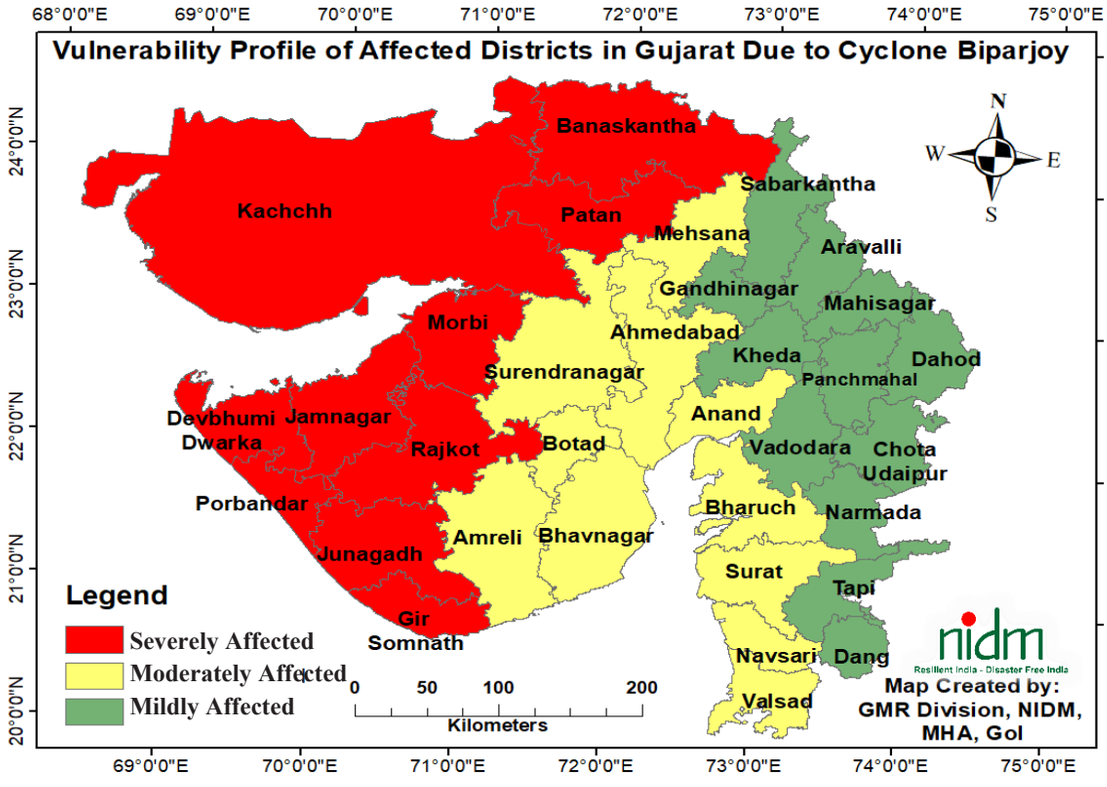



**Figure 2.4: Vulnerable Districts of Gujarat during Cyclone Biparjoy (Source: Commissioner of Relief, Govt. of Gujarat)**

**Table 2.2 District-wise population affected (Source: Commissioner of Relief, Govt. of Gujarat)**

| S. No. | District | Taluka | No. of Villages | Population affected |
|---|---|---|---|---|
| 1 | Junagadh | 2 | 47 | 2,38,108 |
| 2 | Kachchh | 10 | 120 | 3,00,670 |
| 3 | Jamnagar | 4 | 39 | 1,34,672 |
| 4 | Porbandar | 1 | 41 | 3,40,664 |
| 5 | Devbhoomi Dwarka | 4 | 82 | 2,83,904 |
| 6 | Gir Somnath | 6 | 99 | 5,411 |
| 7 | Morbi | 5 | 15 | 29,823 |
| 8 | Rajkot | 0 | 0 | 0 |
| **Total** | | **32** | **443** | **13,33,252** |

# Chapter 3
# Coordination, Preparedness, Protection and Pre-positioning

The coastal state of Gujarat received a bulletin from the IMD on the 6th June 2023, that revealed the formation of a deep depression over the Arabian Sea. The consequent action taken by state government, government of India and various stakeholders including communities are summarized as follows.

## 3.1 Coordination meetings on receipt of Cyclone Alert

Recognizing the possible severity of the situation, a meeting was organized under the chairmanship of the Chief Secretary of Gujarat on 7th June 2023. It aimed to review the situation and assess the preparedness against the potential impact of the approaching cyclone. The Chief Secretary reviewed the state and district level disaster management preparedness measures to tackle the impending hazard so that it could be prevented from turning into a disaster. Clear directions were given for taking appropriate measures and actions needed to be taken at various levels in government. The need to disseminate timely information to the public for ensuring that all citizens take necessary precautions for safety was also emphasized in the meeting. It was decided to launch an extensive awareness campaign across media including local TV channels to reach out to as many people as possible.

In the wake of cyclone alert, Shri Bhupendra Patel, Hon'ble Chief Minister of Gujarat conducted meeting on Friday, 9th June 2023, with the senior officers of the concerned departments and other agencies in the SEOC-GSDMA, Gandhinagar (Figure 3.1). The District Collectors (DCs) and Superintendents of Police (SPs) along with other officers from the relevant districts also joined the meeting virtually. It aimed to assess the preparedness of administration in susceptible districts across Gujarat in anticipation of Cyclone Biparjoy. Keeping in view urgency of situation, the Chief Minister directed concerned officials to take timely and adequate measures to reduce the risks posed by the anticipated cyclone.

As a follow up on the instructions given by the Hon'ble Chief


**Figure 3.1: Review Meeting by Shri Bhupendra Patel, Hon'ble Chief Minister of Gujarat**

The administration shared real-time alerts through various media platforms including social media, ensuring timely dissemination of crucial information to the public. These efforts kept the community well informed and prepared during the cyclone, fostering a sense of awareness and safety.

Minister, the Chief Secretary along with other Heads of the various government departments held a video-conference with the concerned districts to sensitize the officers, review their preparedness and to give appropriate guidance.

At central government level, the Union Home Secretary convened a meeting of National Executive Committee (NEC) on Sunday, 11th June 2023 (Day -4). The meeting was attended by senior officers from various government Ministries/ Departments including the Secretary of Ministry of Power, the Member Secretary of National Disaster Management Authority (NDMA), the Director General of National Disaster Response Force (NDRF) and other senior officers from relevant line departments as well as the Chief Secretary of Gujarat. The primary objective of the meeting was to review preparedness in the face of Cyclone Biparjoy and ensure a coordinated response.

- On Monday, 12th June 2023 (Day -3), the Cabinet Secretary called a meeting of National Crisis Management Committee (NCMC) to review the

preparedness of the Government of Gujarat and central ministries/ agencies in the face of the impending cyclone. The meeting was attended by the Union Home Secretary, Secretaries of Ministry of Power, Ports, Shipping & Waterways, Civil Aviation, Railway Board, Department of Fisheries, DG Telecom, Member Secretary NDMA, CISC IDS, DG IMD, DG NDRF, DG Coast Guard, senior officers from the Ministry of Home Affairs and Chief Secretary of Gujarat. The Chief Secretary of Gujarat apprised the NCMC of the preparatory measures being taken to protect the population in the expected path of the cyclone. He informed that "the fishermen have been advised not to venture out into the sea and those at sea have been called back to safe places. A total of 21,000 boats have been parked at safe places so far. List of all vulnerable villages have been prepared for evacuation purpose. Details of Salt pan workers have also been prepared for shifting them to safe places. Adequate shelters, power supply, medicine and emergency services have been kept in readiness and 10 teams of SDRF have been deployed".

The National Disaster Response Force (NDRF) had also deployed 12 teams and 3 additional teams were kept in readiness in Gujarat. In addition, 15 teams, i.e, 5 Teams each at Arrakonam (Tamil Nadu), Mundli (Odisha) and Bathinda (Punjab) were kept in the state of alert for airlifting on short notice. Rescue and relief teams of the Coast Guard, Army and Navy along with ships and aircrafts were also kept ready on standby.

- The impending cyclone had instilled a sense of urgency and concern across the nation. Recognizing the likely severity of the situation, the Hon'ble Prime Minister of India, Shri Narendra Modi, presided a review meeting on Monday, 12th June 2023 (Day -3)[3] about the advance preparations against the impending cyclone (Figure 3.2). The meeting was attended by the Hon'ble Home Minister, Principal Secretary to PM, Cabinet Secretary and other senior officers. During the review meeting, Hon'ble Prime Minister Modi emphasized the importance of full preparedness in the vulnerable areas. He emphasized the need for a concerted efforts to achieve **'Zero Casualty'** and minimize potential damage that may be caused by Cyclone Biparjoy. The Hon'ble Prime Minister's commitment for a disaster resilient India got reiterated in this meeting as well.

[3] *https://pib.gov.in/PressReleasePage.aspx?PRID=1931690*

**Figure 3.2: Review Meeting by Shri Narendra Modi, Hon'ble Prime Minister**

**"Take every possible measure to ensure that people living in vulnerable locations are safely evacuated and also ensure safety of animals"- Hon'ble PM**

**"Ensure maintenance of all essential IMA services with preparedness for their immediate restoration in the event of damages": Hon'ble PM**

- On 12th June 2023, Shri Sarbananda Sonowal, Hon'ble Union Minister of Ports, Shipping and Waterways, reviewed preparedness for Cyclone Biparjoy. During the meeting, Shri Sonowal directed the senior officers to take every possible measure to ensure safety of people living in vulnerable locations. He said, "We must ensure compliance with the advisories issued by the IMD, DGS, and other authorities in order to protect lives and the environment; also ensure that all precautionary/preventive measures and arrangements are made in time to provide necessary rescue, shelter, rehabilitation, and relief as required".
- On Tuesday, 13th June 2023 (Day 2), Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation, held

[4] *https://pib.gov.in/PressReleasePage.aspx?PRID=1932087*

a meeting through video conferencing to review the preparedness for Cyclone Biparjoy (Figure 3.3). Shri Bhupendra Patel, Hon'ble Chief Minister of Gujarat, Hon'ble Union Minister of Health & Family Welfare, Shri Purushottam Rupala, Hon'ble Minister of Fisheries, Animal Husbandry and Dairying, Mrs. Darshana Jardosh, Hon'ble Minister of State, Ministry of Textiles and Railways, Dr. Munjapara Mahendrabhai, Hon'ble Minister of State, Ministry of Women and Child Development and AYUSH, Mr. Devusinh Chauhan, Hon'ble Minister

Authority (NDMA) and senior officers of Ministry of Home Affairs were also present.

- From Wednesday, 14th June 2023 (Day 1), a series of situation review meetings and media briefings were taken-up by the Hon'ble Chief Minister and Chief Secretary to review the evacuation, relief and rescue operations undertaken in response to Cyclone Biparjoy from the State Emergency Operation Centre (SEOC). The Hon'ble


**Figure 3.3: Review Meeting by Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation**

of State, Ministry of Communications, several Ministers of Government of Gujarat, public representatives, Chief Secretary and District Magistrates virtually participated in the meeting.[3] The Union Home Secretary, Director General of India Meteorological Department (IMD), Member Secretary, National Disaster Management

Chief minister, along with the Chief Secretary and senior officials, took appraisal of the planning and operations carried out by the administration in preparation for the cyclone. Throughout these interactions, necessary guidance and support were

provided to effectively manage the challenging situation posed by Cyclone Biparjoy.

### 3.2 Preparedness, protection and pre-positioning measures

Subsequent to the coordination meetings, the state and central government agencies/ departments/organisations took adequate and timely preparedness, protection and pre-positioning measures to safeguard the people, property and environment.

#### 3.2.1 Activation of Incident Response System (IRS)

As the Cyclone Biparjoy approached with its fierce winds and downpour, the state activated the Incident Response System (IRS). As a part of this system at State Level, Hon'ble Chief Minister and Chief Secretary headed the Strategic Command to take critical decisions. The strategic command was also supported by the ministerial group for timely decisions.

- The Incident Command was led by Additional Chief Secretary – Revenue Department as Incident Commander.
- For the immediate implementation of the instructions of Incident Commander, quick response system was activated under the Operational Command of Commissioner of Relief (CoR). The State Emergency Operation Centre (SEOC) made functional under the directions of CoR and supervision of Director of Relief. SEOC also hosted the control room activities.
- Similarly, at District Level, incident command was led by the District Collectors, who were guided by 'Prabhari Mantris' and 'Prabhari Sachivs' (Annexure 3).
- Incident commanders swiftly assessed the evolving situation, gathering real-time information and intelligence. They worked closely with IMD, Ahmedabad, disaster management authorities, and local agencies to analyze the cyclone's trajectory, intensity, and potential impact. This information and knowledge helped in formulating the effective strategies to minimize the damages.

#### 3.2.2 State Emergency Operation Centre (SEOC) and Support Mechanism

The SEOC, nerve center for emergency response and coordination, was fortified to ensure seamless communication, efficient decision-making, and effective support mechanisms. Advanced technology and state-of-the-art equipment were integrated into the SEOC, enabling real-time monitoring, data analysis, and

information dissemination. The Commissioner of Relief (CoR) and Director of Relief worked together in coordination with District Emergency Operation Centres (DEOCs). Gujarat State Disaster Management Authority (GSDMA), Gujarat Institute of Disaster Management (GIDM) and other organisations supported SEOC continuously as cyclonic effects in the form of heavy winds, rain and storm surges were ongoing in the coastal areas.

State Government departments and Central Government's respondent agencies deputed their nodal resources at SEOC to facilitate quick coordination between incident command and their representative organisation's field formations. Subsequently, 3 Indian Administrative Services (IAS) officers, 3 Gujarat Administrative Services (GAS) officers, and 4 Revenue Officers were appointed to the State Emergency Operation Centre (SEOC) at the disposal of Incident Commander.

## 3.3 Sectoral Preparedness, Protection and Pre-Positioning Measures

During the onset of the Cyclone Biparjoy, sectoral preparedness, protection and pre-positioning measures played a crucial role in mitigating the potential damage and ensuring the safety of the population. Each sector, from infrastructure to healthcare, took proactive measures to minimize the impact of the impending cyclone. Power and utility companies augmented their infrastructure and implemented backup systems to maintain uninterrupted services. The telecom sector took proactive measures to avoid disruption of communications services. Transportation authorities also worked diligently to devise secure alternative routes for access to essential services. Educational institutes including schools and colleges were closed. Hospitals and healthcare facilities strengthened their emergency response plans, ensuring sufficient supplies of medicines, medical equipment, and trained personnel. The water supply department also ensured availability of drinking water.

### 3.3.1 Telecom and Communications Networks

The telecom sector fortified its infrastructure and reinforced the preparedness, protection and pre-positioning efforts in view of the vital role of communications during

disaster situations. Some of the precautionary steps taken by telecom sector were:

- The dismantling of the 90 meter high guy rope supported steel tower of Akashvani as a safety precaution as the tower had undergone a safety audit by experts, who recommended its dismantling. While the tower was being dismantled, Akashvani worked on restoring services from Dwarka using available resources (PIB, 14th June 2023).
- Satellite phones were kept ready and made available strategically in all affected districts and at the State Emergency Operation Centre (SEOC) to maintain communication in case of network disruptions due to communications tower/ landline failures.
- Mobile service providers were directed to stock up on diesel, machinery, and human resources to ensure uninterrupted operations during power outages. To address any service interruptions, the government facilitated mobile service portability in affected districts, allowing users to manually switch to alternative telecom operators if needed.
- 8 dedicated oil tankers were deployed to refuel the DG sets that were placed at high platform of 2m height with standard back up of 48+4 hours. More than 20 lakh liters of diesel was utilized for the functioning of mobile towers during the cyclone.
- For the purpose of quick restoration of communication infrastructure in case of failure during cyclone Biparjoy, the mobile operators were instructed to have dedicated skilled teams equipped with requisite material ready for quick restoration of services.
- Communications redundancy was ensured through various means, including landlines, hotlines, mobile phones, satellite phones, VSAT, wireless sets, quick deployment of antennas, and HAM radios.
- More than 5,00,000 push SMS messages were sent to communities, and WhatsApp groups were established at various levels for effective coordination, communication and information flow.

The telecom sector's commitment to preparedness, protection, pre-positioning and redundancy exemplified their dedication to keeping people connected and safe in times of disasters.

## Intra Circle Roaming: Game Changing Strategy for Resilient Communication

*As the cyclone Biparjoy was inching closer to the coast, effective communication was crucial. Families needed to stay connected, emergency services had to be reachable, and timely information was a lifeline for survival.*

*Drawing from past experiences, the Ministry of Communications and Information Technology took swift action and activated Intra Circle Roaming (ICR) across the region. This collaborative effort between mobile service providers ensured seamless communication, allowing individuals to switch between networks, even if their primary network was disrupted. The administration recognized the vital role that ICR would play in safeguarding the community's well-being. Along with the ICR protocol, the administration established HAM radios at the vulnerable districts anticipating the worst scenario.*

*As the cyclone unleashed its fury upon the people, chaos ensued. Power lines faltered, landlines became silent, leaving the people reliant on their mobile phones as expected. But with ICR, linked on each other's well-being was also linked, providing solace and support in the face of uncertainty. They could check and share vital updates, including but not limited to, evacuation routes and emergency shelters.*

*As the cyclone gradually subsided, the affected community began its journey towards recovery. Power lines were repaired, and the streets were cleared of debris. Amidst all, the spirit of unity and resilience shone brightly. The aim of ICR activation meant that no one would be left stranded or uninformed.*

*The implementation of ICR during the cyclone had demonstrated the power of collaboration. Mobile service providers instead of competing started complementing with each other and prioritized public safety & welfare. They had worked together, pooling their resources and networks to ensure that the community remained connected, informed, and resilient.*

*With each successive disaster that nature presented, the activation of ICR became a cornerstone of the state's preparedness. The people faced each new challenge with courage, knowing that their ability to stay connected, informed, and resilient would be ensured through the collaborative efforts of mobile service providers.*

### 3.3.2 Media and Broadcasting

During disasters, media and broadcasting play a crucial role in disseminating accurate information, raising public awareness, issuing emergency warnings, coordinating response efforts, and mobilizing support. During Biparjoy, the print, electronic, audio-visual and social media (Figure 3.4) played an important role in disseminating information and creating awareness through IEC activities. The time to time alerts were disseminated through different media and broadcast sources. The alerts were also shared by the official Twitter and Facebook accounts of public representatives for wider reach.


**Figure 3.4: Use of media and broadcasting in disseminating information and creating awareness**

### 3.3.3 Power

As a precautionary measure, electric power was disconnected to avert any mishaps. Without power, essential services grounded to a halt. The loss of power meant the loss of communication, and the community felt isolated from rest of the world. In the absence of electricity, phones and radios could not be used, cutting off people from important information and preventing them from calling for assistance. But amidst the darkness, a sense of togetherness grew stronger. Neighbors reached out to one another, offering support and solace, knowing that their unity

was a beacon of hope in the face of adversity. Inside their homes, families gathered around the soft glow of candles and flashlights. Outside, the streets transformed into a maze of hidden dangers. Fallen branches and debris littered the pathways, making it challenging to move around safely. Yet, within the depths of despair, hope began to flicker. Shri R.K. Singh, Hon'ble Union Minister of Power along with key stakeholders from the power sector took review of the situation on 13th June 2023 and gave clear command to all concerned to "continuously monitor the situation and take all necessary steps for maintaining the stable grid supply to the States likely to be affected and also make arrangements for Emergency Restoration System (ERS) along with necessary men and material to be stationed at the strategic locations so that restoration works can be taken up without any delay". POWERGRID, the leading power transmission company, sprang into action, closely monitoring weather conditions and their transmission system through round-the-clock control rooms. Regional stores at circle offices were functional round the clock, equipped with all necessary materials in sufficient quantity for restoration of network or distribution of transformers. Required trucks, heavy duty trailers and vehicles for transportation of poles and materials were also kept ready. Additional teams (each with a deputy engineer, a junior engineer, technical staff and workers) with tools and vehicles were kept on stand for further instructions.

Drawing from disaster and crisis management plans, emergency restoration stockpiles were strategically positioned along with trained personnel ready to swing into action. To ensure quick responses to emergencies, spare transmission line equipment, DG sets, dewatering pumps, emergency lights, diesel, transformer oil, and substations were meticulously arranged.

The local power distribution company, PGVCL, and the transmission company, GETCO, worked in close coordination and mobilized their resources. 597 teams of PGVCL along with the 51 teams of GETCO fanned out across the 8 districts, stationed strategically to restore power with unwavering dedication. Standby teams stood ready, positioned in surrounding areas, prepared to swiftly respond to any emergencies and facilitate the efficient restoration of power.

Recognizing the potential impact on the power infrastructure, Ministry of Power along with state agencies responsible for transmission and distribution, strategically prepositioned resources to ensure swift

restoration of electricity in the affected areas.

### 3.3.4 Health

On 13th June 2023, Dr. Mansukh Mandaviya, Hon'ble Union Minister of Health and Family Welfare, reviewed the status of preparedness of health system for any emergency response with officers from both the Centre and Gujarat state in presence of Shri Rushikesh Ganeshbhai Patel, Hon'ble Health Minister of Gujarat at Bhuj (Figure 3.5).

The major preparedness, protection and pre-positioning measures are briefly discussed below:

- To ensure prompt emergency care and services, six multidisciplinary Quick Response Medical Teams from the Central government were involved. These teams, comprising skilled professionals from renowned medical institutions such as Dr. RML Hospital, LHMC, Safdarjung Hospital, AIIMS (New Delhi, Jodhpur, and Nagpur), were kept ready for medical relief and response. Teams from NIMHANS-Bengaluru were also kept on standby to provide much-needed psychosocial care and support to the affected population.
- Integrated Disease Surveillance Programme (IDSP) was deployed across all vulnerable districts to monitor and detect any potential disease outbreaks in the aftermath of the cyclone. The state and district surveillance units were tasked with post-disaster disease surveillance to ensure timely detection and management of any epidemic-prone diseases. In the event of any logistical requirements, M/s HLL Lifecare Ltd. was entrusted with the responsibility of supplying necessary resources to the state.


**Figure 3.5: Review meeting by Dr. Mansukh Mandaviya, Hon'ble Union Minister of Health and Family Welfare, along with Shri Rushikesh Ganeshbhai Patel, Hon'ble Health Minister of Gujarat at Bhuj, Gujarat**

- Recognizing the importance of uninterrupted healthcare services, the Government of Gujarat took proactive measures by providing ample stocks of essential medicines and logistics to address the healthcare needs of the affected districts. Furthermore, all district hospitals were equipped with 100% DG sets to ensure uninterrupted power supply, assuring that critical medical equipment and facilities remained operational.
- At the primary healthcare level, including PHC, CHC, SDH, and DH, round the clock services were maintained to handle any medical emergencies that arose during the cyclone. 197 DG sets were deployed across various health centers, and 157 ambulance services were strategically stationed in the vulnerable regions to enhance the health emergency capabilities. Additionally, 357 government ambulances and 246 EMRI-108 ambulances were on standby, ready to provide swift medical assistance.
- The health sector deputed 9,354 paramedical staff and ASHA workers, equipping them with anti-epidemic drug kits to address potential health threats during and after the cyclone. Their preparedness ensured that medical support was readily available to those in need. Drug kits, TCL, chlorine and around 33,316 ORS were also provisioned.
- 1,171 pregnant women with expected dates of deliveries in the next 15 days were mapped and contacted. 1,152 pregnant women were evacuated with the support of community (Figure 3.6). Out of the pregnant women who were evacuated, 828 women had safe deliveries under institutional care during Cyclone Biparjoy.
- The blood banks were provided with DG sets as a precautionary step. Wherever the power failures were expected in the blood banks, arrangement were made for shifting of blood transfusion bags to those blood banks where DG sets facilities were available.

The comprehensive preparedness, protection and pre-positioning measures implemented by the health sector exemplified their commitment to save and serve the affected population during the Cyclone Biparjoy.

**Figure 3.6: Pregnant women being shifted to safer places by the community representatives.**

## Cries that brought Smiles

*A remarkable achievement of the health department was the evacuation and care provided to pregnant women. Under supervision of health department, a total of 828 successful deliveries were made, ensuring the well-being of both mothers and infants during this challenging time.*

*During the visit to cyclone-affected areas in Gujarat, Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation, interacted with the affected families. He met with a family that had recently welcomed a baby girl amidst the chaos and destruction caused by the cyclone. Even though the cyclone was devastating, the efforts by the administration brought new smiles and the first cry into the world which created an auspicious atmosphere. Out of happiness and joy, the parents decided to name the new-born girl as Khushi, a Hindi word meaning "happiness". The parents believed that this meaningful name serves as a symbol of hope and optimism.*

*Despite their pains, these women showcased their indomitable spirit, combining the anticipation of new life with the adversity of a disaster. Their stories serve as testaments to the profound psychological strength possessed by women.*

*The importance of support systems became evident in their experiences. The comprehensive crisis response plans in place prioritized not only their physical well-being but also their psychological welfare. This unity of care ensured that the mothers received the emotional support they needed to navigate through challenging circumstances.*

*In the face of adversity, women of Gujarat once again demonstrated their ability to be resilient and emerge stronger even during adversity such as this cyclone. The resilience and determination exhibited by these mothers and their new-borns will forever inspire future generations, serving as a reminder of the power of unity, hope, and the miracle of life.*

### 3.3.5 Water Supply

When a cyclone strikes, it can cause damage to water sources, treatment plants, pipelines, and distribution networks. Heavy rainfall and strong winds can lead to contamination of water sources, making them unsafe for consumption. The disruption of power supply during a cyclone can exacerbate the challenges faced by the water supply system.

Adequate arrangements were made to ensure uninterrupted drinking water supply, particularly for the areas where power failures would have disrupted the water supply. Underground water storage tanks (Sumps) were pre-filled as a preparatory measure and DG (87 in number) sets were pre-positioned to supply the water without interruption. Water pumps (82 in number) and additional generator sets were also strategically placed throughout the affected districts, ensuring a continuous flow of water even in the face of power outages.

A total of 25 generator sets were strategically positioned in Kachchh, Devbhumi Dwarka, and Jamnagar to provide power backup for water infrastructure. A team of dedicated engineers (3 chief engineers and 9 executive/ deputy executive engineers) and technicians were deployed to swiftly address any issues that would arise. 9 DEE/AE/AEE were kept ready on standby for deputation as and when required.

A fleet of 144 water tankers was put on standby, ready to distribute water to communities in need.

The lessons learned from this experience fueled a renewed commitment to build resilient water systems and implementing disaster preparedness measures.

### 3.3.6 Transportation

The state administration took preparedness, protection and pre-positioning measures to ensure the safety of both residents and visitors as the cyclone was likely to affect the transport infrastructure. The airports at Bhuj and Jamnagar were temporarily closed and the flight operations were halted.

The Ministry of Railways took preemptive action by cancelling 180 trains, short originating 45 trains and short terminating 105 trains in the affected districts to ensure passengers' safety.

The technical teams from the Roads & Building Department were strategically deployed across 8 affected districts. The dedicated teams worked tirelessly to maintain accessibility and guarantee the safety of those on the move. Additionally, the concerned authorities took down a total of 4,464 hoardings along roadsides as a precautionary measure **(Figure 3.7).**


**Figure 3.7: Removal of hoardings as a precautionary measure**

State transport buses and privately operated vehicles in susceptible districts were directed to cancel their services, prioritizing the well-being of travelers. However, the transportation services were provided to the responders for evacuation of the vulnerable population from the affected areas. The Gujarat State Road Transport Corporation (GSRTC) allotted 87 buses for evacuation purpose. Foreseeing the likely disruption of road network, 132 technical teams with 224 members of Roads and Building Department were prepositioned along with 276 dumpers, 382 backhoe loaders (JCB machines), 204 tractors and 60 loaders in 8 susceptible districts.

### 3.3.7 Tourism

The enchanting land of Gujarat, known for its cultural heritage, historical treasures, and warm hospitality, attracts tourists from every part of the world. The focus on safety was also extended to iconic pilgrimages, religious and tourist sites. The revered Dwarkadhish Temple in Devbhumi Dwarka and the majestic Somnath Temple in the Saurashtra region closed their doors to devotees during the cyclone, ensuring safety of all.

**Closing of Shrines: Sacred motive of saving lives**

The Iconic and ancient sacred pilgrimage of Dwarkadhish Temple in Devbhumi Dwarka and the majestic Somnath Temple in the Saurashtra region, closed their doors to devotees during the cyclone. Even the Dhwaja Aarohan, most significant practice observed in Dwarka temple, was cancelled during the cyclone. Other tourist sites also suspended their operations temporarily, recognizing the need to prioritize safety of all involved and reflecting the paramount importance placed on the well-being of worshippers and visitors. This commitment to safety and tradition exemplified Gujarat's enduring spirit.

### 3.3.8 Fisheries

During cyclones, strong winds and rough seas make it unsafe for fishermen to enter into the sea water. The Cyclone Biparjoy made landfall in the month of June, which is no fishing period in the western coast. Due to implementation of no fishing period, the fisherman actually moved their boats to the coast. The fisheries department disseminated the early warning to the fishermen, who were reported to have ventured into deep sea, and advised them to relocate to safety. They were urged to move their boats to safe locations with support from fishermen association and seek shelter until the cyclone passed. The fishermen, well aware of the risks associated with such natural calamities, heeded the advice and took immediate action. The details of total number of boats parked safely at coast as a precautionary & protection measure before the landfall of Cyclone Biparjoy in highly vulnerable districts is given in Table 3.1.

**Table 3.1: Boats parked in highly vulnerable districts (Data Source: Commissioner of Relief, Govt. of Gujarat)**

| Districts | No. of Boats Parked at Coast |
|---|---|
| Junagadh | 3,377 |
| Kachchh | 2,001 |
| Jamnagar | 832 |
| Porbandar | 4,202 |
| Devbhumi Dwarka | 4,385 |
| Gir Somnath | 6,675 |
| Morbi | 123 |
| Total | 21,595 |

### 3.3.9 Ports, Ships & Cargoes

The vast coastline of Gujarat has 44 minor ports that operate under 10 port offices along with the 4 Greenfield ports operated by private companies. As cyclone Biparjoy unbound its wrath upon the coastal regions of Gujarat, the bustling ports that were once teeming with activity transformed into empty harbours. The impending danger prompted an immediate and coordinated response to ensure the safety of all vessels and the people on board. The order clearly stated that all vessels should move out to the deep seas and away from the path of the raging cyclone. Amid the rising danger posed by the cyclone, all the ships were cleared from the coast and suitable signals were put up from time to time. It was a race against time as ship captains and their crews diligently followed the instructions, navigating their way through rough waters and turbulent winds. At the Gulf of Kachchh, a total of 67 vessels were among those advised to seek shelter in the vastness of the open sea. The Mercantile Maritime Board (MMB), Gujarat Maritime Board (GMB), DG Shipping, Indian Coast Guard (ICG), Indian Navy and other related authorities ensured adequate & timely preparedness and protection measures.

### 3.3.10 Education

Recognizing the potential risks, schools and colleges were temporarily closed between 15th and 17th of June 2023 to prioritize the safety of students and staff. Additionally, in an impressive display of preparedness, a total of 2,059 school buildings were identified as evacuation shelters, for those evacuated during the cyclone. Teachers were assigned to work in the control room/war room, utilizing their communication skills to relay critical information to the public and coordinate emergency efforts. Thus, the teachers from the education department played a significant role in ensuring effective communication and response. It also demonstrated the teachers' commitment towards ensuring communities' well-being in disaster situations.

### 3.3.11 Animal Husbandry

As the residents prepared for the impending cyclone, another significant aspect of the community's safety was at stake, i.e. the well-being and survival of the livestock & animals.

The local authorities and communities took an initiative to safeguard the livestock & animals, and evacuated them to safer places through coordinated efforts. They formed dedicated teams consisting of veterinary professionals, animal welfare organizations, and volunteers passionate about animal care. Details of the livestock and animals shifted to safer places from 199 villages are given in table 3.2.

**Table 3.2: Number and details of the districts from where animals were shifted to safer places**

| S. No | District | Villages | Population | Animals |
|---|---|---|---|---|
| 1 | Kachchh | 110 | 2,80,649 | 51,448 |
| 2 | Dwarka | 46 | 86,435 | 1200 |
| 3 | Jamnagar | 22 | 36,363 | 0 |
| 4 | Morbi | 21 | 15,835 | 333 |
| **Total** | | **199** | **4,19,282** | **52,981** |

As the cyclone approached, the teams quickly sprang into action. They assessed the animal husbandry facilities, identified vulnerable areas, and developed a comprehensive plan for the evacuation process. The cattle in the vulnerable areas were shifted to the cow-shelters i.e. Goshalas, where requisite fodder and water were arranged as a counteractive measure. The administration also provided feed to the stray animals in the streets or on the roads including dogs.

### 3.3.12 Forest and Wildlife Protection Measures

As Cyclone Biparjoy was approaching, there was a growing concern for the endangered Asiatic lions in Gujarat's Gir forest, Narayan Sarovar Sanctuary in Kachchh, Mata No Madh Barda and the Great Indian Bustards in Naliya. The remaining four Great Indian Bustards, representing the last of their species in Gujarat, faced heightened risks. As the cyclone posed threat to the biodiversity, the government and conservation authorities decided to protect the precious wildlife. Taking swift action, authorities under the guidance of the Chief Wildlife Warden implemented necessary measures to protect wildlife, including orders cancelling leaves of staff, preparation of rescue teams, and stocking of hospitals with essential supplies for animal care.

Deep within the dense forests of Gir, teams of 184 dedicated individuals stood ready. These teams were prepared to swiftly rescue animals, take necessary actions, and clear fallen trees that could pose threat to wildlife. The movement of 40 lions fitted with radio collars, was tracked through satellite links. This system was very helpful in ensuring their safety and providing adequate data for conservation efforts. Shri Narendra Modi, Hon'ble Prime Minister sought to know the steps taken by the state administration for the safety of wild animals, especially the lions in the Gir forest (Figure 3.8).

As the cyclone's dark clouds loomed over the horizon, a network of 58 control rooms spanning across nine divisions was established. These vigilant control rooms were the lifeline connecting the teams, enabling prompt response to any SOS messages concerning wild life. The safety and well-being of the lions and other wildlife were closely monitored, ensuring immediate action as and when necessary.

Specialized teams were deployed to handle any rescue operations in the lion zone to avert the potential dangers of heavy rainfall and rising water levels associated with the cyclone. As a preventative measure, the Maldharis, pastoral communities living in the Gir region, were relocated to safer areas.

The protection efforts extended beyond the iconic lions to embrace the diverse wildlife. Six dedicated wildlife rescue teams were dispatched to the sanctuary area of Kachchh, known for its vast salt desert, migratory flamingo birds, and the wild ass. These teams together with the local communities worked diligently to preserve the delicate balance of nature, safeguarding the rich flora and fauna.

Amidst the howling winds and torrential downpour, fallen trees were swiftly cleared to remove any threats to the wildlife. Distressed animals were rescued with utmost care, their safety becoming the top


**Figure 3.8: Shri Narendra Modi, Hon'ble Prime Minister spoke to Shri Minister Bhupendra Patel, Hon'ble Chief Minister of Gujarat over the phone and sought to know the steps taken by the state administration for the safety of wild animals, especially the lions in the Gir forest**

priority. Every step was taken to protect wildlife from the ravages of the cyclone, ensuring their continued existence, contributing to the preservation of the precious biodiversity.

Through the unwavering dedication of the specialized rescue teams, the support of the vigilant control rooms, and the collaborative efforts of passionate conservationists, a heartwarming tale of resilience emerged. The endangered Asiatic lions continued to roam freely in their natural habitat, their numbers thriving under the watchful eyes of their protectors. Gujarat's diverse landscapes became haven for flourishing wildlife, serving as a testament to the indomitable spirit and commitment of all those involved in the noble mission of conservation.

### 3.3.13 IEC Activities

Media plays an important role in disaster management by educating the public about the role in risk reduction and resilience, through dissemination of IEC materials to keep them informed and prepared.

From the very beginning, continuous press briefings were conducted by Hon'ble Chief Minister, Chief Secretary, and District Administration. These briefings served as a platform to provide accurate and reliable updates and dispel any rumors or misinformation.

GSDMA made arrangements to warn the public about the impending cyclone through various media channels (Figure 3.9, Figure 3.10). Information regarding do's and don'ts for the public's safety and survival were disseminated through all possible means. Announcements were made on television, radio, and other platforms so that no one was left behind without the early warning information. Additionally, bulk SMS services were utilized to deliver alerts and warnings directly to people's mobile phones, ensuring that important information reached them in a timely manner.

Social media platforms such as WhatsApp, Facebook and Twitter were effectively utilized to further enhance communication and awareness. These platforms served as a means to disseminate alerts, warnings, and crucial information about safety measures. The administration in all vulnerable districts was actively engaged with the public through social media, generating mass awareness and ensuring that people were well-prepared to face the cyclone.



**Figure 3.9: Information, Education & Communication (IEC) activity by GSDMA**

**Figure 3.10: Vulnerable population evacuated to safe shelters**

### 3.3.14 Evacuation, Safe Shelters and Community Kitchens

Identifying the vulnerable population and shifting them to safe shelters (Figure 3.11) was a priority for protection of people living in the likely affected areas, to achieve the target of zero casualty in the face of the impending threat. Safe shelters were identified as per the respective existing Disaster Management Plans prepared in districts, talukas, cities and villages. A total of 2,213 safe shelters were identified and used in the affected districts. All necessary arrangements like drinking water, food, and other logistics support were made available at the shelters.

The government, well aware of the potential danger, sprung into action to ensure the safety of residents. As a part of their emergency preparedness plan, they established safe shelters throughout the susceptible districts.

The local government authorities collaborated with various organizations and volunteers to set up safe shelters in secure locations. These shelters were equipped with substantial infrastructure (as per guidelines for cyclone shelters) and essential amenities to provide a conducive environment for the residents during the cyclone.

## Dealing with Disaster: Shelters with a Difference

*As the cyclone approached, the government made sure to stock the shelters with ample supplies of nutrition and hygiene items. As during the times of crisis, access to proper nutrition and hygiene plays a vital role in safeguarding the health and well-being of the affected individuals.*

*During cyclone, the safe shelters became more than just physical structures. The extended care and support, providing a nurturing environment for pregnant women, lactating mothers, infants, and young children. The government's focused approach on adequate nutrition demonstrated their commitment to the well-being of the most vulnerable members of the community (feeding norms as per maternal and adolescent healthcare; National guidelines on infant and young child feeding). The government facilitated dedicated lactation corners for breastfeeding within the safe shelters. Trained lactation counselors were present to offer guidance, support, and education to lactating mothers. They encouraged exclusive breastfeeding, providing women with the knowledge and confidence to nurture their infants even in challenging circumstances.*

*Infants and young children were also given proper attention. The government established child-friendly spaces within the safe shelters, equipped with age-appropriate toys, books, and educational materials. Special attention was given to providing nutritious meals for these young ones. The milk cooperative ensured sufficient supply of milk to the children in these shelters. Nutrient-dense foods, fortified with essential vitamins and minerals, were served to meet the growing needs of their developing bodies. Local corporates extended their support in providing ready to eat food items.*

*As the cyclone raged outside, the safe shelters echoed with the laughter of children and the comforting whispers of mothers. The government's efforts to prioritize nutrition had a profound impact, ensuring that the physical and emotional needs of pregnant women, lactating mothers, infants, and young children were met during this challenging time. It became a symbol of hope, resilience, and community solidarity.*

A total of 1,43,053 people were identified for evacuation as a preparatory measure in wake of Cyclone Biparjoy from the 8 affected districts. A total of 1,152 pregnant women, 6,895 old people, 25,329 children and 1,09,677 others were evacuated. The people evacuated were kept in the 2,405 safe shelters, which include 38 cyclone shelters, 2,050 government schools and 317 other shelters in 798 villages of the affected districts. The details of the people evacuated from vulnerable districts and safe shelters are detailed in Annexure-4. Warm, freshly prepared meals were given to the evacuees at each of the shelter where a community kitchen had been set up.

- 6,229 salt pan workers were evacuated from 869 salt pans. The details of the evacuation of salt pan workers are given in the Table 3.3 below:
- Animals including livestock and street dogs were relocated from the conceivably affected villages to safer locations.
- Police patrolling was conducted after evacuation of the vulnerable population to protect the assets of the evacuees and to make sure that nobody ventures outside during the cyclone.
- Tourists from popular tourist and religious destinations were asked to seek shelter in secure areas and wait for the cyclone to pass.
- Large number of animals were shifted to safer places from the vulnerable villages. Out of 4,19,282 animals, 52,981 were shifted from 199 villages. Details of the same are given in Table 3.2.

**Table 3.3: District-wise number of workers evacuated from the salt pans (Data Source: Commissioner of Relief, Govt. of Gujarat)**

| S. No. | District | No. of Salt Pans | Salt Pan Workers Evacuated |
|---|---|---|---|
| 1 | Kachchh | 799 | 4,509 |
| 2 | Jamnagar | 13 | 355 |
| 3 | Devbhumi Dwarka | 5 | 310 |
| 4 | Morbi | 52 | 1,055 |
| **Total** | | **869** | **6,229** |

### 3.4 Role of Ministry of Home Affairs- Nodal Ministry for Disaster Management

The Ministry of Home Affairs (MHA), Government of India (GoI) is the nodal ministry for disaster management at the national level. As per Disaster Management Act 2005, the Union Home Secretary is the chairman of National Executive Committee (NEC). The National Disaster Management Authority (NDMA), National Disaster Response Force (NDRF) and National Institute of Disaster Management (NIDM) are affiliated with Ministry of Home Affairs. The disaster management division of MHA coordinates with the state governments and union territories for response to disaster situations. The National Emergency Response Centre (NERC) receives situation eports from the disaster affected states/UTs and shares it with concerned stakeholders.

With regard to the impending Cyclone Biparjoy, the MHA coordinated meetings of the relevant central and state level functionaries to review the level of preparedness, protection and pre-positioning measures for achieving the target of zero causality in the event. Some of the key aspects on which MHA has worked during the Cyclone Biparjoy include:

- Monitoring, coordination and review meetings with the concerned stakeholders.
- Assistance to the state in preparedness and efficient response.
- Sharing of requisite information, knowledge, experiences, ideas and innovations for disaster management.
- Facilitation of inter-agency coordination.
- Providing relief assistance from the central level.

The efforts focus on efficient information dissemination, resource allocation, interagency coordination, and supporting affected states, aiming to minimize loss of life and property while promoting effective disaster management at all levels.

#### 3.4.1 National Disaster Management Authority (NDMA)

The "ALERT" window for Cyclone Biparjoy on the NDMA website was timely updated. In addition to a list of Do's and Don'ts, NDMA created SMS material for cyclone warnings. These could be localized and translated into common tongue for wider exposure using CAP "SACHET". The NDMA gave Principal Secretary/Relief Commissioners of all cyclone threatened States/UTs on the West Coast instructions on what to do in the event of an approaching

## Role of MHA

*The Ministry of Home Affairs, Government of India led by Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation took proactive initiative in view of the impending Cyclone Biparjoy. On 13th June 2023, Hon'ble Minister of Home Affairs and Minister of Cooperation conducted a meeting, with Shri Bhupendra Patel; Hon'ble Chief Minister of Gujarat, Dr. Mansukh Mandaviya, Hon'ble Union Minister of Health & Family Welfare; Shri Purushottam Rupala, Hon'ble Minister of Fisheries Animal Husbandry and Dairying, Mrs. Darshana Jardosh; Hon'ble Minister of State, Ministry of Textiles and Railways, Dr. Munjapara Mahendrabhai; Hon'ble Minister of State, Ministry of Women and Child Development and AYUSH , Mr. Devusinh Chauhan; Hon'ble Minister of State, Ministry of Communications, several Ministers of state Government of Gujarat, public representatives; Chief Secretary and District Magistrates virtually participated. The Union Home Secretary as chairman of the Nation Executive Committee had also organized a meeting on 11th June 2023 to review the situation and actions being taken for preparedness and efficient response to the impending disaster situation. These meetings were followed up with persistent communication and coordination with concerned authorities from state and central governments for pursuing the goal of zero casualty.*

*The Disaster Management (DM) Division of MHA formed a WhatsApp group to maintain continued updation of information and actions related to preparedness, protection, pre-positioning, response, restoration and recovery to deal with the disaster situation. The recently launched Common Alerting Protocol (CAP) and the sachet app were also utilized for timely dissemination of early warning to local communities during the cyclone period.*

cyclone on 6th June 2023. The National Disaster Management Authority (NDMA), sent a letter to the Ministry of Petroleum and Natural Gas on 12th June 2023. Cyclone Biparjoy led the NDMA to write to Gujarat State's Relief Commissioner on 12th June 2023 recommending that they take precautions. The NDMA wrote to Gujarat's Chief Secretary on 14th June 2023, describing the preparation and response measures to be taken in the wake of impending Cyclone Biparjoy (Annexure-5). A cyclone analysis along with recommendations was also prepared by the Mitigation

Division of NDMA and shared with Government of Gujarat.

**National Cyclone Risk Mitigation Project (NCRMP)**

The NCRMP provided infrastructure and software tools for cyclone risk mitigation. Special efforts were made to facilitate the operationalization and real time usage of Web DCRA for the evacuation planning.

### 3.4.2 National Disaster Response Force (NDRF)

National Disaster Response Force (NDRF) promptly activated teams during Cyclone Biparjoy. Coordination was established with NDRF HQs, Commandants of 5th/6th/10th Bn NDRF, MHA (DM Division), and State Relief Commissioners/SEOCs for continuous information flow. On 7th June 2023, the cyclone intensified into a Very Severe Cyclone, leading to additional NDRF teams being deployed in various regions. By 15th June 2023, the cyclone made its landfall in Kachchh and Saurashtra regions, necessitating rescue and relief operations by NDRF teams. Subsequently, the cyclone weakened and by 19th June 2023, NDRF teams were demobilized, concluding their response efforts. The details of mobilisation of NDRF teams has been listed in the Annexure-6. A total of 17 teams of NDRF were deployed for the rescue and relief operations in the 8 affected districts of state of Gujarat.

### 3.4.3 National Institute of Disaster Management (NIDM)

The capacity development programmes of the institute for dealing with disaster situations made a significant contributions in effective preparedness of human resources, which also helped them to achieve the goal of zero casualty during Cyclone Biparjoy. The NIDM conducts training to deal with all aspects of disaster management as per its mandate under the DM Act 2005, with active participation from the different stakeholders of the states/ UTs. It equips them with information, knowledge, experiences, innovation and ideas to prepare, respond and recover from disaster situations with involvement of affected communities and other stakeholders.

## 3.5 Role of National Remote Sensing Centre (NRSC)

- The National Remote Sensing Centre (NRSC), Hyderabad prepared and upgraded the flood inundation maps for affected areas .
- NRSC provided facility maps (Figure 3.11) to communicate effectively .
- Based on predictions from IMD, the track line was spatially depicted on National Database for Emergency Management

(NDEM) portal along with the infrastructure facilities required for relief and rehabilitation such as hospitals, relief shelters, etc.

### 3.6 Evacuation

Days before the cyclone's arrival, 1,43,053 people were evacuated to shelter homes, showcasing the state's proactive approach towards disaster management. The state and central ministers were deputed to monitor preparations and ensure the safety of the vulnerable population living within a 10-kilometer radius of the predicted impact zone. The goal was clear to attain '**Zero Casualty'.**

A comprehensive plan was implemented, assessing the population density within the 0-5 km and 5-10 km radius. According to officials, only 122 villages in Kachchh district fell within the 0-10 km range, and 72 villages within the 0-5 km range. Shri Narendra Modi, Hon'ble Prime Minister personally assessed the situation and provided guidance to Shri Bhupendra Patel, Hon'ble Chief Minister of Gujarat for effective disaster management. Ministers were dispatched to each district, with a special focus on the Gir-Somnath, Porbandar, Junagadh, Jamnagar, and Kachchh districts, which were expected to bear the brunt of the cyclone's impact.

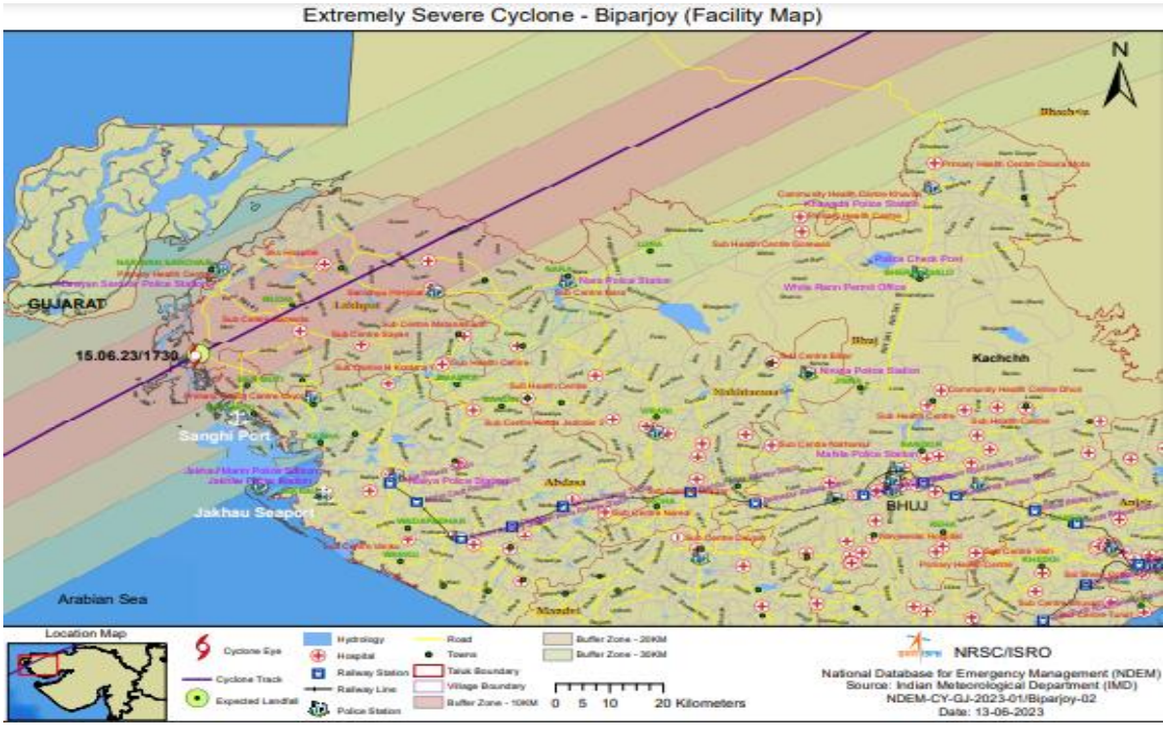



**Figure 3.11: Facility map during Cyclone Biparjoy along the coast at 10 km distance**

Eight coastal districts, including Kandla, Mundra, Mandvi, and the Jakhau Fisheries Port, were affected by the cyclone. Ensuring the safety of workers and the withdrawal of

ships became a priority. Meetings were held with stakeholders to coordinate evacuation efforts, and persuading coastal residents to move to designated shelter homes became a significant challenge. Public representatives, ranging from block panchayat officials to central ministers, visited villages to counsel and educate residents about the severity of the situation. Over three days, from 12th June 2023 to 14th June 2023, 1,43,053 people were safely evacuated, thanks to the collective efforts of all involved parties.

Amidst the evacuation efforts, the administration also worked to protect the region's animals, an integral part of the local economy. Over two lakh of animals were safely moved to higher ground, shielding them from the cyclone's impact. The coordination, preparation, and timely actions of the Gujarat government, aided by the guidance and support of the central government, showcased the state's resilience in the face of Cyclone Biparjoy. Their commitment to safeguarding lives, properties, and animals during the cyclone stands as a testament to their unwavering determination and preparedness.

# Chapter 4
# Response, Relief and Restoration

## 4.1 Deployment of Human Resources

Pre-positioning and deployment of human resources played a significant role for an efficient response, relief and restoration during the cyclone period. Proper coordination, training, and allocation of skilled personnel as well as resources maximized search, rescue and relief efforts, ensuring swift assistance and support to affected communities. Large number of responders were deployed along with necessary search and rescue equipment to save the maximum number of human lives. The four levels of response forces were alerted during the Cyclone Biparjoy. The first layer (Community volunteers/ First Responders/Aapda Mitra), second layer (SDRF, State Police, Fire and Emergency personnel, functionaries of local bodies), third layer (NDRF) were involved in the response whereas the fourth layer (Defence service i.e Army, Navy, Airforce and Indian Coast Guard) was on standby for the effective response. The Department of Health and Family Welfare, Gujarat deputed doctors, paramedics, nurses and other staff including ASHA workers at the PHCs, CHCs, SDH and DH for medical response and support to the affected population. Indian Medical Association also sent doctors to provide healthcare during the period of cyclone. The district administration directed the revenue officials to provide immediate relief assistance to the affected population through direct beneficiary transfer. The municipal corporations and municipalities also extended their resources and deputed their teams to respond to the disaster situation. The organizations related to critical infrastructures like power supply, drinking water supply, transportation and communication, deputed their technical staff and workers for immediate restoration in the wake of the impact of cyclone.

## 4.2 Role of Response and Relief Agencies

The first response to the cyclone came from the affected communities, social volunteers, non-governmental organisations at grass roots level and the Aapda Mitra volunteers. A well coordinated collective effort was made to search for the trapped victims, rescue them and provide adequate relief to them in the temporary shelters. 383 Aapda Mitra volunteers were involved as first responders. NGOs like

Swami Narayan Trust, Akshaya Patra Foundation and others, also complemented and supported the efforts and enabled the communities to face the challenges of cyclone with resilience. They

total of 10 SDRF teams and 8,367 personnel of state police were deployed during the Cyclone Biparjoy. The strategic placement of response teams in the districts are detailed out in Annexure-7.

**Figure 4.1: Distribution of Food packets to the affected population**

also supported the community kitchens in the shelters and took care of the children, lactating mothers and pregnant ladies **(Figure 4.1).**

The team of first responders was supported by the second layer of response agencies that included SDRF, State Police, Fire and Emergency personnel. This layer played a vital role in cyclone response by providing specialized search and rescue, medical assistance and logistical support, ensuring efficient disaster management and acted as a bridge between communities and authorities **(Figure 4.2).** A

The SDRF teams carried out search and rescue operations in the affected areas during cyclone and assisted the victims in evacuating those areas while the state police forces and ancillary wings made sure to maintain law and order, provided security to affected areas and ensured the safety of individuals as well as properties during the cyclone.

Comprehensive fire preparedness measures were implemented during the Cyclone Biparjoy. Multiple teams comprising 33 officers and 241 employees were deployed by Municipal


**Figure 4.2: NDRF, SDRF, Police and Aapda Mitra teams worked together in the field.**

Corporations, Municipalities, and Fire and Emergency Services to ensure efficient response and assistance. Furthermore, a total of 89 vehicles, including emergency rescue vehicles, boats, and other specialized equipment, were made available to enhance emergency response capabilities. These measures were put in place to effectively handle fire-related incidents and provide prompt assistance during the cyclone.

The activities of the District Emergency Operation Centre (DEOC) and the State Emergency Operation Centre (SEOC) as well as the activation of Incident Response System (IRS) helped in coordinated and efficient response by different agencies.

Further, the Department of Health and Family Welfare as well as Indian Medical Association came forward to meet the needs of healthcare and medical relief in response to the cyclone situation. The PHCs, CHCs, SDHs and DHs extended free services with support from medical professionals, paramedics, nurses and other staff. The response teams worked tirelessly to address the medical needs of the affected population. From 11th June 2023 to 20th June 2023, pregnant women were evacuated using emergency ambulances and provided with safe places to ensure the safety of newborns. Health facilities were provided with sufficient cotton, bandages, sutures, and dressing materials for treatment of affected population. Fully operational diesel ambulances (52 in number), one ambulance per PHC (totaling 69), 34 Rashtriya Bal Swasthya

Karyakram (RBSK) vehicles, 48 emergency 108 ambulances, and 23 additional vehicles were deployed. For the healthcare, Pradhan Mantri JanArogya Yojana (PMJAY) was also quite helpful. The combined efforts of government officials, hospitals, medical professionals, and support staff led to quality healthcare, even in the face of adversity. It emphasized the resilience and dedication of healthcare professionals who braved challenging conditions to provide essential medical care.

Hospitals and medical professionals offered free services, extending a helping hand to the affected population. The joint efforts of 69 Primary Health Centers (PHCs), 16 Community Health Centers (CHCs), Sub-District Hospitals (SDHs), District Hospitals, Medical Colleges, and 14 Urban Primary Health Centers (UPHCs) formed a comprehensive network of care. A total of 53 doctors joined the efforts, providing free medical care and expertise during the trying times.

The medical staff comprised medical officers of 69 PHCs, including both Ayush PHCs and allopathic PHCs. In addition, there were 7 dental surgeons and 35 medical officers of CHCs. To ensure specialized care, services of 14 specialists, including physicians, general surgeons, orthopedic surgeons, anesthetists, and pediatricians, were made available in three SDHs and one CHC.

The National Disaster Response Force deputed 17 teams along with requisite resources and equipment to respond to the situation and carry out rescue and relief operations. Amidst the chaos and devastation of the cyclone, the NDRF carried out rescue operations with dedication and compassion to remove hazards that threaten the people, properties or environment. They quickly removed the fallen trees & electrical wires/poles and cleared the way for access to safer locations for the affected population. A significant rescue operation was done by NDRF at Bagicha Bagh, Mandvi, Kachchh, and another one in the low lying areas of Rupen Bandar, in Dwarka district where they rescued 2 stranded individuals during the landfall of cyclone.

The fourth layer of response included Army, Navy, Airforce, Indian Coast Guard and Mercantile Marine Department (MMD). Corresponding to the cyclonic situation, MMD directed the ships coming to the coast to keep away and go deep into the sea. The Indian Coast Guard- a maritime law enforcement as well as search and rescue agency in coastal areas also played a vital role in evacuation operations during the cyclone. The Directorate General of Hydrocarbons

(DGH) requested Indian Coast Guard (ICG) for evacuation of 50 crew from jack up rig 'KEY SINGAPORE/01' located 46 km west of Okha, Gujarat on 12th June 2023. On receipt of the request, ICG initiated the operation for the safe evacuation of all 50 crews onboard the rig in rough weathers and high seas. ICG Ship 'Shoor' was diverted immediately for rescue operations. Meanwhile, ICG Helicopter (CG 858) was also positioned from Rajkot to Okha for evacuation.

In a nerve-wracking operation, ICG evacuated 26 crew by the evening of 12th June 2023. Consequently, the operation resumed with first light on 13th June 2023 which resulted in safe evacuation of the remaining 24 crew-members, bringing all 50 crew to safety ashore. In a swift and well-coordinated move, Indian Coast Guard (ICG) evacuated 50 persons on 13th June 2023 at Okha, Gujarat as a preventive measure[7] (Figure 4.3). The operation was completed successfully.

The Indian army also deployed the columns for the response during cyclone. Four integrated columns and four ETF (Emergency Task Force) teams, along with eight medical teams, were dispatched to Bhuj. Relief columns with resources like 01-02-55, ETF-01-00-10, and medical team-01-00-03 were also deployed. A 24x7 Disaster Relief Coordination Centre was established at HQ/11 Infantry Division. In Jamnagar, five relief columns, three ETF teams, and eight medical teams were deployed. Gandhinagar and Dharangdhra received six relief columns and three ETF teams each. Three relief columns and two ETF teams were dispatched for Vadodara. Gandhidham, Naliya, Mandvi, and Dwarka received one relief column each,

**Figure 4.3: Indian Coast Guard during evacuation operations of crew members from Oil Rig KEY SINGAPORE/01**

[7] *https://pib.gov.in/PressReleseDetail.aspx?PRID=1931690*

and Gandhidham additionally got two medical teams. Ahmedabad was supported by five medical teams and four ETF teams. In total, 30 relief columns, 15 ETF teams, and 45 medical teams were deployed to various locations in response to the disaster situation in Gujarat. The details of army rescue teams deployed in response to cyclone are given in the Annexure-7 (b).

The Western Naval Command (WNC) in Mumbai also took significant relief measures in response to the disaster situation in Gujarat. One ship with Helo embarked and three other ships with HADR (Humanitarian Assistance and Disaster Relief) were deployed towards Gujarat. Additionally, WNC Mumbai dispatched five relief teams each to Porbandar and Okha, and 15 relief teams to Valsura. Sea King Helicopters and Advanced Light Helicopter (ALH) from Hansa and Shikra were prepared to move to Gujarat, along with P-8i and Dornier aircraft from Hansa and Goa for aerial reconnaissance and transportation of relief materials. Furthermore, additional HADR stores and materials were kept on standby in Mumbai. In total, 25 relief teams, four ships, one Sea King & ALH helicopter, and one P-8i & Dornier aircraft were mobilized to support relief efforts in Gujarat.

Indian Air Force's assets include three aircrafts- one C-17 and one C-130 from Hindon, and one IL-76 from Chandigarh. Additionally, five helicopter assets: two MI-17s from Yelahanka (Bengaluru), two Chetaks from Hakimpet (Hyderabad), and one MI-17 from Mumbai were kept ready for deployment in transportation and relief operations.

### 4.3 Relief Assistance

Relief assistance encompasses a range of coordinated actions and interventions aimed at providing immediate support and essential services to affected population. It involves various stakeholders, including government agencies, non-governmental organizations (NGOs), and local volunteers working together to address the immediate needs of affected communities. By providing immediate assistance and supporting recovery, relief efforts contribute to building more resilient communities during disasters.

Relief assistance is normally provided from the State Disaster Relief Fund (SDRF) as per

norms of the relief issued by the Ministry of Home Affairs, Government of India. However, in the present case, Government of Gujarat made an additional component of relief from its side over and above this assistance to the affected population.

The Cyclone Biparjoy had a devastating impact in Gujarat leading to infrastructure and economic losses. Government of Gujarat disbursed an amount of Rs. 349.03/- lakh in form of cash doles (Rs. 100/- per day to adults and Rs. 60/- per day to children) to 1,13,952 affected people. An amount of Rs. 0.04 lakh was spent in treatment of the 55 injured people. Further, around 2,89,000 kgs of grass, amounting to Rs. 26 lakh was distributed. The information related to relief assistance provided by the state administration as per GR.No. CLA/102012/253 dt. 27.04.2015 are listed in Annexure-8.

The food and civil supplies department also responded to the situation by adequately supplying the ration stock during the cyclone situation. Apart from above, the local industries, corporates and civil society organisations, also supported the relief activities by providing food, ration and other essential items to the evacuated population. They also supplied ration kits for the shifted people after the cyclone to support their families for food and related stuffs for about 3 to 5 days when the affected population returned to their respective homes.

### 4.4 Survey and Visit by Union Minister of Home Affairs and Minister of Cooperation

On 17th June 2023, Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation, conducted an aerial survey of cyclone affected areas from Bhuj to Mandvi and Jakhau in Gujarat. He visited the villages and met farmers along with their families. He also met the NDRF Jawans (Figure 4.4 (b)) and praised them for their commendable response as well as relief works during the cyclone. In Jakhau, he visited a Primary Health Centre where around 200 villagers were sheltered. Shri Shah also took stock of the facilities being provided to the villagers. The villagers thanked him and the local administration for the good arrangements made for them before and during the cyclone.


**Figure 4.4: Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation, visited cyclone affected areas (a) Civil Hospital, providing reassurance and support to pregnant women (b) Praise NDRF Jawans for their commendable work during the cyclone**

In Mandvi, the Hon'ble Union Minister of Home Affairs and Minister of Cooperation, (Figure 4.4 (a)) visited the civil hospital where pregnant women were brought before the onset of cyclone. He visited the wards of the hospital and spoke with pregnant women and women who have delivered babies during cyclone period. He found the people in a pleasant mood for having been blessed with new born babies. One of the families, who had a newly born girl child during this time, named her as Khushi to express their happiness.

### 4.5 Immediate Restoration Activities after Passing of the Cyclone

As soon as the cyclone passed away from the affected areas, the restoration activities for critical infrastructure and facilities were initiated by respective organisations as briefly described below:

**Power**

The electric supply was cut-off for few hours during the landfall and passing of the cyclone over the affected areas to avoid any kind of mishaps due to electric line failures, electric shocks or electrocution. As continuous power supply is a pre-requisite for effective search, rescue and relief operations and therefore, restoration operations were undertaken.

However, Cyclone Biparjoy proved to be a formidable adversary, unleashing severe winds and relentless rainfall that wreaked havoc on the power infrastructure. As the cyclone swept across the affected districts, certain villages found themselves plunged into darkness, as power supply was discontinued as a precautionary measure.

When the ferocity of the cyclone subsided, the skilled workforce of the power companies sprang into action. With determination and expertise, they worked tirelessly to restore the power lines that had succumbed to the cyclone's wrath. The linemen and technicians, undeterred by the formidable task at hand, braved the aftermath of the cyclone. Working diligently, they repaired and re-established the fallen power lines, allowing restoration of electric supply. Their unwavering dedication ensured that power was restored to the villages that had been plunged into darkness during the cyclone. Gradually, as power lines were repaired and electricity was restored, a glimmer of normalcy returned to the affected districts. The lights flickered back to life, bringing renewed hope and a sense of relief to the communities that had endured the hardships brought upon by the cyclone.

The power sector demonstrated its resilience in the face of adversity by providing uninterrupted power supply to the affected population, even in the most challenging of circumstances. The use of latest technologies such as Geo-Urja based maps, drones, pole erection

devices and automatic meter reading etc., were used during the restoration work. Necessary power restoration plans were implemented for restoring power supply to hospitals, important government offices, shelters, control rooms on priority basis. About 1,089 teams were deployed for restoration work including human resources from the departments and the contractors (601 teams of home circle, 279 teams of other PGVCL circles, 181 teams of other DISCOMs and 28 teams from Torrent Power). The prepositioned material resources were utilized for immediate restoration works.

The power sector's ability to rise from the wreckage, re-establishing the lifeline of electricity, stood as a testament to the resilience and staunch spirit of Gujarat and its people.

**Communications Infrastructure Redundancy**

Communication plays a vital role in connecting people during disaster situations and helps in reducing chaos and panic among the affected population. Various means of communication systems were used for uninterrupted connectivity through landlines, hotlines, mobile phones, satellite phones, VSAT, wireless sets, Quickly Deployable Antenna and Ham radios. The communications infrastructure was supported by adequate supply of diesel, machinery and human resources. The government facilitated mobile service portability, allowing users to manually switch to another telecom operator in case of no service or temporary interruption in their subscribed network. All telecom service providers deputed their teams along with materials for quick restoration of communications infrastructure wherever disruption occurred due to cyclone. Priority call services were also activated to facilitate emergency communications, particularly for the functionaries who were involved with response, relief and restoration operations.

**Transportation and Road Infrastructure**

A high priority was accorded to the mobility of responders and affected population immediately during and after the cyclone for the safety of the people. Roads and Building Department deployed 132 technical teams in the 8 affected districts to work for restoration in cases of disruption of road networks. The restoration work was undertaken jointly in coordination with the forest department as many of the roads were blocked or damaged due to fallen trees. About 1,784 trees were removed from roadside by the forest department. The prepositioned resources such as dumpers, backhoe loaders (JCB machines), tractors and loaders were helpful in immediate restoration of the road networks.

## Health Infrastructure

All PHCs, CHCs, SDHs and DHs functioned round the clock to handle medical emergencies during and after the cyclone. Round the clock control rooms were made operational at state, district and taluka levels for the health sector. The leaves of the medical officers and support staff were cancelled and they were directed to stay at their respective headquarters. Health infrastructure was prioritized to ensure uninterrupted power supply and availability of water at these premises.

*Amidst the chaos, the local administration in collaboration with various government agencies, worked tirelessly to quickly assess the damage caused by the cyclone. Recognizing the need to help the affected residents rebuild their lives, a compensation program was initiated to provide financial aid and support. The goal was to provide a fair and comprehensive compensation package that would help the affected people recover from the devastation. After monitoring, it was decided that a total of Rs. 349.03/- lakh cash doles were to be distributed to a total of 1,13,952 affected persons.*

*Compensation serves as a helping hand, offering hope and support for livelihood continuity in the future. The Jan Dhan Yojana scheme encouraged a significant portion of the population to open bank accounts, facilitating direct benefit transfers for quick relief after Cyclone Biparjoy. This demonstrated the government's commitment to standing by its citizens during crises and providing essential support to overcome challenges. The Unified Payments Interface (UPI) utilized for payments ensured seamless transactions, addressing issues related to inaccessibility of traditional banking services during the disasters. With the financial burden lifted, the affected population rolled up their sleeves and began rebuilding their lives. They worked together, helping one another reconstruct homes, clear debris, and started to build back better as they did after the Kachchh earthquake of 26th Jan 2001.*

*The quick relief provided by the administration after Cyclone Biparjoy in direct benefit transfer mode became a testament to the power of compassion, empathy, unity, and collective support. It showcased the resilience of the human spirit and the determination of a community to rise above the challenges brought by a natural disaster. Together, they rebuilt their lives, knowing that their community, would emerge stronger and more resilient than ever before.*

# Chapter 5
# Loss and Damage Assessment

All efforts were made through preparedness and preventive measures (elaborated in chapter-3), to reduce the losses and damages due to cyclone Biparjoy. Although these endeavors yielded results in terms of zero casualty, yet the cyclone did cause devastations in terms of impacts on different physical assets, infrastructure, services, utilities and resources exposed to it. The impacts on population, housing, health, food and civil supplies, power, animal husbandry, agriculture, horticulture, roads, bridges and buildings, forest and environment, ports and transport, women and children, water resources, urban development, airstrips, industries and mines, and tourism are briefly discussed below.

## 5.1 Population

The Cyclone Biparjoy impacted the population of 8 affected districts namely Kachchh, Gir-Somnath, Devbhumi-Dwarka, Junagadh, Jamnagar, Rajkot, Porbandar and Morbi. The aftermath of the cyclone brought about immense challenges and hardships for the affected communities (Figure 5.1). However, the Government of Gujarat took pre-emptive actions to prevent any loss of life and swiftly sprang into action to alleviate the sufferings of the affected communities. Recognizing the urgent need for immediate assistance, the government mobilized all available resources and agencies to provide safe shelters and relief to the affected population. Through remarkable efforts and effective collaboration between different departments, the government achieved the goal of Zero Casualty.

Understanding the importance of providing relief to the affected individuals/families for their losses and damages, the government promptly provided relief assistance in the form of Direct Benefit Transfers (DBT). This mode of payment ensured that the funds reached the rightful recipients without any delay.

The government aimed to provide eligible assistance to help the affected community, to rebuild their lives and restore their livelihoods. The injured persons were also provided with necessary medical support to recover from their injuries.

Furthermore, recognizing the impact of the cyclone on agriculture, horticulture and animal husbandry particularly in rural areas, the government arranged for supply of essential resources. The essential resources included availability of fodder for sustaining the livestock and

**Figure 5.1: Affected community in the aftermath of Cyclone Biparjoy**

animals, which play a vital role in the rural economy of the region. Through the combined efforts of the government, corporates, civil society and NGOs, the state of Gujarat managed to achieve the incredible feat of Zero Casualty in terms of loss of human lives.

As time passed, the state of Gujarat gradually recovered from the aftermath of Cyclone Biparjoy. With the collective efforts of the government and communities, normalcy was restored in the affected districts. The tale of resilience in the face of adversity served as an inspiration, reminding everyone of the strength of unity and collaboration in overcoming even the most devastating of challenges.

## 5.2 Housing

The menacing cyclone unleashed its fury, bringing severe winds and relentless rainfall. As the cyclone raged on, a large number of homes across various parts of the state were damaged by its destructive force. It was a devastating sight to behold, as homes stood in various states of ruin—some completely and others partly damaged.

**Figure 5.2: Damage to the houses in Mandvi Taluka (Photo Credits: GMRD, NIDM)**

The impact of Cyclone Biparjoy on the housing sector was staggering. Many families found themselves without a place to call home, their lives up-ended by the destructive forces of nature (Figure 5.2). The monetary loss incurred by the housing sector and the grim statistics provided a somber reflection of the challenges that lay ahead for the affected communities.

A total of 951 huts and 7219 dwellings were affected by the cyclone, leaving families displaced and their homes in shambles. The loss incurred by the damaged houses alone amounted to a staggering Rs. 1386.65/- lakh. The extent of the damages and the monetary losses in the housing sector are meticulously documented and summarized in **Figure 5.3,** serving as a stark reminder of the cyclone's destructive power.

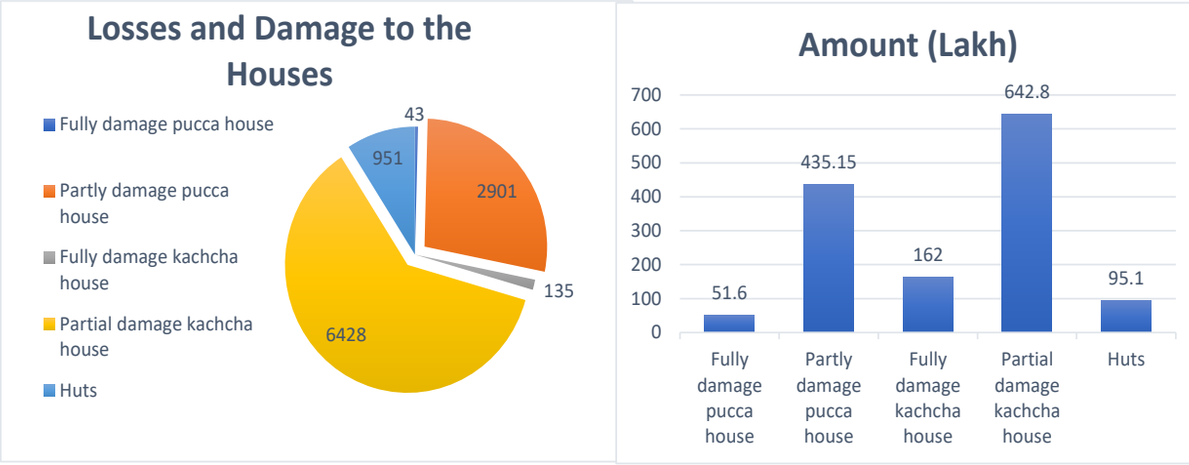



**Figure 5.3: Damages in Housing sector (Data Source: Commissioner of Relief, Govt. of Gujarat)**

It wasn't just individual homes that suffered. The cyclone also wreaked havoc and caused damages to district/taluka/gram panchayat buildings and other assets. These suffered a considerable loss of approximately Rs. 65.74/- lakh, as indicated **in Figure 5.4.**

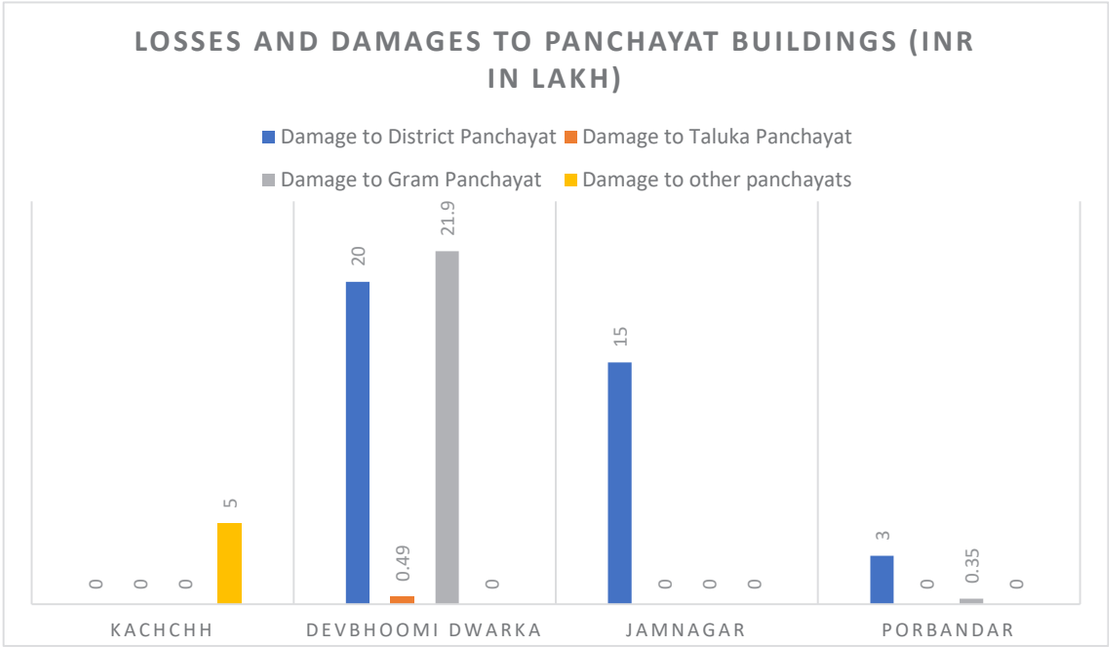



**Figure 5.4: Damage to panchayat buildings at district, taluka and gram level (Data Source: Commissioner of Relief, Govt. of Gujarat)**

However, in the face of adversity, the people of Gujarat stood resilient. The government, alongside various agencies and organizations, mobilized swiftly to provide aid and support to those affected by the cyclone. Their collective efforts aimed to alleviate the sufferings of the displaced families and to facilitate the process of rebuilding.

Cyclone Biparjoy left an indelible mark on the state of Gujarat, forever etching the memory of its devastating power. Yet, it also served as a testament to the strength of the human spirit and the power of collective action. In the years to come, the rebuilt homes and revitalized communities would stand as a testimony to the resilience, a beacon of hope rising from the ashes of destruction.

The road to recovery would be a long one, but with each passing day, progress is being made. Step by step, houses are being reconstructed and communities revitalized. The spirit of unity and resilience prevailed as the people persevered through the arduous task of rebuilding their lives and the structures that once sheltered them.

## 5.3 Health

The Department of Health and Family Welfare faced significant challenges as the healthcare infrastructure in the affected areas suffered some damages. The District Hospital, Sub-District Hospital, Community Health Centres (CHCs), Primary Health Centres (PHCs), and Sub-Centers, all crucial pillars of the healthcare systems, got impacted. The losses incurred by the department amounted to approximately Rs.66/- lakh, underscoring the extensive impact on the health industry. The loss and damage details are given in the **Table 5.1.**

**Table 5.1: Losses and Damages in Health Sector (Source: Commissioner of Relief, Govt. of Gujarat)**

| S. No. | Items | Damages in terms of Quantity | Amount (Lakhs) |
|---|---|---|---|
| 1 | PHCs/CHCs | 8 | 16 |
| 2 | GMERS (Gujarat Medical Education and Research Society) | 1 | 50 |
| **Total** | | | **66** |

Recognizing the gravity of the situation, the government quickly deployed officials to affected areas to supervise and monitor the emergency response. Joint Directors (CH), Joint Directors (NVBDCP), Epidemic MO district-Gandhinagar, and RDD, Rajkot were among the dedicated officials appointed for this purpose. Additionally, six liaison officials were designated to oversee the impacted seven talukas, coordinating efforts and ensuring effective management of resources.

## 5.4 Food and Civil Supplies

In the bustling corridors of the Gujarat State Civil Supply Corporation Ltd., a sense of dismay hung heavy in the air. Cyclone Biparjoy had given a severe blow to the department, leaving a trail of destruction in its wake. Storage facilities, once filled with grains, pulses, and other essential goods, now lay in ruins. The department had incurred a loss, amounting to Rs. 80.7/- lakh, as food supplies were destroyed.

The initial estimates provided by the Gujarat State Civil Supply Corporation Ltd. laid bare the extent of the damage. The loss was not merely financial but also had profound implications for the welfare of the people who relied on the department for their basic sustenance. The loss and damage to food & civil supplies have been represented in Figure 5.5.

Amidst the devastation, the Gujarat State Civil Supply Corporation Ltd. rallied together, determined to address the crisis head-on. Efforts were made to assess the damage, secure alternative storage facilities, and initiate procurement processes to restock the shelves. Collaboration and support were crucial during these trying times. The government, along with various stakeholders, worked hand in hand to provide assistance and resources to the department. Local

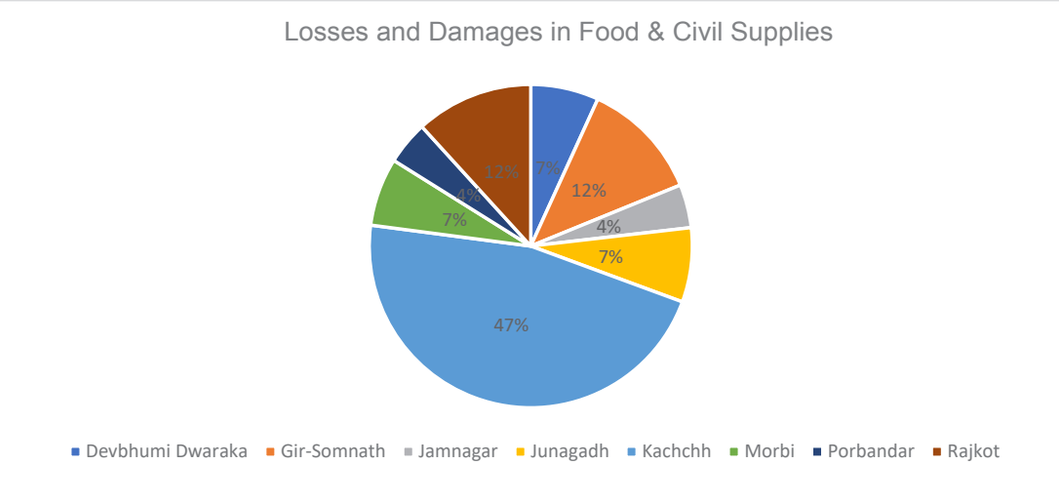



**Figure 5.5: Losses and Damages in Food & Civil Supplies (Data Source: Commissioner of Relief, Govt. of Gujarat)**

communities, organizations, and individuals extended a helping hand, recognizing the urgency and importance of ensuring food security in the aftermath of the cyclone. In the end, the tale of resilience and determination prevailed, as the Gujarat State Civil Supply Corporation Ltd. vowed to learn from the past, adapt to future challenges, and uphold its vital role in nourishing the people and preserving their well-being.

## 5.5 Power

The Gujarat Urja Vikas Nigam Limited (GUVNL) stood as a pivotal entity, overseeing the operations of six subsidiary companies engaged in power generation, transmission, distribution and played a significant role in ensuring a steady supply of electricity to the state.

However, Cyclone Biparjoy caused losses and damages on the power infrastructure. As it swept across the affected districts, certain villages found themselves plunged into darkness, since the power supply was discontinued as a precautionary measure.

The power sector suffered a substantial loss of approximately Rs.90,947.60/- lakh (PGVCL & UGVCL- Rs.80,547.60/- lakh and GETCO-10,400/- lakh). During cyclone, one of the towers at location 248 in 400kV D/C Mundra-Bhachau line got damaged. POWERGRID restored this line on 27th June 2023 after erecting a permanent tower despite challenges like water logging, Right of Way (ROW) and damaged approach roads. Assessment of the damage to transmission are shown in **Table 5.2.**

POWERGRID also helped GETCO in restoring its 3 nos. of 220kV D/C lines (220kV D/C Nakhtrana-Nanikhakar, 220kV D/C Varsana-Nakhatrana, 220kV D/C Varsana-Bhachunda line) after erecting 8 permanent towers. All these lines were restored progressively by 7th July 2023 (220 kV D/C Nakhtrana-Nanikhara & 220 kV D/C Varsana-Nakhatrana on 28th June 2023 and 220kV D/C Varsana-Bhachunda line on 7th July 2023).

In the midst of the chaos, transient faults caused power lines to trip, adding to the challenges faced

**Table 5.2: Losses and Damages to the Transmission Lines**

| Substation | Transmission Lines | Remark |
|---|---|---|
| 400kV Bhachau s/s | 400kV Mundra - Bhachau - 1 & 2 | One tower collapsed at Loc. No. 248(DD+23.5) |

by the power sector. PGVCL and UGVCL reported 117,957 damaged poles, 41,311.85 ckm of HT lines, 17,757.47 ckm of LT lines, and 16,446 impacted distribution transformers, resulting in a combined loss of Rs.80,547.60 lakh. GETCO experienced losses due to 50 affected substations, 170 damaged transmission towers, 300 kms of conductor material, hardware & accessories, 60 kms of E/W & OPGW lines, and civil works, amounting to Rs.10,400 lakh. The impact was profound, and the staggering figures are meticulously recorded and outlined in Annexure-9.

Urgent attention and resources were essential for restoration and recovery of the affected infrastructure and services. As the ferocity of the cyclone subsided, the skilled workforce of the subsidiary companies under GUVNL sprang into action for restoration of power supply.

The power sector, despite the significant losses and damages incurred, demonstrated its resilience. The subsidiary companies—GSECL, GETCO, DGVCL, MGVCL, and UGVCL—under GUVNL stood firm in the face of adversity. They exemplified the unwavering commitment to provide uninterrupted power supply to the people of Gujarat, even in the most challenging circumstances.

**Figure 5.6: Damage to the electric poles in Morbi District (Photo Credits: GMRD, NIDM)**

## 5.6 Animal Husbandry

Not only humans but also animals got impacted staggeringly by the destructive forces of nature and several animal deaths were reported across various districts of Gujarat **(Figure 5.7).**

The total reported animal deaths, amounted to 2,095. The Kachchh district, hit hard by the cyclone, witnessed a significant loss of 1,986 animal life, Devbhumi-Dwarka reported 31 deaths, Jamnagar reported 12 deaths, and Morbi reported only one death. The remaining 65 deaths were distributed across other districts in the state.

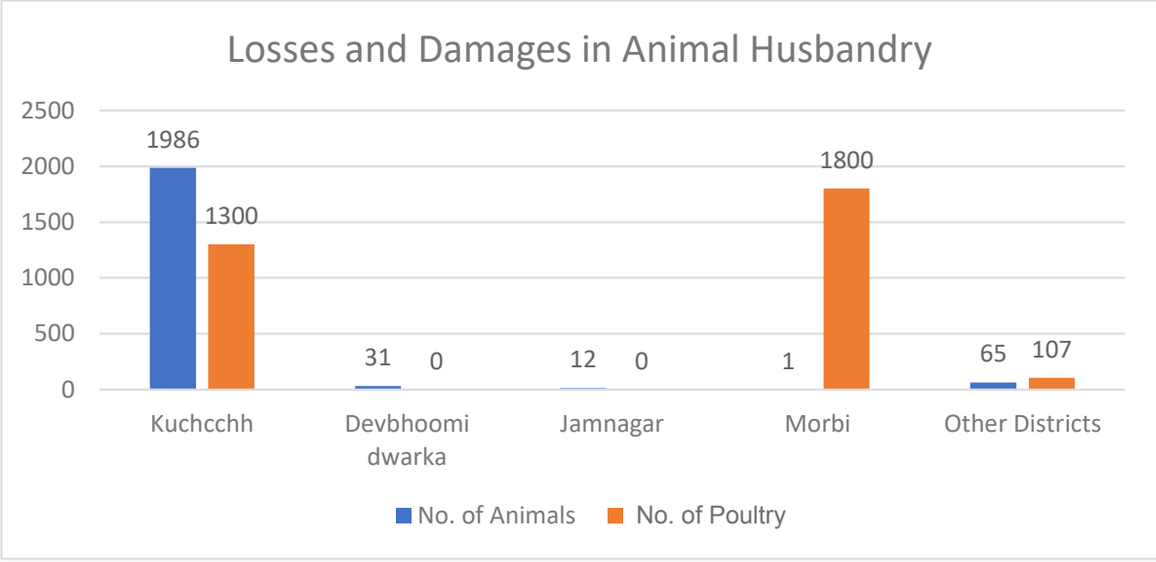



**Figure 5.7: Losses and Damages in Animal Husbandry (Data Source: Commissioner of Relief, Govt. of Gujarat)**

While examining the overall animal fatalities, it was observed that small animals (calf and donkey), large milch animals (cow, buffalo, camel), small milch animals (sheep and goat) and large non-milk animals (horse, camel, bull) suffered heavily. These animals play a vital role in the agricultural economy of the state.

In addition to the loss of land animals, poultry also faced significant fatalities. Out of the reported 3,207 poultry deaths, the highest number, totaling 1,800, was reported from the Morbi district, thereby substantially impacting the poultry farming industry. Kachchh followed closely behind, reporting 1,300 deaths and 107 deaths in other districts, underscoring the significant toll taken on poultry in that region.

Amidst the devastation, there was a small silver lining for the Animal Husbandry Department. Despite the widespread destruction, the 59

public buildings belonging to the department remained unscathed. These buildings, crucial for the welfare and care of animals, managed to withstand the wrath of the cyclone.

The losses suffered by the animals due to the cyclone were immense and heart-wrenching. However, the government and animal welfare organizations vowed to support the affected farmers and animal owners. Steps were taken to provide assistance, healthcare, and rehabilitation for the surviving animals. Efforts were made to restore the well-being of the animal population, recognizing their significance in the lives and livelihoods of the people of Gujarat.

## 5.7 Agriculture & Horticulture

In the vast expanse of Gujarat, where agriculture thrived as a lifeline for the communities, Cyclone Biparjoy unleashed its fury, causing extensive damage to crops, soil, and the livelihoods of farmers. It took a toll on the farming community, leaving behind a trail of destruction and losses that would be felt for years to come.

The loss incurred by the agriculture sector was immense: 1,33,129 ha


**Figure 5.8: Measures taken to safeguard the cattle**

The tale of Cyclone Biparjoy served as a reminder of the vulnerability of both human and animal life in the face of nature's wrath. It highlighted the need for preparedness, resilience, and compassion to protect and care for all living beings during times of adversity. The collective efforts to rebuild and rehabilitate the animal population demonstrated the unwavering commitment to restoring balance and preserving the well-being of all creatures, big and small.

out of 3,53,688 ha agriculture and horticulture area (Figure 5.9) got affected, resulting in production loss of Rs. 96,437/- lakh and asset loss of Rs. 24,813/- lakh. This loss encompassed a wide range of damages, including the loss of horticulture (Banana, Papaya, Mango, Coconut, Lemon, Guava, Sapota, Pomegranate, Date palm, Vegetables etc.) and agricultural crops (Bajra, Sesame, Groundnut, Moong, Cotton etc.), soil erosion, siltation, and flooding. The farming community, whose lives were intricately woven with the land, faced an uncertain future as their livelihoods were shattered by the forces of nature. The specific details of the harm caused to the agricultural sector and horticulture are given in Annexure-10, providing an overview of the losses and damages incurred. It served as a grim reminder of the extent of the devastation faced by the farmers and the challenges they had to overcome.

The implications of these losses and damages extended far beyond the financial burden. The agricultural sector is the backbone of economy of the affected areas, providing sustenance and employment opportunities to countless families. With destruction of crops and disruption of agricultural ecosystem, repercussions would be felt not only by the farmers but also by the entire community.

**Figure 5.9: Damage to the Dates trees in Mundra Taluka (Photo Credits: GMRD, NIDM)**

In the wake of the devastation, the government and various other organizations rallied to provide support and assistance to the affected farmers. Efforts were made to assess the damage, provide financial aid, and initiate rehabilitation programs. Steps have been taken to restore the fertility of the soil, promote sustainable agricultural practices, and mitigate the impact of future disasters.

## 5.8 Roads & Buildings

In the vast state of Gujarat, the Roads & Building Department holds the immense responsibility of overseeing and maintaining a sprawling road network that stretches over 1,12,205 kilometer. This extensive network consists of state and national highways, major district roads, village roads, and unplanned roads, connecting communities across all 33 districts of the state. The Roads & Building Department took great pride in ensuring that the majority of settlements in Gujarat had access to all-weather roads with a bituminous surface. Of the 18,028 settlements in the state, a staggering 17,862 are connected by these well-constructed roads, covering an impressive 99.81% of their total length.

The affected regions, already grappling with limited resources for road construction, witnessed the devastating impact of the cyclone on the road networks. The roads that were built with earthwork, a layer of metal, consolidation and drainage work, another layer of metal, and a thin asphalt surface, struggled to withstand the relentless onslaught of rainfall during the cyclone.

**Figure 5.10: Clearing the blocked road by the Indian Army**

The damage inflicted on the State Highways, Major District Roads (MDRs), Other District Roads (ODRs), and Village Roads (VRs) was exacerbated by the diversion of high traffic onto state routes leading to national highways. The strain on these roads proved overwhelming, as they were not designed to handle such heavy traffic loads. The continuous flow of floodwaters, combined with the increased traffic, led to significant damage and deterioration of the road infrastructure.

The Department of Roads and Buildings faced a daunting task in the aftermath of the cyclone. The loss incurred by the department amounted to approximately Rs.70,242.38/- lakh- a staggering sum that highlighted the scale of the destruction inflicted upon the road network. The detailed information of damage and losses in Roads & Buildings is at Annexure-11. The financial burden further underscored the challenges faced in rebuilding and restoring the road infrastructure to its former state.

Amidst the daunting task of recovery, the Roads & Building Department worked tirelessly to devise strategies for rehabilitation. Efforts were made to repair the damaged roads, reinforce weak sections, and strengthen the overall resilience of the road network. The process of reconstruction would require careful planning, allocation of resources, and coordination among various agencies and stakeholders.

The road to recovery would be long and arduous, but the resilience and determination of the Roads & Building Department and the people of Gujarat were unwavering. They understood the critical role that well-constructed roads played in the socio-economic development of the state. Together, they embarked on the journey of rebuilding, striving to restore the road network and ensure safe and efficient connectivity for all.

**Figure 5.11: Sand on the Dwarka Somnath Highway Cleared by NHAI**

*The tale of Cyclone Biparjoy served as a reminder to the fragility of human infrastructure in the face of nature's fury. It highlighted the need for robust planning, investment, and adaptation to build road networks that could withstand the challenges posed by extreme weather events. Through collective efforts and a steadfast commitment to progress, Gujarat would once again witness the resurgence of its road network, forging pathways that would lead to resilience, connectivity and prosperity.*

## 5.9 Forest & Environment

In the vast and lush forests of Gujarat, the cyclone, left a trail of destruction. The Forest and Environment Department, tasked with safeguarding the natural treasures of the state, suffered significant losses and damages of Rs.2,060.41/- lakh. Majestic trees were uprooted, leaving barren patches where they once stood tall. The dense foliage that once adorned the forest floor was scattered and ravaged, torn apart by the strong winds and relentless rainfall. Moreover, the cyclone wreaked havoc on the forest roads, which were vital for access, patrolling, and fire management. These roads, designed to traverse through the dense vegetation and provide connectivity within the forested areas, faced substantial damage. The detailed information relating to damage and losses to forest and environment is at Annexure-11.

The loss incurred by the Forest and Environment Department was not only financial but also ecological. Forests play a crucial role in maintaining the delicate balance of the ecosystem, providing habitat for wildlife, regulating water cycles, and serving as carbon sinks. The destruction caused by the cyclone threatened these vital functions, leaving an indelible impact on the natural heritage of Gujarat.

The Forest and Environment Department rallied together, determined to restore the splendor of the forests. Assessments were conducted to evaluate the extent of damage, and plans were formulated for rehabilitation and reconstruction. Efforts were made to clear the debris, replant trees, and reinforce the infrastructure to ensure the long-term conservation and sustainability of the forests.

The tale of Cyclone Biparjoy served as a reminder of the vulnerability of even the most seemingly invincible aspects of nature. It underscored the need for vigilance, preparedness and sustainable practices to mitigate the impact of such calamities. Through collective efforts and a shared vision for a greener future, the Forest and Environment Department aimed to restore Gujarat's forests to their former

glory, ensuring their preservation for generations to come.

### 5.10 Ports and Transport

The impact of cyclone extended beyond the shores and into the realm of ports and infrastructure. The powerful winds and torrential rainfall wreaked havoc on the ports, disrupting their operations and causing substantial economic losses. Initially, the forceful winds of cyclone and heavy rain associated with the deep depression battered the coastal areas, and resulted in the losses and damages to the ports.

The interruptions in the operating activities of the ports further exacerbated the economic losses. With operations disrupted, the flow of goods and trade came to a grinding halt, impacting businesses and livelihoods that relied on the smooth functioning of the ports. The Port & Transport Department, responsible for overseeing the ports and related infrastructure, bore the weight of the losses. The department incurred a staggering total loss of Rs. 7,254.39/- lakh (GSRTC-22.54/- lakh, GMD-1,618/- lakh, private assets-4,900/- lakh, fisheries-713.85/- lakh), underscoring the financial burden and challenges faced in the aftermath of the cyclone. The estimated losses and damages to the ports & transportation are represented in the Figure 5.12.

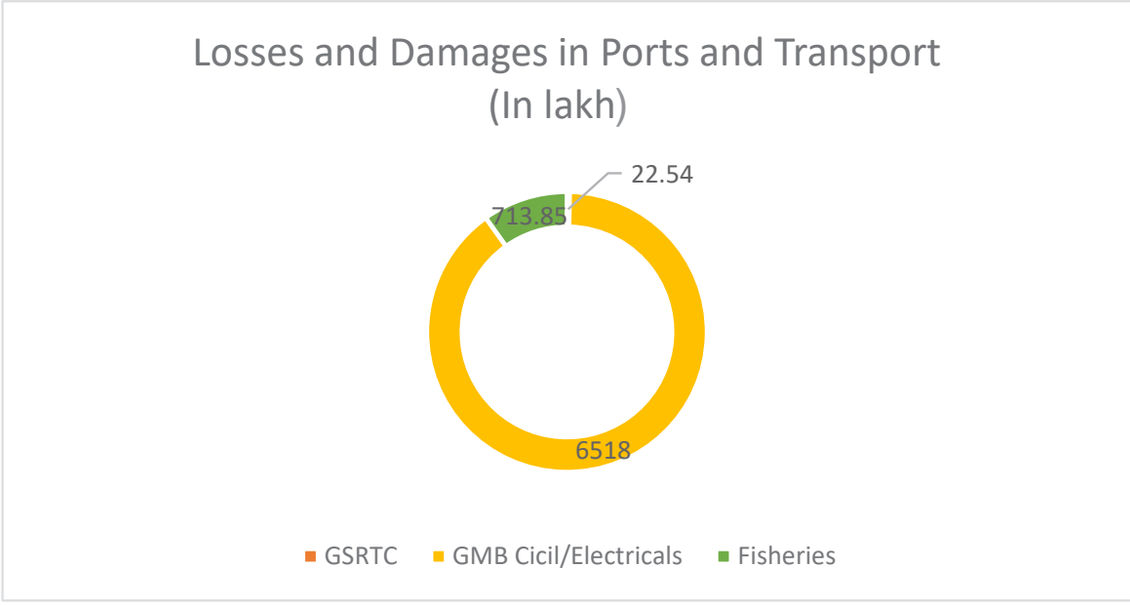



**Figure 5.12: Damage and Losses to the Port & Transport (Data Source: Commissioner of Relief, Govt. of Gujarat)**

The tale of cyclone Biparjoy serves as a reminder of the far-reaching consequences of disasters. The impact on ports and infrastructure highlights the interconnectedness of various sectors and the need for resilience in the face of adversity. The road to recovery for the Port & Transport Department was arduous, requiring strategic planning, resource allocation, and collaborative efforts to restore the operations and economic vitality of the ports.

*The task of reconstruction and rehabilitation was arduous, requiring strategic planning, resource allocation, and collaborative efforts to restore the operations and economic vitality of the ports. Despite significant losses incurred, Gujarat's spirit remained strong. The government, alongside various stakeholders, stood united in their determination to rebuild and restore the ports and infrastructure, ensuring that the state's maritime activities could once again flourish. The tale of resilience and perseverance would continue, as Gujarat rose above the destruction and worked towards a brighter and robust future.*

**Figure 5.13: Jetty at Okha port (Photo Credits: GMRD, NIDM)**

## 5.11 Women & Child Department

The impact extended to the vital Anganwadi centres across Gujarat. These centres, which play a crucial role in providing early childhood education, nutrition, and healthcare services to vulnerable communities, were not spared from the destructive forces of nature. Approximately 865 Anganwadi centers suffered losses and damages of Rs.264.51/-

lakh. The destruction of these centers not only disrupted the essential services but also posed a significant setback in the overall development and well-being of the communities they served. Efforts would be needed to rebuild and restore these centers, ensuring that the vital support they offer to children and families could be reinstated in the affected areas.

## 5.12 Water Resources

Cyclone Biparjoy had a significant impact on several irrigation schemes in Saurashtra, and Kachchh Districts. Porbandar faced erosion of sea walls and damages to the Bardasagar Scheme. In Kachchh, Dedrani and community ponds suffered notable damages. In Rajkot, the communication device in the Bhadar II Scheme was damaged. The main canal structure of the Jhanjeshri Scheme incurred damage. Ambajal Scheme in Junagadh experienced damage to the service road and canal escape gate. Additionally, the Und-I dam in Jamnagar District was affected. The district-wise damage to the irrigation sector is illustrated in the **Figure 5.14.**

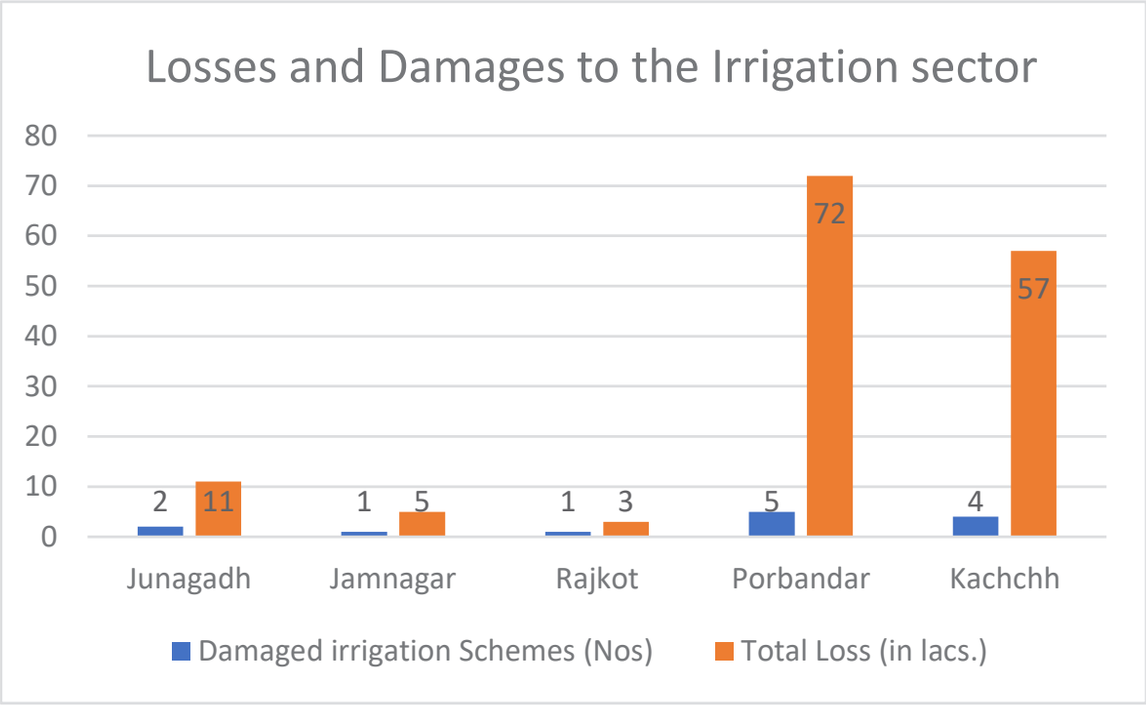



**Figure 5.14: Losses and Damages to the Irrigation sector (Source: Commissioner of Relief, Govt. of Gujarat)**

These areas witnessed various levels of destruction to the irrigation infrastructure, highlighting the substantial impact of Cyclone Biparjoy on the region's water management systems. The Irrigation Department suffered a loss of Rs.208/- lakh.

**Figure 5.15: Chlorination of Drinking Water**

## 5.13 Urban Development Sector

The losses and damages to the urban development sector is Rs.979.53/- lakh.

**Table 5.3: Losses and Damage to Urban Devlopment Sector (Data Source: Commissioner of Relief, Govt. of Gujarat)**

| S.No | Items | Damages in terms of Qty. | Amount (Rupees in Lakh) |
|---|---|---|---|
| 1 | Municipal Corporation | 3 | 7.90 |
| 2 | Nagar Palika | 31 | 971.63 |
| **Total** | | | **979.53** |

**Table 5.4: Losses and Damages in Mining Sector (Data Source: Commissioner of Relief, Govt. of Gujarat)**

| S.No | Name of the lignite mine | OB removal loss in cubic meters approx. | Lignite could be exposed in Mt (approx.) |
|---|---|---|---|
| 1 | *Mata no Madh* | 8,40,000 | 75,000 |
| 2 | *Umarsar* | 2,00,000 | 13,000 |

### 5.14 Air Strip: Reported losses and damages

Mandvi airstrip situated near the coastal area was damaged, resulting in a loss of Rs.208.55/- lakh.

### 5.15 Industries and Mines

The cyclone Biparjoy impacted the lignite mines in the Mata no Madh and Umarsar of Kachchh region. The estimated losses and damages are mentioned in Table 5.4.

Along with the lignite mines, the bauxite mines were also affected resulting in a loss of Rs. 9.5/- lakh.

### 5.16 Tourism

The gusty winds of cyclone Biparjoy created a havoc and caused huge damage to the tourism sector. The estimated losses in the tourism sector is Rs.377.00/- lakh.

### 5.17 Overall Losses and Damages from the Cyclone Biparjoy

Considering the impacts of cyclone Biparjoy on different sectors, facilities, services, infrastructure, resources and environment, the overall losses and damages have been estimated to be **Rs.2,99,372.16/- lakh**. The details of different components of losses and damages to various sectors are given in the **Annexure 12.**

*In the aftermath of Cyclone Biparjoy, a remarkable display of resilience and unity emerged as communities rallied together to recover from the disaster. Thanks to concerted efforts, not a single life was lost, families were reunited, and affected regions received much-needed support. The activation of the Integrated Response System (IRS) highlighted the strength of the human spirit, showcasing that in the face of nature's fury, compassion and courage prevail. The State Emergency Operations Center (SEOC) evolved into a robust support system, bolstering the state's emergency response capabilities. The collaborative preparedness across sectors led to a resilient response system, effectively mitigating the cyclone's impact. Notably, the power sector's proactive measures and rapid response, exemplified by POWERGRID, GETCO, and PGVCL, ensured minimal disruptions and a swift restoration of electricity, symbolizing Gujarat's resilient infrastructure. The health sector's dedication and round-the-clock operations further safeguarded lives and ensured essential healthcare services during this challenging time.*

# Chapter 6
# Community Resilience

The impact of cyclones on communities can be devastating, but the proactive approach of the communities, their preparedness, early warning dissemination, efficient evacuation efforts, and collaborative emergency response were instrumental in mitigating the cyclone's impact and safeguarding lives, properties and environment.

## 6.1 Proactive Approach Adopted from the Past Experiences

Community preparedness is crucial in mitigating the impact of cyclones. A proactive community that invests time and resources in disaster preparedness is more likely to minimize the loss of life and property during a disaster compared to a reactive, unaware, uninformed and unprepared community.

Drawing from past experiences and the lessons learned from previous disasters like Kandla Cyclone (1998), Bhuj Earthquake (2001) and Tauktae Cyclone (2021), the communities of Gujarat adopted a proactive approach in cyclone preparedness. They actively participated in disaster preparedness activities, such as trainings, exercises, mock drills, meetings of local disaster management committees, and ensuring last mile connectivity for early warning systems. This proactive mindset played an important role in promoting the safety and well-being of the community during Cyclone Biparjoy.

***'Despite the slow movement and changes in the path of Cyclone Biparjoy, the proactive approach of the state government helped to identify the vulnerable population and swift evacuation of 1,43,053 people from vulnerable areas without any resistance. The shopkeepers in the coastal districts voluntarily closed their shops on the advice of chamber of commerce before occurrence of the cyclone. Further, the banners and hoardings of their shops were taken off and grounded at safe places as a precautionary measure.'***

***'The communities actively assisted the local administration and response forces in implementing evacuation plans. They identified vulnerable individuals, coordinated transportation arrangements, and provided support throughout the evacuation process. The community members' knowledge of the local geography, resources and infrastructure facilitated smooth evacuations, minimising the risk of casualties and ensuring the relocation of affected individuals to safe shelters.'***

### 6.2 Warning Dissemination and Efficient Evacuation

The local communities in Gujarat played a significant role in disseminating early warnings to vulnerable populations. Utilising various communication channels, including community loudspeakers, local radio stations and cable channels, they ensured that the cyclone-related information reached every resident, especially those with limited access to communications. This timely dissemination of information enabled individuals and empowered the community to take necessary actions to protect themselves and their families.

### 6.3 First Responders in Emergency Situations

During and immediately after Cyclone Biparjoy, the communities acted as the first responders, working alongside government agencies, disaster management organisations and concerned line departments. Trained volunteers known as Aapda Mitra, with their knowledge of the area and its inhabitants, contributed their expertise in search and rescue operations, provided first aid, and assisted in the distribution of emergency supplies. Their active involvement ensured a rapid and coordinated emergency response, saving lives and providing critical support to affected communities.

### 6.4 Shelters and Support

The vulnerable population were shifted to the Multi-Purpose Cyclone Shelters (MPCS), Community buildings and safe school buildings before the landfall of the cyclone. In adverse weather conditions, it is often difficult to provide hygienic and nutritious food to the relocated population. However, during Cyclone Biparjoy, the administration provided hygienic & nutrient-rich fresh meals to the relocated people (Figure 6.1). This kind of provision could not be possible without active support of the community, social volunteers and community based organisations at the grass roots level.


**Figure 6.1: Food distribution at the shelters**

The administration adopted various methods to provide freshly cooked meals in the safe shelters. In some places, the staff of mid-day meal schemes were deployed for community kitchens. In some districts, the community-based organisations like ISKCON and Swami Narayan Trust helped in providing timely fresh cooked hygienic meals. Only in a few places, packed or readymade food was served.

The community buildings were also used as shelters for the deployed response forces. For example, community buildings in Narayan Sarovar were used for accommodation of the NDRF, SDRF and other teams.

## 6.5 Health, Psycho- Social Support and Community Cohesion

Recognizing the importance of health and emotional well-being in disaster situations, due to injuries and mental stress, community took special care of the vulnerable sections of the affected population and provided them with adequate healthcare and emotional support during the cyclone. They offered active listening, empathy, and created safe spaces for individuals to express their fears and concerns. Community-led support groups were established, allowing affected individuals to connect, share experiences, and find strength in the collective support of others facing similar challenges. Additionally, community members organised wellness activities, such as yoga, meditation, and local music sessions, promoting emotional healing and resilience within the community. At the shelter levels,

**Figure 6.2: Community participation in the restoration works**

community leaders and teachers organised engagement activities for the children, women, youth and the senior citizens.

## 6.6 Community Participation in Post-Cyclone Restoration, Recovery and Re-development

The restoration, rehabilitation, recovery and re-development phase after Cyclone Biparjoy saw active community participation in the cleanup activities, restoration of infrastructure, rehabilitation of affected households, revitalization of local economies, recovery and re-development activities (Figure 6.2). Community participation in the decision-making processes for re-development initiatives ensured that the recovery efforts addressed the specific needs and aspirations of the affected population, promoting a sense of ownership and empowerment.

## 6.7 Support from Community Based Organisations, Cooperatives and Corporates

Community based organizations played a vital role during the cyclone by disseminating timely information, coordinating essential services, assisting with evacuation, and providing support to affected individuals and communities. Furthermore, community based organisations and corporate social responsibility initiatives played a significant role in complementing government efforts. NGOs, such as Swami Narayan Trust, Akshaya Patra Foundation, and local community groups, provided support by supplying food, essentials, and other necessary aid to affected communities.

Farmer cooperative societies also assisted in evacuation and

securing the livestock by shifting them to the shelters/community cattle sheds and providing them with fodder and water. The farming community also collaborated in recovery efforts by providing the available machinery to the administration.

Major corporates, industries and chambers of commerce at the local level also played a key role during the Cyclone Biparjoy by extending physical resources, shelter, food and other items to their workers, affected population as well as administration (Figure 6.3). It facilitated good coordination and communication amongst different businesses, communities and government entities. The industries including salt pan industries, timely shifted their labourers to the safe shelters.

### 6.7.1 Agariya community (Salt pan Workers)

The affected areas have one of the largest salt pan industries in the country. The Agariya community (salt pan workers) has been living there for centuries, knowing just one means of living, salt production. Throughout their lives, members of the Agariya community work tirelessly in the fields of the Rann of Kachchh. After the alerts from administration, the Agariya community proactively took the measures to shift to the safe shelters. They were also supported by the owners of salt industry in undertaking such actions for their safety. However, the cyclone did cause damage to the infrastructure, loss of livelihoods and health risks.

**Figure 6.3: Relief Assistance from community organizations**

## 6.8 Community Resilience: a Success Story

The success story of Zero Casualty during Cyclone Biparjoy in Gujarat stands as a testament to the benefits of investments in resilience, preparedness, and active involvement of the communities. This narrative of community resilience serves as an inspiration and blueprint for future disaster management efforts, emphasizing the significance of community engagement and empowerment in safeguarding lives and promoting sustainable recovery in disaster situations.

*Amidst the destruction, a glimmer of hope emerged from the resilience and determination of the farming community. They stood united, ready to face the challenges ahead and rebuild their lives from the ruins. The spirit of Gujarat, rooted in its agricultural heritage, would not be easily broken. The road to recovery would be arduous, but with collective efforts and support, the farmers would sow the seeds of a new beginning, cultivating a future that rose from the ashes of devastation.*

*The tale of Cyclone Biparjoy served as a stark reminder of the unpredictable forces of nature and the vulnerability of human endeavors. Yet, amidst the chaos and destruction, the strength of the human spirit shone through as communities came together to heal, rebuild, and restore the agricultural heartland of Gujarat.*

## Lessons from the Past Experiences

*The Kandla Cyclone (1998) and the Bhuj Earthquake in 2001 were devastating events, but these events reminded and encouraged the local communities to pursue resilience in aftermath of such disasters. The people of Gujarat came together to support one another, demonstrating a strong spirit of unity and determination. The community quickly mobilized resources, provided aid, and participated in the rebuilding process using disaster resistant designs, technologies and construction practices. They also learned to strengthen the last mile connectivity for the early warning system to follow timely evacuation and precautionary measures for safety of lives, properties and environment.*

*Lessons learned from subsequent disasters, such as Cyclone Tauktae (2021), echoed through the community during Cyclone Biparjoy. Proactive measures like preparedness, protection and prepositioning measures as well as deployment of adequate human resources equipped with sufficient materials and machines, last mile connectivity for early warning dissemination to provide sufficient time for evacuation of the affected population, were rewarded in terms of achievement of Zero Causality during the Cyclone Biparjoy. Robust plans, the safety of vulnerable population through well-coordinated evacuation procedures and designated shelters equipped with essential supplies, also yielded good results for the community.*

*The resilient communities have actually worked hand in hand with local authorities, NGOs, and government agencies to assess damages, clear debris, restore infrastructure, and rehabilitate affected areas after the cyclone. They have demonstrated strength, determination and solidarity, contributing to the successful recovery and re-development of their communities.*

*This collective resilience resulted in minimum losses and swift restoration of livelihoods, and the revitalization of affected areas.*

# Chapter 7
# The Triumph of Zero Casualty- A Tale of Resilience

The National Policy on Disaster Management released during the year 2009 envisaged the goal of Zero Casualty which is also aligned with the Sendai Framework for Disaster Risk Reduction (2015-2030), a global framework aimed at reducing disaster risk and enhancing resilience. India's Zero Casualty goal is a significant aspect of the nation's disaster management strategy. The policy highlights the government's dedication to being prepared in advance, responding effectively, and coordinating efficiently across all levels and sectors during disasters.

Through seamless alignment between the centre, state, district and local governments as well as relevant nodal agencies, line departments and response forces, the country achieved the remarkable goal of Zero Casualty during the Cyclone Biparjoy. This triumph of Zero Casualty and tale of resilience would serve as an inspiring example of best practices in disaster management strategies worldwide.


**Figure 7.1: Evacuation of 50 crew members by Indian coast guard from jack-up rig 'KEY SINGAPORE/01,' operated by M/s Vedanta Ltd.**

## 7.1 Resilience during the Cyclone: The Heroic Mission of the Indian Coast Guard on a Call for Safety

In the face of a perilous situation, a remarkable success story unfolded on 12th June 2023. The Directorate General of Hydrocarbons (DGH) urgently reached out to the Indian Coast Guard (ICG) for assistance. The jack-up rig 'KEY SINGAPORE/01,' operated by M/s Vedanta Ltd, found itself in a precarious situation, requiring immediate evacuation (Figure 7.1). With 50 crew members in harm's way due to rough seas and inclement weather, time for safety became a critical factor.

Swiftly recognizing the gravity of the situation, the Devbhumi-Dwarka district administration invoked the National Disaster Management Act 2005. They issued a notice to the company, emphasizing the importance of safety protocols and the well-being of those working under hazardous conditions.

Responding to the distress call with unparalleled determination, the Indian Coast Guard (ICG) launched a daring operation to rescue the entire crew of 50 from the rig. Despite facing fierce winds and towering waves, an ICG ship adjusted its course while a helicopter, CG 858, was swiftly deployed from Rajkot to Okha, providing crucial aerial support.

On 12th June 2023, the first phase of the operation successfully evacuated 26 crew members from the rig, navigating treacherous conditions with precision and resolve. As the first light of dawn broke on 13th June 2023, the operation resumed. The ICG continued their relentless efforts, ensuring the safety of the remaining 24 crew members. Despite fury of the cyclone, with unwavering bravery and skill they lifted each individual from the rig, and delivering them to the awaiting rescue teams on the mainland.

***This extraordinary achievement serves as an awe-inspiring success story, epitomising humanity's resilience and compassion. It stands as a testament to the unwavering spirit of unity and determination that can triumph over even the most formidable challenges posed by nature's fury. The incident is a constant reminder that safeguarding lives must always be the utmost priority, urging proactive measures to prevent and mitigate the impact of disasters.***

## 7.2 MV HAI NAM 81 Emergency

On 15th June 2023, the merchant vessel MV HAI NAM 81, on its journey from Kandla Port to Deen Dayal Port, encountered engine

troubles. As the cyclone loomed, the vessel dropped anchor near Dwarka, outside the Gulf. Operations at Kandla Port came to a halt and a state of alertness prevailed among the authorities responsible for disaster response.

As the weather deteriorated, the vessel's situation worsened. Despite utilising its engines, the ship began to drift, with winds reaching speeds of 130-150 kmph and swells as high as 8-10 metres. This raised concerns among all involved, given the vessel's inadequate engine power and the potential risks associated with it drifting in an unfavourable direction.

Immediate action was taken and vigilance was heightened at key command centres, including the Ministry's War Room, DG Comm centre, MMD Kandla, and MMD Jamnagar. The Director General of Shipping personally supervised operations throughout the night, closely monitoring the vessel's progress and maintaining constant communication with the ship's master. Various options were explored to secure assistance, including arranging a tug. After meticulous coordination with relevant stakeholders, the Deendayal Port Authority offered a tug from its fleet at OTT Vadinar Terminal. However, for the safety of the crew, it was deemed necessary to wait until the wind speed decreased to 54 kmph before initiating the tug's movement.

As the vessel's drift paused momentarily, only to resume in the opposite direction during the early hours of 16th June 2023, continuous monitoring revealed promising weather and sea conditions in its vicinity. Simultaneously, the cyclone's path veered eastward, worsening conditions at OTT Vadinar.

Finally, on 16th June 2023, at approximately 13:45 hours, a breakthrough was achieved. With careful precision and strategic decision-making, the vessel successfully retrieved its anchor and steered into deeper waters, leaving the challenging circumstances behind it. Later, the vessel came to Kandla port and finished the cargo operation (Figure 7.2).

This remarkable success story stands as an inspiring example of effective collaboration and prompt action in navigating through adverse conditions.

**Figure 7.2: Tracking of MV HAI NAM 81 from Kandla port during Cyclone Biparjoy**

***"Effective coordination, constant monitoring, and prompt action by maritime agencies are crucial in averting potential disasters at sea. The incident involving the merchant vessel MV HAI NAM 81 highlights the importance of proactive measures, such as timely communication of vessel status and close monitoring of its position and drift rate. By quickly responding to the vessel's dragging anchor situation and taking precautionary measures, a major oil pollution incident was successfully prevented. The story emphasises the significance of effective communication, preparedness, and collaborative efforts in ensuring the safety of vessels, crew members, and the environment."***

## 7.3 Against the Tempest: A Tale of Resilience and Saving Lives

Bet Dwarka, is a captivating island nestled at the mouth of the Gulf of Kachchh. Located approximately 2 km away from the coastal town of Okha in Gujarat, India, it boasts of a rich historical and spiritual significance. However, during Cyclone Biparjoy, the serene waters that connect Bet Dwarka and Okha were disrupted. As a precautionary measure, ferry services were temporarily suspended to ensure the safety of tourists and residents alike. This decision was aimed to mitigate the potential risks posed by the cyclone's wrath.

On 16th June 2023, a young girl named Aarti Ben, aged 15 and a resident of Bet Dwarka Island, was bitten by a venomous snake. Acting swiftly, her family rushed her to the nearest dispensary/PHC at Bet Dwarka, where a skilled medical team promptly provided her with initial treatment, recognizing the urgency of the situation. However, it became evident that Aarti Ben

**Figure 7.3: Visuals representing treatment to the snake bite victim**

required specialised care at the Taluka hospital. Sadly, the ferry services to and from the island were temporarily suspended due to the approaching Cyclone Biparjoy, as a precautionary measure. The medical team immediately informed the CDHO, Devbhumi-Dwarka, about the critical situation (Figure 7.3).

Overcoming the obstacles presented by the fierce winds and halted ferry services, the administration swiftly devised an extraordinary rescue plan. A boat was promptly arranged at the Bet Dwarka jetty to transport Aarti Ben to safety. Meanwhile, at the Okha jetty, a 108 ambulance stood prepared with a team of skilled medical professionals, equipped with the necessary antidote. Urgency propelled the ambulance towards the Taluka hospital, with every passing moment crucial for Aarti Ben's recovery. The collective expertise and presence of the antidote instilled hope in the hearts of all who witnessed this remarkable rescue effort.

***The coordination and cooperation between various departments, driven by the shared goal of saving a young girl's life, proved to be an unstoppable force. The determination of the administration and the seamless collaboration between these departments was an inspiring demonstration of coordination, unity and resolve in the face of adversity.***

## 7.4 Rebuilding Resilience: The Swift Restoration of Power after Cyclone Biparjoy

In the aftermath of the Cyclone Biparjoy, a tale of resilience and triumph unfolded in Vadinar, Devbhumi-Dwarka District. The destructive power of the cyclone had left the infrastructure supplying power to Bharat Oman refinery in ruins. However, through extraordinary collaboration and unwavering determination, the Gujarat Energy Transmission Corporation Limited (GETCO), Bharat Oman refinery, and other utilities achieved the seemingly impossible task of restoring power supply within an astounding time frame of 64 hours and 28 minutes.

When the cyclone struck and caused the source line of Bharat Oman refinery to trip, it served as a wake-up call for the higher authorities. Joint discussions were initiated, leading to a crucial decision: the collapsed towers had to be replaced. Despite facing various challenges, including the presence of baboon trees and waterlogging that hindered access to the site, the team remained undeterred. They tirelessly

cleared the area and prepared it for restoration process.

The tower dismantling and foundation work quickly commenced. The foundation work was completed, and tower stubs from another project site were arranged to expedite the process of erecting the tower. The necessary tower material was promptly received from GETCO Keshod Store, unloaded, sorted, and stacked with utmost efficiency.

***The successful restoration of power supply to Bharat Oman refinery stands as a testament to the indomitable spirit and collective efforts of all those involved. It serves as a shining example of the power of collaboration, preparedness, and timely action in the face of adversity. This remarkable achievement highlights the importance of resilient infrastructure and proactive measures to mitigate the impact of disasters. By investing in such initiatives, communities can fortify their defenses, safeguard lives, and build a brighter and more resilient future.***

The successfully accomplished tower erection became a significant milestone.

On 20th June 2023, the dedicated team embarked on the tower line stringing work in the early morning hours. Their tireless efforts and unwavering dedication led to completion of the stringing work on the newly erected towers.

At 4:27 pm on the same day, a moment of triumph arrived as both circuits were charged, and power flowed once again to the 66kV Bus of Bharat Oman refinery.

## 7.5 Rebuilding Resilience: The Quick Restoration of Transmission lines

The following activities were taken up immediately after the cyclone for quick restoration of affected elements for early restoration of power supply. Immediate damage assessment of affected Transmission assets was conducted through field surveys (All transmission lines came into service after subsidence of the cyclone except 400 kV D/C Mundra-Bhachau-Line 1&2, in which a tower at location no.248 had been damaged) (Figure 7.4).

**Figure 7.4: Damaged tower of Mundra-Bhachau**

Required spares (tower parts, conductor, earthwire, Insulators and hardware fittings) were arranged and its transportation to the tower location was mobilised immediately.

Food and shelter were made available for the human resources (Figure 7.6). Equipment and tools like backhoe loader (JCB machines), hydra, pulley, gas cutter, safety equipment, portable

**Figure 7.5: Restoration works being carried out during late evening and night hours**

Transmission line erection being a specialised job, expert human resources were deputed to ensure quick restoration works **(Figure 7.5).**

DG sets, magnetic drill machine, inflatable emergency lights, first aid kits etc., were arranged (Figure 7.7).

**Figure 7.6: (a) Buttermilk distribution to workers (b)Food arrangement at site for working staff**


**Figure 7.7: Use of Poclain Machine in Wet fields for material shifting**

Transportation arrangement for spares, mobilization of skilled human resources along with requisite materials was made to reach the affected site. Senior level officials also visited the site to ensure smooth execution of restoration works which led to permanent restoration of power in record time (Figure 7.8)

**Figure 7.8: Restoration work at affected tower site**

## 7.6 Resilience and Swift Response: Overcoming Cyclone Biparjoy's Impact

In the face of the destructive Cyclone Biparjoy, the city of Jamnagar encountered numerous challenges. However, the coordinated efforts of the fire teams and emergency response units proved instrumental in mitigating the consequences and ensuring the safety of the community (Figure 7.9). This is a success story that highlights the resilience and quick response demonstrated during the calamity.

As the cyclone approached, the control room began receiving reports of falling

**Figure 7.9: Rescue operation in Jamnagar by Fire & Emergency Department**

trees and branches from various parts of the city. The fire teams swiftly sprang into action, equipped with tools such as woodcutters, axes, bolt cutters, and spreaders. Despite relentless rain and wind gusts of 70 to 80 km per hour, the teams tirelessly worked round the clock, clearing blocked roads and addressing calls of trees and branches damaging important government buildings, houses, and walls.

Amidst the chaos, several incidences showcased the dedication and effectiveness of the rescue operations. A rickshaw driver, trapped under a fallen tree, was promptly rescued and rushed to a hospital for medical attention. Additionally, a family of four trapped in a car under a fallen tree was immediately rescued, averting a potentially life-threatening situation. Two houses collapsed during the cyclone, necessitating the evacuation of five individuals from one house and two from another. Moreover, the fire teams displayed their commitment to all human lives and animals, as they successfully rescued a dog that had fallen into a well and another trapped in a deep pit.

Throughout the cyclone, the control room remained vigilant, processing and responding to all calls of fallen trees on houses, roads, schools, sub-stations, and house gates. In addition to their tree-related duties, the fire teams addressed and extinguished eight fire incidents reported during this challenging period of the cyclone.

***The success story of Jamnagar's response to Cyclone Biparjoy highlights the importance of effective disaster preparedness, quick response, and coordinated efforts. The city's resilience and the commitment of its emergency response units proved crucial in safeguarding lives, minimising damage, and ensuring the well-being of the community. This narrative serves as an inspiration for future disaster management initiatives, emphasizing the significance of preparedness, prompt action, and unwavering dedication in the face of adversity.***

## 7.7 The Remarkable Resilience: A Tale of Triumph in Disaster Response by NDRF

Cyclone Biparjoy roared across the vulnerable coastal regions of Kachchh, Gujarat, leaving a trail of destruction in its wake. However, amidst the chaos and devastation, a truly remarkable achievement emerged that not a single life was lost after the cyclone made landfall in Gujarat. This extraordinary triumph served as a testament to the nation's growing competence in effectively responding to disasters of such magnitude.

Despite facing power disruptions and communications issues, the response efforts were bolstered by the indomitable spirit of the National Disaster Response Force (NDRF). Their resourcefulness shone through as they skillfully utilised light systems and communications equipment, ensuring the uninterrupted flow of vital information throughout the crisis.

Rescue and evacuation operations unfolded in densely populated areas, presenting the responders with formidable challenges. Yet, their dedication and compassion knew no bounds as they promptly addressed requests for assistance, tirelessly removing hazards that threatened residential areas and institutions, such as uprooted trees and fallen electric wires.

Amidst the chaos, special attention was given to the needs of the most vulnerable, including the elderly and children (Figure 7.10). Rescuers provided personalised care and support, going above and beyond to carry individuals on stretchers, improvised chairs, or even their own shoulders when mobility was compromised.


**Figure 7.10: Evacuation by NDRF at Bagicha Bag, Mandavi Kachchh**

Close coordination with state and administration of the districts, played a pivotal role in the success of the response efforts. Response teams meticulously surveyed low-lying regions, visiting relief shelters, and disseminating crucial advisory announcements to ensure the local population remained informed and prepared. The NDRF's unwavering commitment shone through as they spearheaded large-scale evacuations to cyclone shelters and safer locations.

In one inspiring incident, an NDRF team rescued two stranded individuals from the low-lying areas of Rupen Bandar in Devbhumi-Dwarka district, exemplifying the heroic efforts made by the responders during the landfall of Cyclone Biparjoy.

## 7.8 Welcoming Newborns and Nurturing Children Amidst the Cyclone

The government of Gujarat during the Cyclone Biparjoy, took extraordinary measures to ensure the safety and well-being of its vulnerable citizens, particularly pregnant ladies, lactating mothers, children and women (Figure 7.11).

With the invaluable assistance of Auxiliary Nurse Midwives (ANMs) and Accredited Social Health Activists (ASHA) workers, the administration promptly identified pregnant women residing in the cyclone-prone districts. Realising the potential dangers posed by the cyclone, a total of 1,152 pregnant women were identified and relocated to Primary Health Centers (PHCs) and Community Health Centers (CHCs), away from harm's way.

During Cyclone Biparjoy, a remarkable 828 successful deliveries took place out of the 1,152 pregnant women who had been safeguarded. The diligent efforts of the Gujarat government and the healthcare workers resulted in numerous precious lives being brought into the world amidst the cyclone's chaos.

***This well-coordinated and efficient response, culminating in Zero Casualty, set the bar high for future disaster management endeavours. It underscored the critical importance of preparedness, coordination, and an unwavering commitment to community well-being. The success story of Cyclone Biparjoy serves as an inspiration, demonstrating the transformative power of effective disaster management and the potential for minimising loss of life and property.***

### Special Care to the Infants

Simultaneously, recognizing the essential nutritional needs of the people affected by the cyclone, the district administration took proactive steps. They collaborated with local milk dairies to ensure a steady supply of pasteurised milk and milk powder to the safe shelters. In an exemplary display of preparedness, a minimum of 5 kilogram of milk powder, along with milk packets, were made available during the cyclone. Moreover, cradles were thoughtfully placed in the safe shelters, providing a safe and comfortable haven for the toddlers.

Understanding the importance of addressing the psycho-social aspects of those seeking refuge in the safe shelters, various engaging methods were adopted. In the districts of Rajkot and Porbandar, jingles were played on television to uplift spirits and foster a sense of togetherness. In Kachchh and other affected districts, the dedicated Anganwadi workers took the role of facilitators, engaging the inhabitants in various activities and organising several indoor games to bring joy and normalcy to their lives, even in the midst of adversity.

**Figure 7.11: Special Care to the Infants**

*The combined efforts of the government, healthcare workers, and compassionate individuals resulted in a successful narrative during Cyclone Biparjoy. Gujarat's proactive approach in identifying and relocating pregnant women, ensuring the availability of essential supplies like milk and cradles, and providing mental and emotional support through engaging activities is a testament to the state's commitment to the well-being of its citizens, even in the face of disasters. This inspiring story of resilience and care serves as a shining example for other regions grappling with similar challenges, showcasing the power of collective action and empathy in the face of adversity.*


**Figure 7.12: Visit and interaction with people by Shri Amit Shah, Hon'ble Union Minister of Home Affairs and Minister of Cooperation at District Hospital Mandvi (Gujarat)**

# Chapter 8
# Innovations, Interventions and Best Practices

In the face of escalating hydro-meteorological hazards, the coastal states of India stand exposed to significant vulnerability. The risk of cyclones is further compounded by global warming and climate variability, presenting a daunting challenge for disaster risk reduction. However, India's unwavering commitment to mitigating these risks has yielded remarkable results. Recent cyclones such as Phailin (2013), Hudhud (2014), Titli (2015), Vardha (2016), Okhi (2017), Bulbul (2019), Fani (2019),Vayu (2019), Maha (2019), Amphan (2020), Nisarg (2020), Tauktae (2021), Yaas (2021), Asani (2022), Mandous (2022) etc., serve as testament to the nation's commendable approach to disaster management. Yet, the profound economic losses and far-reaching social impact of these disasters remain unaffordable in the long term.

Disasters offer a profound opportunity for individuals, communities, societies and governments at all levels to develop and hone skills that contribute to overall risk prevention, mitigation, preparedness, response, recovery and resilience. Individuals, communities, and organizations are compelled to innovate, adapt, and acquire new competencies, innovations and best practices. It also serves as a catalyst for technological advancements. From early warning systems and remote sensing technologies to disaster-resistant infrastructure and communication networks, the need to respond effectively to disasters drives innovation and the adoption of cutting-edge solutions. The Cyclone Biparjoy also provided the opportunity to adapt technologies and devise innovative solutions with effective interventions and best practices.

## 8.1 Technological Innovations, Interventions and Best Practices

During the proactive measures taken in response to the Cyclone Biparjoy, two important aspects of the Prime Minister's 10-point Agenda on Disaster Risk Reduction (DRR) were used: Agenda No. 5, which focuses on "leveraging technology to enhance the efficiency of disaster risk management efforts", and Agenda No. 7, which emphasizes the importance of "utilising the opportunities provided by social media and mobile technologies for disaster risk reduction".

In terms of Agenda No. 5, advanced technologies were employed to improve disaster preparedness and response. Remote sensing, Doppler Weather Radar and satellite imageries were used to monitor the cyclone's trajectory and intensity. Latest techniques using numerical multi models were applied to predict cyclone track, intensity and associated adverse weather like heavy rain, wind and storm surge enabling timely warnings and evacuation. Additionally, predictive modeling and data analytics were utilized to assess potential hazard, vulnerability, risk and damage and allocate resources effectively. This technology-driven approach helped authorities make informed decisions and mitigate the impact of the cyclone.

**Agenda No. 7** refers to fostering the use of social media and mobile technologies for last mile connectivity. By disseminating accurate information through trusted channels, the administration aimed to curb the spread of fake news/ rumors and ensure that the public had access to reliable and timely updates regarding the cyclone and associated safety measures. The newly launched Common Alert Protocol (CAP) and the mobile app SACHET were also been used to disseminate messages to everyone possessing mobiles in the affected areas. This dual approach of leveraging social media like WhatsApp groups, Twitter, Facebook as well as CAP and SACHET for information dissemination and utilizing official social media accounts of public representatives for authentic updates apart from conventional approaches, helped maintain a well-informed and prepared population. It contributed to the overall success of the proactive measures in terms of achievement of Zero Casualty during Cyclone Biparjoy.

### 8.1.1 Specific Innovations and Interventions in Forecast and Early Warning

(i) GIS based Decision Support System (DSS) was deployed to analyse various observations, models and other guidance in real time.

(ii) Development of multi-model ensemble techniques for cyclone track, intensity, landfall, heavy rainfall, wind and storm surge forecasts.

(iii) IMD implemented the Web-DCRA developed jointly by NDMA, IMD and other agencies and the products on hazard, vulnerability and risk were prepared and made available to the users.

(iv) The innovative technique for forecasting probability of wind exceeding 32 kmph (squally winds) and 63 kmph (gale wind) were prepared indigenously.

(v) Colour coded district-wise impact-based risk assessment of heavy rainfall, wind and storm surge was carried out utilising multi model technique.

### 8.1.2 Innovations & Interventions in Services

(i) Fisherman warning was issued for entire Arabian Sea in textual and graphical format for next 5 days based on multi-model technique developed indigenously by IMD.

(ii) Customized location specific advisories in colour coded format were provided to onshore and offshore industries during Biparjoy. This personalised information was shared with stakeholders like DGH, ONGC, Reliance, Adani, etc. Needless to mention, relief and rescue operations for Singapore rig could be carried out successfully because of the early warnings issued in this regard.

(iii) Automation in generation of cyclone bulletins was another innovation implemented by IMD which helped in error free timely generation and dissemination of cyclone bulletins as per user requirements including ports, ships, fishermen, aviation, railways, tourists, agriculture etc.

(iv) The consensus forecast was generated for the additional area of responsibility of Indian navy and were made available to them in real time every six hours.

### 8.1.3 Web based Dynamic Composite Risk Atlas (DCRA)

During Cyclone Biparjoy, the administration used the Web based Dynamic Composite Risk Atlas (DCRA) to identify the vulnerable areas for evacuation. DCRA utilizes geospatial technology and data visualization techniques to present complex risk information in a user-friendly and accessible manner. It allows users to explore and analyze different layers of risk, identify hotspots, and assess the potential impacts of multiple hazards and vulnerabilities on a given area.

Special efforts were put during Cyclone Biparjoy by NCRMP, NDMA for operationalization and real time usage of Web DCRA module, hosted by IMD. There was success in ensuring that the Web DCRA outputs are incorporated in the IMD National Bulletin issued every 3 hours during the cyclone. Further, special efforts were made to apprise the Kachchh District Collector about the results available from DCRA which were helpful in evacuation planning, especially with regard to villages which were beyond 10 km from the coast as the state had already taken a decision for evacuation of villages within 10 km of coast. Additionally, 25 villages were evacuated by the district

administration of Kachcch based on the inputs from web DCRA.

### 8.1.4 Mobile Apps, CAP Alerts/ SACHET and Geotagged SMS

During the cyclone, alerts were issued as per the Common Alert Protocol. Alerts were sent via Bulk SMS to the communities for better preparedness. Thousands of messages were sent to the users to enhance the last mile connectivity. SACHET app of NDMA was widely downloaded along with the Mausam, Damini apps by the IMD.

Dissemination of alerts by Geo-tagged SMS, mobile app, browser notification, RSS feed, browser notification, DTH services and NavIC/ GAGAN satellite terminals was extensively used along with conducting reorientation training of SDMA for judicious use of the said platforms before arrival of the event.

### 8.1.5 Priority Call Services and Activation of Intra Circle Roaming

Mobile phone priority of 220 officials of GSDMA and NDMA was accorded higher precedence over regular calls in order to ensure interruption free calls during the cyclone.

In times of disasters, intra circle roaming is crucial for uninterrupted communication as it enables seamless connectivity, enhances emergency response efforts, and facilitates efficient coordination among responders and affected individuals. It allows mobile network operators to collaborate and ensure that affected areas have access to vital services. The Department of Telecom (DoT) coordinated with all the Telecom Service Providers (TSPs) to extend this service as part of the procedure under the DM plan of DoT. The activation of Intra circle roaming between 14th June 2023 and 22nd June 2023 during the Cyclone Biparjoy in Gujarat enhanced the connectivity and uninterrupted communications.

## 8.2 Strategic Interventions, Innovations and Best Practices

Based on the lessons learnt from the past events like Kandla Cyclone (1998) and Tauktae Cyclone (2021), the strategies and the practices to deal with the challenges of cyclone Biparjoy were implemented with innovative solutions and best practices for disaster risk reduction and resilience. Such strategic interventions, innovations and best practices are briefly discussed below.

### 8.2.1 Command, Control and Coordination with Efficient Cooperation and Collaboration

After the early warning of the cyclone was received, coordination meetings were organized at the central

government, state government and district levels to review the situation and monitor the preparedness measures along with immediate actions to deal with the disaster situation. The strategy led to effective cooperation and collaboration between different stakeholders. Besides administration, cooperation was extended by the elected representatives of the state who guided and motivated the administration in achieving Zero Casualty.

**At Central Level**

At central level, regular monitoring and review meetings by the Hon'ble Prime Minister and Hon'ble Union Minister of Home Affairs and Minister of Cooperation, boosted the coordination and cooperation between various agencies. Ministry of Home Affairs coordinated the actions with an aim to achieve Zero Casualty as highlighted by the Hon'ble PM.

**At State Level**

The Hon'ble CM of Gujarat monitored the situation at the SEOC along with the Commissioner of Relief, Prinicipal Secreatry (R&R) in the presence of Prabhari Mantris made the communities evacuate without any hesitation or reluctance at the ground. The activation of the Incident Response System by the state for efficient command, control and coordination during disaster situation was also a key intervention that led to achievement of Zero Casualty through concerted efforts.

**At District Level**

The presence of MLAs, Pradhans and other public representatives at the ground level and coordination with the administration made evacuation of 1,43,053 vulnerable population possible in the quickest time prior to the event. At the districts level, Prabhari Mantris and the Prabhari Sachivs made constructive contribution in seeking cooperation from the citizens in the affected areas.

#### 8.2.1.1 Several Dimensions of Effective Response to Biparjoy

**Innovations and Best Practices**

Innovations and best practices in preparedness, protection, and pre-positioning measures for cyclone played a vital role in minimizing the impacts on communities, infrastructure, and the environment.

**Effective planning and Best Practices**

Effective planning and proactive measures were essential in saving lives and reducing the economic and social impacts of the event.

**Advanced Technology**

Leveraging advanced technology for communications enabled the delivery of precise and timely cyclone forecasts and alerts, facilitating comprehensive readiness for both authorities and communities. In the digital age, the development of mobile applications and SMS alert systems furnished individuals with real-time updates on cyclone forecasts, evacuation pathways, and essential emergency contacts, which empowered them to make informed decisions during the cyclone.

**Strategic Pre-Positioning Measures**

In the sphere of pre-positioning measures, a series of strategic actions taken enhanced cyclone response capabilities. One such approach involved strategic stockpiling, entailing the pre-positioning of vital necessities such as food, water, medical equipment, and emergency kits in conveniently accessible locations ahead of the cyclone season. The proactive strategy ensured a prompt and efficient response in the aftermath of the cyclone's impact. Additionally, meticulous logistical planning was essential, entailing the creation of comprehensive plans delineating the movement and distribution of relief supplies. This encompasses the establishment of streamlined transportation networks and close collaboration with pertinent agencies which ensured a smooth flow of aid. Collaborative engagement with private businesses and industries was another effective avenue, entailing partnerships to pre-position resources such as construction materials, machinery, and equipment that played a pivotal role in the immediate recovery and reconstruction phase. Furthermore, fostering community-based resilience involved enlisting local communities that served as a valuable supplementary asset during the initial stages of recovery.

By integrating these innovations and best practices into cyclone preparedness, protection, and pre-positioning measures, authorities and communities did significantly enhance their resilience and capacity to respond effectively to Cyclone Biparjoy.

### 8.2.2 Preparedness measures by Ministry of Power

The preparedness measures by the Ministry of Power related organisations like POWERGRID, PGVCL, GETCO etc., helped in quick restoration of the power supply to the critical facilities.

#### 8.2.2.1 Innovation and interventions by POWERGRID

- **Identification of transmission assets to be impacted by Cyclone:**

  Based on the trajectory path of cyclone given by IMD/ISRO, mapping of the predicted trajectory of cyclone over the POWERGRID's assets was done using Geographical Information System (GIS) for identification of transmission lines/ sub-stations which was coming under the predicted impact trajectory of cyclone. The transmission lines / sub-stations at risk, were identified and preparedness activities were initiated.

- **Advance planning of spares, Emergency Restoration System (ERS) and manpower:**

  Advanced planning of spares, ERS and expert manpower was done. ERS were placed at strategic locations and movement was ensured based on trajectory path before the landfall of cyclones. Required spares and expert human resources were placed at strategic locations along the projected path of cyclone for quick movements to meet any eventuality.

### 8.2.3 Involvement of Public Representatives, Community Organizations and Corporates

The public representatives from the affected areas supported the administration in convincing the communities to evacuate from the affected areas and move out timely to safe locations/ shelters.

Community organizations played a vital role during the cyclone by providing crucial support and assistance to affected individuals and communities in evacuation and shelter management. Several community organizations supported the administration in providing food and other supplies to the evacuated population.

The major corporates supported the affected population by providing food, ration kits and other items at the rehabilitation shelters and also at the time of returning to their homes after the cyclone.

***The story of Cyclone Biparjoy would forever be etched in the annals of Gujarat's history. It would serve as a reminder of the power of nature's wrath and the efforts of those who worked tirelessly to rebuild and restore what was lost.***

# Chapter 9
# Way Forward

The coordinated and proactive approach proved to be prime reason for the success of achieving the Zero Casualty during the Cyclone Biparjoy in Gujarat. At the same time, the Cyclone Biparjoy highlighted the best practices along with the gap areas for improvement. The way forward emphasizes specific considerations to enhance preparedness, response, and recovery efforts related to cyclones.

The Sendai Framework for Disaster Risk Reduction (SFDRR) and the Prime Minister's 10-point agenda on DRR highlights, inter-alia, women's inclusion, global risk mapping, technology use, social media engagement, local capacity building, and learning from past disasters to enhance disaster risk management, leading to more effective strategies, improved understanding, efficient response, community empowerment, and resilience building. While the Gujarat government have made substantial progress in implementing the Prime Minister's 10-point agenda on DRR and SFDRR, it is essential to recognize that Cyclone Biparjoy also offered opportunities to learn for capacity enhancement and improvement in disaster risk reduction and resilience. Some of the key aspects from the present study for way forward, is briefly discussed below.

## (A) Preparedness and Early Warning:

### 9.1 Integration of all observed and forecast information into a single platform/ bulletin

During Cyclone Biparjoy, IMD issued forecast about the cyclone and NRSC, Hyderabad, was issuing inundation maps based on IMD's forecast track. Similarly, Central Water Commission was providing riverine outflow. Additionally, Space Application Centre, ISRO provided scatterometer based imageries. It is suggested that all risk information products from different centres / agencies like ISRO, CWC, IMD etc. should be made available on a common platform/ consortium of such organizations in the country and the region. All these products should be integrated within a single bulletin, website and GIS platform for easy accessibility and better decision making on early warning, preparedness, protection, pre-positioning and response actions.

### 9.2 Augmentation of Observational and Modelling Capabilities

Cyclone Biparjoy changed its path 9 times during its life period of 13 days 3 hours. Enhanced observations, better modelling capabilities like

dynamic numerical multi-model ensemble techniques with improved lead time and accuracy, use of advanced technologies like satellite images, UAVs, aircrafts, augmented observational network including doppler weather radars, wind profiler, automatic weather stations etc. helped to get the real-time information about the cyclone including rapid intensification during genesis & growing stage and slow weakening after landfall. The learning from this forecasting has to be institutionalized.

### 9.3 Synergised Standard Operating Procedure (SSOP)

Every organization / agency has its own set of standards of procedures and guidelines for working on forecast and early warning. Thus, they have different standards and parameters for issuing alerts and sharing information in different formats. It becomes difficult for disaster management authorities and communities to make effective decision based on this kind of information. Hence, a consortium of such organizations should establish a minimum standards of practice which may be termed as Synergised Standard Operating Procedure (SSOP) among various stakeholders for effective warning, communication & dissemination. There is a need to enhance interoperability among these various stakeholders.

### 9.4 Regulatory framework for weather forecast by various agencies / experts to avoid rumors and misinformation

During times of disasters, various meteorological agencies/ experts (some of whom may not have adequate qualification and competence as well as lack proper resources an infrastructure) have been sharing weather related information with the public, for awareness among masses with respect to impending hazard on 𝕏 (Twitter), Facebook, news media etc. Sometimes such practices result in misinformation and rumors, thereby misleading the concerned authorities and communities. Therefore to bring accountability by regulatory framework may be brought in place to restrict issuing of the early warning and alerts on cyclone and other extreme weather events by these agencies/ experts. However, they can play a major role in complementing the common platform services of the consortium through data and information sharing, dissemination, capacity building and awareness campaign among the masses. The nodal agencies for early warning, mitigation and response to specific disasters have been identified in the National Disaster Management Plan (2019).

### 9.5 Updation & Utilization of IDRN

Effective utilization of the IDRN facility may be tested during such disasters to ascertain gaps and required logistic upgradation to meet contingencies. Cyclone specific equipment and stores/ logistic base may be created in focus areas for enhancing futuristic response in worst-case scenarios. NIDM may extend its outreach and assistance to DDMAs and SDMAs in using IDRN portal. IDRN portal should be updated to real time geo-spatial database for quick decision making by the administration.

### 9.6 Management of Cyclone Shelters

Efficient management of resilient infrastructure for cyclone shelters is crucial for ensuring the safety of vulnerable communities during cyclonic events. In Gujarat, under the NCRMP initiative, approximately 74 cyclone shelters were constructed in highly vulnerable regions. However, there's a requirement to improve the supervision and upkeep of these shelters, in addition to maintaining the roads that provide access to these shelter locations. By prioritizing effective management practices and regular maintenance, the cyclone shelter infrastructure can better serve its intended purpose of providing safe shelters and facilities for individuals during cyclones and other disasters.

### 9.7 Capacity Enhancement of State Disaster Response Force (SDRF)

Gujarat SDRF played a significant role during Cyclone Biparjoy. However, considering the large area and vulnerability profile, the state may plan enhancement of the strength and availability of the SDRF round the year. Other coastal states may also establish state level disaster response forces and quick response teams to deal with disaster situations. These teams should be equipped with necessary instruments, skills, knowledge and trainings.

### 9.8 Mobilisation of Volunteers

A lot of effort has gone into training volunteers, such as Aapda Mitra to be of assistance during such disasters. A study may be undertaken in the districts to bring out the system adopted for mobilising volunteers and highlight what value additions or improvements can be made. During the Cyclone Biparjoy, Gujarat state has very well utilized the trained and skilled Aapda Mitra in response to the disaster situation. Similarly, other coastal states have also utilized the services of Aapda Mitra in judicious manner like Kerala state utilized them during the floods in 2018 and the Odisha during Cyclone Fani in 2019. The Aapda Mitra system has provided a huge pool of human resources, trained and skilled as first responders.

However, this resource pool can even be more effectively deployed and monitored if regular update is mandated for states to include this data in IDRN portal.

### 9.9 Public Awareness & Education for Social and Behavioral Change

NIDM in collaboration with the disaster management authorities and other stakeholders, may design and implement Social and Behavioral Change Campaigns (SBCC) to adopt best practices for disaster risk reduction and resilience. This can improve understanding and perception of the risks, formulate better strategies for communicating risk messages, dissemination of education and awareness, simulation exercises & mock drills, preparedness and response at various stages of disasters. Continuous innovation, collaboration, and public engagement would be key to success of this approach.

### 9.10 Periodic Review of DM plans, SoPs and Guidelines

Periodic review of Disaster Management (DM) plans, Standard Operating Procedures (SoPs) and guidelines is essential to ensure their effectiveness and relevance. It helps identify gaps, incorporate new information, address emerging risks, and enhance coordination among stakeholders. The plans should be updated in a holistic manner in consideration with the concurrent hazards and risks.

## (B) Disaster Risk Assessment:

### 9.11 Decision Support Systems like Web based Dynamic Composite Risk Assessment (DCRA)

Enhancing administration's capacities in taking timely decisions using latest mapping products like Web based Dynamic Composite Risk Assessment (DCRA) and alert information sources can be helpful in evacuation and response planning in disaster situations. A comprehensive strategy involves training state and district administrators in system navigation, data interpretation, and decision strategies, while emphasizing system significance. User-friendly interfaces and tailored data delivery to optimize engagement of designated agencies for evacuation as well as search & rescue after the event. Collaboration with various stakeholders, staying updated with technology advancements, real-time updates and integration into workflows ensure timely response. During the Cyclone Biparjoy, the information from DCRA assisted the administrators in evacuation from the probable affected areas.

### 9.12 Comprehensive Multi-hazard Risk Assessment

Comprehensive approach for Multi-hazard risk assessment including primary and secondary hazards as well as concurrent, cascading and complex disaster situations, will help to protect

vulnerable communities, minimize damages to properties and environment, and ensure a more resilient response to future cyclonic events. For example, while dealing with cyclone risk assessment, aspects of storm surges, high intensity rainfall, and probability of flood etc., may also be considered in multi-hazard risk assessments to improve further early warning information in the affected areas. This holistic approach will further enhance understanding of potential threats, enabling effective mitigation and resource allocation for the overlapping vulnerabilities.

**9.13 Adoption of PM GatiShakti National Master Plan Framework**

Under PM GatiShakti master plan, more than 1500 GIS data layers and inter-departmental technical and policy level governance structures have been put in place for multi-modal and last mile connectivity with the economic zones. This transformative approach has the potential to be a game changing policy tool for creating disaster resilient infrastructure appropriate to various risk zones.

**(C) Disaster Risk Mitigation:**

**9.14 Improving Real Time Data Collection and Analysis at State / District Level**

Establish a comprehensive data collection mechanism specific to cyclones, gathering information on cyclone paths, intensity, affected areas, casualties, damages, and resources requirement. Collaboration with local authorities, meteorological agencies, and communities to ensure reliable and real-time data is needed. This data may be analysed to identify trends, vulnerabilities, and gaps in cyclone preparedness and response.

**9.15 Establishment of National Centre for Tropical Cyclones**

It is evident that funding for technological advancement and skill development is imperative to enhance the different aspects of early warning systems. Further, to carry out all the above research & developments in a holistic and continuous manner, there is a need to establish a National Centre for Tropical Cyclones in the country in line with Shanghai Typhoon Institute of China and Hurricane Research Division of USA. The ideal location for the centre could be the NIDM's south campus situated in Vijayawada, in collaboration with organizations such as IMD, INCOIS, NRSC, NCCR, NIO, NIOT, and other institutes focusing on coastal areas. The strategic advantage of the NIDM south campus being close to all coastal states and UTs makes it the most suitable choice for establishing the centre.

### 9.16 Codes and Standards for Cyclone Resistant Design and Construction

There is a need to establish and implement design & construction codes and standards tailored to withstand cyclonic impact, incorporating reinforced materials, appropriate structural design, and strong foundations to endure cyclone-related elements such as powerful winds, storm surges, and intense rainfall. Additionally, in coastal regions, strict adherence to the Central Electricity Authority's (Technical Standards for Construction of Electrical Plants and Electric Lines) Regulations, 2022, should be made mandatory. Innovations related to the design codes and standards for the power structures and networks particularly in the coastal regions to withstand the heavy winds should be adopted.

### 9.17 Revision and Updation of NDMA Guidelines on Management of Cyclone

The national guidelines on management of cyclones were released during the year 2008. However, subsequently there have been now developments and technological innovations in this area including applications of artificial intelligence, machine learning and big data analysis etc. Hence, it would be appropriate to revise and update the national guidelines in view of the lessons learnt from the recent cyclones.

### 9.18 Strengthen Critical Infrastructure for Resilience & Sustainability

Identify critical infrastructure and lifeline buildings such as power stations, hospitals, and communication networks in cyclone-prone areas and reinforce them to withstand cyclonic forces. This can involve implementing backup power systems, reinforcing structures, adopting aero-dynamic designs, and establishing redundancies to ensure their functionality during and after cyclonic events.

### 9.19 Enhance Drainage Systems

The Cyclones are often accompanied by heavy precipitation leading at times to floods / flood like situations, particularly in the urban areas where drainage systems are not appropriately and adequately designed for such situations. Swachh Bharat Abhiyan has made a huge impact in the country in managing municipal solid waste which resulted into improved functioning of storm water drainage system. However, cities particularly in the coastal states of the country need to give special focus to storm water drainage system and ensure litter free cities by introducing responsible waste management systems including resource recovery centers so as to reduce drainage congestions. The drainage systems may also be modified and strengthened including appropriate design, construction and maintenance

of storm water drains, improved solid waste management practices, and implementing proper urban planning to avoid development in flood-prone areas.

**9.20 Strengthening SDMAs & DDMAs**

Strengthening SDMAs and DDMAs is important for taking timely proactive preparedness, response and recovery actions. It would enhance coordination, enable timely decision-making, optimize resource allocations, facilitate training and enhance human capacities, raise public awareness, and ensure continuous improvement in disaster risk reduction and resilience. There is also need to mainstream DRR by establishing State Institute of Disaster Management (SIDM) by respective coastal states on lines of GIDM in Gujarat. GIDM also extended support to GSDMA in technical analysis of disaster situation during the Cyclone Biparjoy.

**9.21 Public-Private Partnerships**

It is important to foster partnerships between the public and private sectors for undertaking activities initiatives for disaster risk reduction and resilience. This can involve leveraging private sector expertise and resources to implement innovative solutions, while governments can provide regulatory frameworks, incentives, viability gap funding and support to ensure infrastructure resilience.

**9.22 Women Leadership and Empowerment**

As per Prime Minister's 10-point agenda on DRR, promoting women's leadership (point 3 in the agenda) and empowerment will go a long way in further strengthening disaster resilience in communities. It is crucial to address their unique vulnerabilities, ensure inclusive decision-making, promote gender equality, and mitigate gender-based violence. During Cyclone Biparjoy, ASHA workers and other grass-roots women leaders helpedin mobilizing the affected community for medical assistance and any post cyclone outbreak of diseases was prevented. Similarly women self-help groups, particularly in coastal state like Kerala have contributed a lot in response and relief during the flood in the year 2018.

**(D) Climate Change and Long-Term Risk Reduction in Coastal Areas:**

**9.23 Climate Change Adaptation in DRR**

To integrate climate change into cyclone risk management, vulnerability assessments must be conducted to identify high-risk areas and understand climate-related challenges.

Climate considerations should be mainstreamed into policies and plans, including adaptation, mitigation measures and resource allocation. Additionally, early warning systems need upgradation by incorporating climate change projections for accurate and timely warnings to communities.

### 9.24 Nature-based solutions

The pace of climate change is aggravating environmental uncertainties which necessitate new approaches in cyclone risk mitigation that need to be more integrated and holistic and based on principles of sustainability, resilience, and inclusivity. For integrating such an approach and promoting nature-based solutions like coastal restoration, mangrove conservation, wetlands conservation and ecosystem based adaptation measures etc. should be considered for inclusion into cyclone risk management plans. These solutions can provide natural buffers against impacts of cyclones and enhance resilience of communities. The studies of the basins and sub-basins of each river need to be based on *systems approach* and going beyond administrative territories. It would require identification of challenges and addressing them through appropriate interventions including nature-based solutions like plantations of vetiver grasses and other local species for erosion control and bank protection.

# Annexure-1

## CAP Warning Dissemination Report Cyclone Biparjoy
## Total Subscribers – 2,88,72,510
## Total SMS Count – 5,22,11,598

| S. No. | Organisation | Warning Event | Message | Warning Creation Time | Area Description | Total Subscriber Count | Total SMS Count |
|---|---|---|---|---|---|---|---|
| 1 | Gujarat SDMA | High Wave alert | *High wave warning from Jakho to Diu Island was forcasted with height from 3.5m to 4.5 m from 09 June 2023 (11:30 pm) to 11 June 2023 (8:30 pm). | 9 June 2023 9:58 pm | Coastal area from Jakhau to Diu island of Gujarat (11402.69 sq. km) | 9,13,469 | 27,40,407 |
| 2 | Gujarat SDMA | High Wave alert | *Due to Biparjoy Cyclone the coast of Gujarat State from Lakhpat to Umargaon was predicted for high waves from 11 June 2023 (5:30 pm) to 13 June 2023 (23:30 pm). During this period waves height from 3.5 m to 7.0 m was forecasted in sea. | 11 June 2023 7:07 pm | Coastal area from Lakhpat to Umargaon of Gujarat (12776.08 sq. km) | 11,84,356 | 35,53,068 |
| 3 | Gujarat SDMA | Very Heavy Rain | Heavy to very heavy rain is very likely to occur at isolated places over Jamnagar, Junagadh, Kachch, Rajkot in next 24 Hours. | 13 June 2023 11:09 pm | Jamnagar, Junagarh, Kachch, Rajkot districts of Gujarat (70059.59 sq. km) | 71,16,685 | 71,16,685 |
| 4 | Gujarat SDMA | Extremely Heavy Rain | Extremely Heavy Rain is very likely to occur at few places with isolated extremely heavy rainfall over Devbhoomi Dwarka, Porbandar, Kutch in next 24 hours. | 13 June 2023 1:51 pm | Devbhoomi Dwarka, Kachch, Porbandar districts of Gujarat (55125.74 sq. km.) | 27,85,437 | 55,70,874 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | Gujarat SDMA | High Wave alert | High Wave Warning for the coast of GUJARAT from Lakhapat to Umargam due to Very Severe Cyclonic Storm Biparjoy. High waves in the range of 4.0-7.5 meters are forecasted during 17:30 hours on 13 June 2023 to 23:30 hours on 15 June 2023. | 13 June 2023 6:28 pm | Coastal area from Lakhpat to Umargam of Gujarat | 20,39,892 | 40,79,784 |
| 6 | Gujarat SDMA | Extremely Heavy Rain | Heavy to very heavy rains at isolated places with isolated extremely heavy rainfall in the districts over Devbhoomi Dwarka in next 24 hours. | 14 June 2023 1:20 pm | Devbhoomi Dwarka district of Gujarat (4754.86 sq. km.) | 5,14,571 | 5,14,571 |
| 7 | Gujarat SDMA | Extremely Heavy Rain | Heavy to very heavy rains very likely at a few places with isolated extremely heavy falls in the districts of over Devbhoomi Dwarka, Jamnagar, Kachchh in next 24 hours. | 15 June 2023 1:52 pm | Devbhoomi Dwarka, Jamnagar, Kachch, Porbandar districts of Gujarat. | 35,21,905 | 70,43,810 |
| 8 | Gujarat SDMA | Extremely Heavy Rain | Heavy to very heavy rains very likely at a few places with isolated extremely heavy falls in Kutch Heavy to very heavy rains very likely at isolated places with. isolated extremely heavy falls in the districts namely Banaskantha and Patan in next 24 hours. | 16 June 2023 2:18 pm | Banas Kantha, Kachch, Patan districts of Gujarat | 38,79,800 | 77,59,600 |
| 9 | Gujarat SDMA | Extremely Heavy Rain | Heavy to very heavy rains very likely at a few places with isolated extremely heavy falls in Kutch Heavy to very heavy rains very likely at isolated places with isolated extremely heavy falls in the districts namely Banaskantha and Patan in next 24 hours. | 16 June 2023 4:01 pm | Banas Kantha, Devbhoomi Dwarka, Jamnagar, Kachch, Morbi, Patan districts of Gujarat | 69,16,395 | 1,38,32,790 |

***Translated from Gujarati Language.**
**(Source:** Indian Meteorological Dept.)

# Annexure-2

## Some of the major hazards faced by state in the last 200 years as mentioned in the table given below

| Hazard | Years |
|---|---|
| Cyclones* | 1892,1893, 1894, 1897, 1903, 1917, 1920, 1930, 1935, 1947, 1948, 1961, 1964, 1975, 1976, 1981, 1982, 1996, 1998 (June), 1998(October), 2021, 2023 |
| Droughts / Heat Waves | 1897, 1985, 1986, 1987,1998,1999, 2000, 2001, 2002, 2003, 2004, 2005,2006, 2012, 2015, 2016, 2017 |
| Floods | 1980,1989,1991, 1993,1994,1996,1997,1998, 2003, 2004, 2005, 2006,2013, 2015, 2017, 2019 |
| Earthquakes | 1819, 1845, 1847, 1848, 1864, 1903, 1938, 1956, 2001 |
| Source: Revenue Department, Government of Gujarat<br>* As per record from IMD | |

## Historical Record of Major Cyclones crossing Gujarat State (Maximum sustained wind speed ≥ 62 kmph) during 1891-2023

| Date of Genesis | Life Time Maximum Intensity | Place of Landfall | Date & Time of Landfall | Intensity at the Time of Landfall and Recorded Wind Speed |
|---|---|---|---|---|
| 28-04-1892 | VSCS | Saurashtra & Kachchh coasts to the north of Mandvi | 01-05-1892 | Crossed as VSCS with maximum sustained wind speed (MSW) of 115-125 kmph |
| 12-11-1893 | VSCS | South Gujarat coast between Veraval and Diu | 20-11-1893 | Crossed as VSCS with MSW of 115-125 kmph |
| 23-10-1894 | CS | South Gujarat coast between Surat and Valsad | 26-10-1894 | Crossed as CS with MSW of 60-70 kmph |
| 10-07-1897 | CS | Gujarat coast between Veraval and Porbander | 11-07-1897 | Crossed as CS with MSW of 80-90 kmph |
| 14-07-1903 | CS | South Gujarat coast between Veraval and Diu | 14-07-1903 | Crossed as CS with MSW of 60-70 kmph |
| 19-10-1917 | CS | North Gujarat coast between Porbander and Dwarka | 25-10-1917 | Crossed as CS with MSW of 80-90 kmph |
| 06-06-1920 | VSCS | Gujarat coast between Veraval and Porbander | 11-06-1920 | Crossed as VSCS with MSW of 115-125 kmph |
| 25-10-1930 | CS | South Gujarat coast near Surat | 29-10-1930 | Crossed as CS with MSW of 80-90 kmph |
| 28-01-1935 | CS | Saurashtra & Kachchh coast near Naliya | 28-01-1935 | Crossed as CS with MSW in the range of 60-80 kmph |
| 12-04-1947 | VSCS | South Gujarat coast near Diu | 17-04-1947 | Crossed as VSCS with MSW of 115-125 kmph |
| *19-09-1948 | SCS | South Gujarat coast near Diu | 24-09-1948 | Crossed as SCS with MSW in the range of 90-110 kmph |

| | | | | |
|---|---|---|---|---|
| 20-06-1961 | SCS | Saurashtra & Kachchh coast near Naliya | 23-06-1961 | Crossed as SCS with MSW of 95-105 kmph |
| 08-06-1964 | VSCS | Saurashtra & Kachchh coast near Naliya | 12-06-1964 | Crossed as VSCS with MSW of 135-145 kmph |
| 19-10-1975 | ESCS | North Gujarat coast to the North of Porbandar | 22-10-1975 | Crossed as ESCS with MSW in the range of 160-180 kmph |
| 29-05-1976 | ESCS | South Gujarat coast between Mahuva and Bhavnagar | 03-06-1976 | Crossed as ESCS with MSW in the range of 160-180 kmph |
| 29-10-1981 | VSCS | South Gujarat coast near Mangrol | 01-11-1981 | Crossed as VSCS with MSW of 135-145 kmph (at Mangrol) |
| 04-11-1982 | ESCS | South Gujarat coast between Veraval and Kodinar | 08-11-1982 | Crossed as ESCS with MSW of 170-180 kmph gusting to 220 kmph |
| 17-06-1996 | VSCS | South Gujarat coast near Diu | 18-06-1996 | Crossed as VSCS with MSW in the range of 120 - 130 kmph |
| 04-06-1998 | ESCS | South Gujarat coast near Porbandar | 08-06-1998 | Crossed as ESCS with MSW in the range of 160-180 kmph (IAF Jamnagar reported 180 kmph and Kandla Port reported 160 kmph) |
| 11-10-1998 | CS | South Gujarat coast near Veraval | 16-10-1998 | Crossed as CS with MSW of 60-70 kmph near Veraval |
| 14-05-2021 | ESCS (Tauktae) | South Gujarat coast near Diu | 17-05-2021 | Crossed as ESCS with MSW in the range of 160-170 kmph gusting to 190 kmph (reported at Diu) |
| 06-06-2023 | ESCS (Biparjoy) | Saurashtra & Kachchh coast near Jakhau Port | 15-06-2023 | Crossed as VSCS with MSW in the range of 115-125 gusting to 140 kmph (Dwarka reported 130 kmph) |

**Legend:** MSW: Maximum sustained wind speed, CS: Cyclonic Storm (MSW: 62-87 kmph), SCS: Severe Cyclonic Storm (MSW: 88-117 kmph), VSCS: Very Severe Cyclonic Storm (MSW: 118-165 kmph), ESCS: Extremely Severe Cyclonic Storm (MSW: 166-221 kmph), SuCS: Super Cyclonic Storm (MSW: ≥ 222 kmph)

*Note: It includes only the cyclones that crossed Gujarat coast as a cyclone (MSW: ≥ 62 kmph). It does not include the cyclones that crossed the Gujarat coast after weakening into a depression/deep depression and the cyclones that developed over Arabian Sea but did not make landfall over Gujarat.*

**September 1948 cyclone developed over Bay of Bengal, emerged into Arabian Sea and crossed south Gujarat coast near Diu.*

## Coastal Districts of Gujarat with Degree of Proneness to Cyclone Hazard

| Name of Districts | Category of Proneness |
|---|---|
| Junagadh, Ahmedabad, Kachchh, Bhavnagar, Jamnagar, Anand, Navsari, Surat, Bharuch, Valsad, Rajkot, Porbandar, Morbi, and Gir Somnath | P2 |
| Devbhumi Dwarka | Between P2 and P3 |
| Vadodara and Amreli | P3 |
| Surendra Nagar and Kheda | P4 |

# Annexure-3

## Responsibilities given to of 'Prabhari Mantris' and 'Prabhari Sachivs'

| Name of Districts | Hon'ble Central Minister/ Hon'ble Prabhari Mantri | Prabhari Sachiv |
|---|---|---|
| Kutch | Shri Mansukh Mandaviya<br>Shri Rushikesh Patel<br>Shri Prafulbhai Panseriya | Shri Harshad R. Patel |
| Devbhumi Dwarka | Shri Purushottam Rupala<br>Shri Harsh Sanghavi | Shri P. K. Solanki |
| Rajkot | Shri Raghavjibhai Patel | Shri Rahul Gupta |
| Jamnagar | Shri Mulubhai Bera | Shri Anupam Anand |
| Gir Somnath | Shri Parshottam Solanki | Shri Jenu Devan |
| Junagadh | Shri Jagdish Vishvakarma | Shri Manish Bhardwaj |
| Porbandar | Shri Kunvarjibhai Bavaliya | Shri Ranjit Kumar J. |
| Morbi | Shri Kanubhai Desai | Smt Manisha Chandra |

# Annexure-4

## Number of people identified to be evacuated from the 8 districts that were most vulnerable to Cyclone Biparjoy

(**Data Source:** Commissioner of Relief, Govt. of Gujarat)

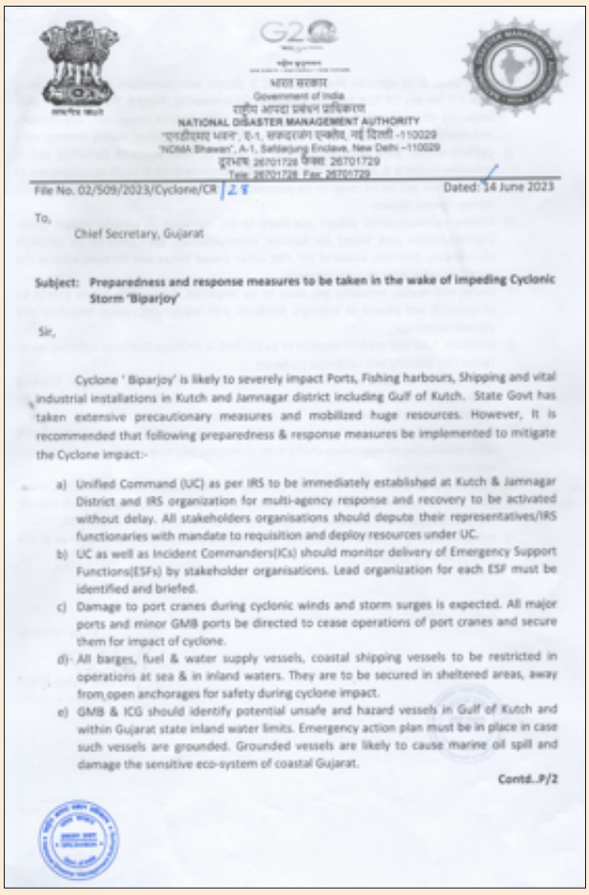
| S. No. | Name of Districts | Number of People Evacuated | | | | |
|---|---|---|---|---|---|---|
| | | Pregnant women | Old age people | Child | Others | Total |
| 1 | Junagadh | 66 | 524 | 1,875 | 4,663 | 7,128 |
| 2 | Kachchh | 552 | 1,703 | 10,086 | 61,828 | 74,169 |
| 3 | Jamnagar | 66 | 2,536 | 845 | 13,460 | 16,907 |
| 4 | Porbandar | 33 | 482 | 2,008 | 3,384 | 5,907 |
| 5 | Devbhumi Dwarka | 135 | 487 | 3,838 | 8,162 | 12,622 |
| 6 | Gir Somnath | 94 | 110 | 889 | 1,885 | 2,978 |
| 7 | Morbi | 4 | 367 | 1,356 | 10,271 | 11,998 |
| 8 | Rajkot | 202 | 686 | 4,432 | 6,024 | 11,344 |
| **Total** | | **1,152** | **6,895** | **25,329** | **1,09,677** | **1,43,053** |

## Number of villages from where people were evacuated and number of temporary shelters present in the vulnerable districts

(**Data Source: Commissioner of Relief, Govt. of Gujarat**)

| S. No. | Name of Districts | No. of Villages Evacuated | Number of Temporary Shelters | | | |
|---|---|---|---|---|---|---|
| | | | Cyclone Shelters | Govt. Schools | Others | Total |
| 1 | Junagadh | 131 | 25 | 712 | 133 | 870 |
| 2 | Kachchh | 141 | 4 | 149 | 52 | 205 |
| 3 | Jamnagar | 117 | 1 | 153 | 13 | 167 |
| 4 | Porbandar | 99 | 4 | 119 | 21 | 144 |
| 5 | Devbhumi Dwarka | 82 | 4 | 184 | 0 | 188 |
| 6 | Gir Somnath | 99 | 0 | 472 | 35 | 507 |
| 7 | Morbi | 15 | 0 | 88 | 0 | 88 |
| 8 | Rajkot | 114 | 0 | 173 | 63 | 236 |
| **Total** | | | | | | **2,405** |

# Annexure-5



भारत सरकार
Government of India
राष्ट्रीय आपदा प्रबंधन प्राधिकरण
NATIONAL DISASTER MANAGEMENT AUTHORITY
"एनडीएमए भवन", ए-1, सफदरजंग एन्क्लेव, नई दिल्ली -110029
"NDMA Bhawan", A-1, Safdarjung Enclave, New Delhi –110029
दूरभाष: 26701728 फैक्स: 26701729
Tele: 26701728 Fax: 26701729

File No. 02/509/2023/Cyclone/CR 128 Dated: 14 June 2023

To,
Chief Secretary, Gujarat

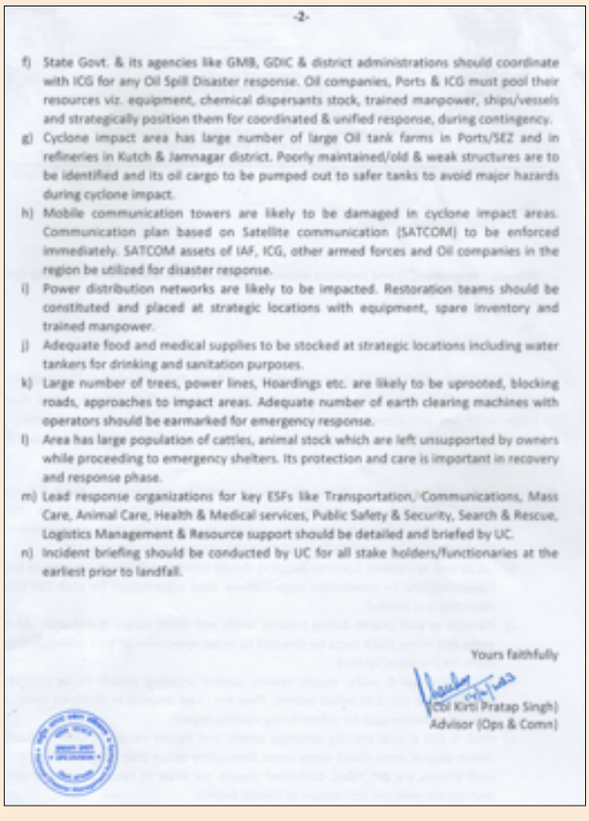
**Subject: Preparedness and response measures to be taken in the wake of impeding Cyclonic Storm 'Biparjoy'**

Sir,

Cyclone ' Biparjoy' is likely to severely impact Ports, Fishing harbours, Shipping and vital industrial installations in Kutch and Jamnagar district including Gulf of Kutch. State Govt has taken extensive precautionary measures and mobilized huge resources. However, it is recommended that following preparedness & response measures be implemented to mitigate the Cyclone impact:-

a) Unified Command (UC) as per IRS to be immediately established at Kutch & Jamnagar District and IRS organization for multi-agency response and recovery to be activated without delay. All stakeholders organisations should depute their representatives/IRS functionaries with mandate to requisition and deploy resources under UC.
b) UC as well as Incident Commanders(ICs) should monitor delivery of Emergency Support Functions(ESFs) by stakeholder organisations. Lead organization for each ESF must be identified and briefed.
c) Damage to port cranes during cyclonic winds and storm surges is expected. All major ports and minor GMB ports be directed to cease operations of port cranes and secure them for impact of cyclone.
d) All barges, fuel & water supply vessels, coastal shipping vessels to be restricted in operations at sea & in inland waters. They are to be secured in sheltered areas, away from open anchorages for safety during cyclone impact.
e) GMB & ICG should identify potential unsafe and hazard vessels in Gulf of Kutch and within Gujarat state inland water limits. Emergency action plan must be in place in case such vessels are grounded. Grounded vessels are likely to cause marine oil spill and damage the sensitive eco-system of coastal Gujarat.

Contd..P/2





f) State Govt. & its agencies like GMB, GDIC & district administrations should coordinate with ICG for any Oil Spill Disaster response. Oil companies, Ports & ICG must pool their resources viz. equipment, chemical dispersants stock, trained manpower, ships/vessels and strategically position them for coordinated & unified response, during contingency.
g) Cyclone impact area has large number of large Oil tank farms in Ports/SEZ and in refineries in Kutch & Jamnagar district. Poorly maintained/old & weak structures are to be identified and its oil cargo to be pumped out to safer tanks to avoid major hazards during cyclone impact.
h) Mobile communication towers are likely to be damaged in cyclone impact areas. Communication plan based on Satellite communication (SATCOM) to be enforced immediately. SATCOM assets of IAF, ICG, other armed forces and Oil companies in the region be utilized for disaster response.
i) Power distribution networks are likely to be impacted. Restoration teams should be constituted and placed at strategic locations with equipment, spare inventory and trained manpower.
j) Adequate food and medical supplies to be stocked at strategic locations including water tankers for drinking and sanitation purposes.
k) Large number of trees, power lines, Hoardings etc. are likely to be uprooted, blocking roads, approaches to impact areas. Adequate number of earth clearing machines with operators should be earmarked for emergency response.
l) Area has large population of cattles, animal stock which are left unsupported by owners while proceeding to emergency shelters. Its protection and care is important in recovery and response phase.
m) Lead response organizations for key ESFs like Transportation, Communications, Mass Care, Animal Care, Health & Medical services, Public Safety & Security, Search & Rescue, Logistics Management & Resource support should be detailed and briefed by UC.
n) Incident briefing should be conducted by UC for all stake holders/functionaries at the earliest prior to landfall.

Yours faithfully

(Col Kirti Pratap Singh)
Advisor (Ops & Comn)

# Annexure-6

## Mobilisation of NDRF teams

**06th June 2023**

- 10th Bn NDRF for Karnataka, 5th Bn NDRF for Maharashtra & Goa and 6th Bn NDRF for Gujarat and Rajasthan alerted for necessary preparedness.
- NDRF HQs and Commandants of 5/6/10th Bn NDRF established coordination with MHA (DM Division) and respective State Relief Commissioners/SEOCs for continuous flow of information among all the stakeholders.

**07th June 2023**

- Cyclone converted into a Severe Cyclone in the morning and to Very Severe Cyclone in the afternoon.
- Two teams each deployed in Karnataka and Maharashtra in addition to already available teams at RRCs.
- Five additional teams each at 3rd Bn Mundali (Odisha), 4th Bn Arrakonam (Tamil Nadu) & 7th Bn Bhatinda (Punjab) kept on standby for airlift in case of any exigency.

**10th June 2023**

- In view of the forecast, 3 NDRF teams deployed in Gujarat at Porbandar, Valsad and Gir Somnath.

**11th June 2023**

- 12 more NDRF teams deployed in Gujarat at Rajkot, Kachchh, Jamnagar, Morbi and Dwarka and 01 team in Diu UT – Total 16 teams.

**12th June 2023**

- 02 more NDRF teams deployed in Gujarat at Junagarh and Jamnagar – Total 18 teams.

**14th June 2023**

- Additional teams deployed in Kachchh – Total 19 teams including UT of Diu.

**15th June 2023 (Day 0)**

- Landfall impacted Kachchh and Saurashtra region in the evening. Senior officers of NDRF were available on ground zero to monitor the situation and supervise rescue & relief operations.

**16th June 2023 (Day +1)** – Rescue and Restoration works were carried out.

**17th June 2023 (Day +2)** – Cyclone weakened into a deep depression and further into a depression.

**18th June 2023 (Day+3)** – NDRF teams released by District administration.

**19th June 2023 (Day +4)** – Demobilization of NDRF teams.

# Annexure-7

## Deployment of Human Resources for Effective Response in Gujarat

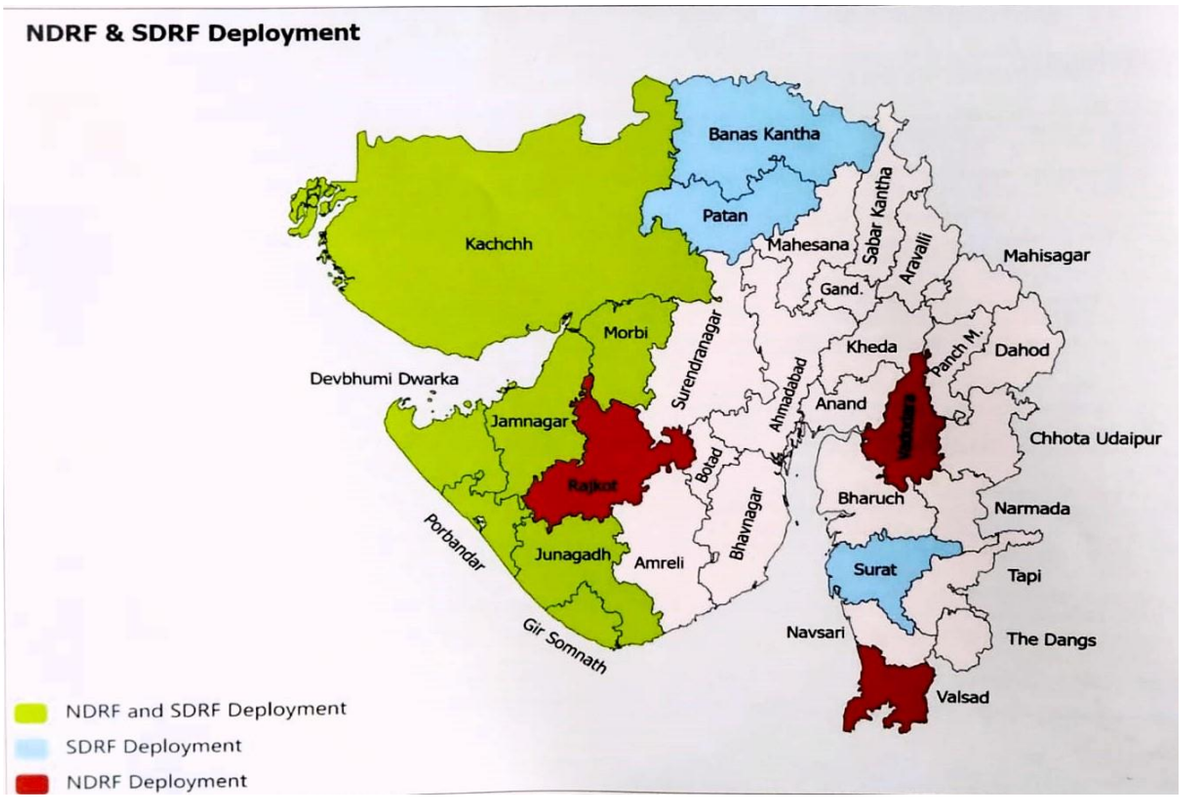
**(Data Source:** Commissioner of Relief, Govt. of Gujarat)

| S. No. | Name of Districts | NDRF | SDRF | State Police |
|---|---|---|---|---|
| 1 | Kachchh | 6 | 2 | 4,747 |
| 2 | Morbi | 1 | 1 | 1,417 |
| 3 | Jamnagar | 2 | 2 | 204 |
| 4 | Devbhumi Dwarka | 3 | 2 | 159 |
| 5 | Rajkot | 2 | 0 | 140 |
| 6 | Porbandar | 1 | 1 | 170 |
| 7 | Gir Somnath | 1 | 1 | 1,200 |
| 8 | Junagadh | 1 | 1 | 330 |
| **Total** | | **17** | **10** | **8,367** |

## Deployment of Indian Army

| Date | Locations | No. of Relief Colns | | | No. of ETF | Med Teams | Remarks |
|---|---|---|---|---|---|---|---|
| 15th June 2023 | Bhuj | 04 | 04 | 08 | 01 | 01 | (a) 01x Integ Coln each move to Naliya Mandavi. (b) 01x Integ Coln each move to Dwarka and Amreli. (c) Relief coln. – 01-02-55, ETF-01-00-10, Med team-01-00-03. (d) 24x7 Disaster relief coord centre established at HQ/11 Infantry division. |
| | Jamnagar | 05 | 03 | 08 | 03 | 03 | |
| | Gandhinagar | 06 | 03 | 09 | - | - | |
| | Dharangdhra | 06 | 03 | 09 | - | - | |
| | Vododara | 03 | 02 | 05 | - | - | |
| | Gandhidham | 03 | - | 03 | 02 | 02 | |
| | Naliya | 01 | - | 01 | 01 | 01 | |
| | Mandvi | 01 | - | 01 | 01 | 01 | |
| | Dwarka | 01 | - | 01 | 01 | 01 | |
| | Ahmedabad | - | - | - | 05 | 04 | |
| **Total** | | **30** | **15** | **45** | **14** | **13** | |

## Deployment of NDRF and SDRF in different districts of Gujarat



# Annexure-8

## Relief Assistance

### Livestock Relief Assistance in 10 districts of Gujarat

| S. No. | Settlement type | No. of livestock dead | Amount of relief assistance paid |
|---|---|---|---|
| 1 | Rural | 2,661 | 4,03,85,000 |
| 2 | Urban | 9 | 1,91,000 |
| **Total** | | **2,670** | **4,05,76,000** |

### Cattle Shed Relief Assistance in 10 districts of Gujarat

| S. No. | Settlement type | No. of cattle sheds damaged | Amount of relief assistance paid (Rs. in Lakh) |
|---|---|---|---|
| 1 | Rural | 317 | 15,09,400 |
| 2 | Urban | 9 | 45,000 |
| **Total** | | **326** | **15,54,400** |

### Household (Urban + Rural) Relief Assistance Provided (as on 30th June 2023)

| S. No. | Name of Districts | Number of families surveyed | Number of households paying household | Amount paid (Rs. in Lakh) |
|---|---|---|---|---|
| 1 | Kachchh | 5,832 | 29 | 2,03,000 |
| 2 | Devbhumi Dwarka | 298 | 71 | 4,97,000 |
| 3 | Morbi | 135 | 0 | 0 |
| 4 | Banaskantha | 647 | 295 | 13,27,500 |
| **Total** | | **6,912** | **395** | **20,27,500** |

## Relief Assistance Provided for the Houses (as on 30th June 2023)

| S. No. | Name of Districts | Partially damaged puccha houses | | Partially damaged kaccha houses | | Huts | |
|---|---|---|---|---|---|---|---|
| | | No. of houses for which relief assistance has been paid | Amount of relief assistance paid (Rs. in Lakh) | No. of houses for which relief assistance has been paid | Amount paid of relief assistance paid (Rs. in Lakh) | No. of huts paid for relief assistance | Amount of relief assistance paid (Rs. in Lakh) |
| 1 | Kachchh | 550 | 79,88,500 | 778 | 76,66,500 | 149 | 14,90,000 |
| 2 | Devbhumi Dwarka | 14 | 1,41,060 | 77 | 7,48,000 | 0 | 0 |
| 3 | Jamnagar | 13 | 60,500 | 40 | 1,37,800 | 0 | 0 |
| 4 | Junagadh | 1 | 15,000 | 50 | 5,00,000 | 0 | 0 |
| 5 | Gir Somnath | 5 | 56,000 | 19 | 1,74,800 | 0 | 0 |
| 6 | Porbandar | 4 | 60,000 | 11 | 1,10,000 | 12 | 36,000 |
| 7 | Morbi | 0 | 0 | 6 | 60,000 | 0 | 0 |
| 8 | Rajkot | 2 | 10,400 | 13 | 45,200 | 0 | 0 |
| 9 | Patan | 50 | 4,10,260 | 159 | 10,07,960 | 10 | 65,000 |
| 10 | Banaskantha | 204 | 17,90,800 | 444 | 25,60,900 | 16 | 1,06,800 |
| **Total** | | **843** | **1,05,32,520** | **1,597** | **1,30,11,160** | **187** | **16,97,800** |

(Source: Commissioner of Relief, Govt. of Gujarat)

# Annexure-9

## Damages and Losses in Power Sector

| S. No. | Name of Departments | Items | Damage in Terms of Quantity | Amounts (Rs. in Lakh) |
|---|---|---|---|---|
| 1 | Energy (PGVCL & UGVCL) | Poles (in Nos.) | 117957 | 5897.85 |
| | | HT Lines (ckm) | 41311.85 | 45773.52 |
| | | LT Lines (ckm) | 17757.47 | 12430.23 |
| | | Distribution Transformer (in Nos.) | 16446 | 16446 |
| | | **Total (UGVCL + PGVCL)** | | **80547.60** |
| 2 | Energy (GETCO) | Substations (in Nos.) | 50 Nos | 1000 |
| | | Transmission lines (Towers) | 170 Nos | 5000 |
| | | Line Material- conductor | 300 kms | 1100 |
| | | Hardware & Accessories | | 300 |
| | | E/W & OPGW | 60 kms | 500 |
| | | Civil Works | | 1500 |
| | | Miscellaneous | | 1000 |
| | | **Total (GETCO)** | | **10400** |

| S. No. | Name of Electric Transmission Line |
|---|---|
| 1 | 400kV Mundra - Jetpur 1 |
| 2 | 400kV Bhachau - Ranchodpura 2 |
| 3 | 400kV Bhachau – Limbdi |
| 4 | 400kV Bhachau – Varsana 2 |
| 5 | 400kV Mundra - Bhachau 4 |
| 6 | 400kV Mundra - Bhachau 3 |
| 7 | 400kV Bhachau – Mansar |
| 8 | 400kV Bhachau - Ranchodpura 1 |
| 9 | 400kV Bhachau - Lakadia - Jamkhambalia 1 |
| 10 | 400kV Bhachau - Lakadia – Jamkhambalia 2 |
| 11 | 400kV Mundra - Jetpur 2 |

# Annexure-10

## Damage and Losses in Agriculture & Horticulture

| S. No. | Crop | Affected area (ha) | Damaged Area (ha) | Total loss (Rs in Lakh) |
|---|---|---|---|---|
| 1 | Agriculture | 84,376 | 64,671.85 | 34,070.00 |
| 2 | Horticulture | 3,485 | 3,485 | 12,572.00 |
| 3 | Perennial Fruit crops | 45,268 | 45,268 | 49,795.00 |
| | **Total** | **1,33,129** | **1,13,424.85** | **96,437.00** |

## Assets Losses of the Crops

| S. No. | Name of the affected fruit crop | No. of uprooted fruit tree | Total economic value (Rs. in Lakh) |
|---|---|---|---|
| 1 | Coconut | 2,500 | 141.00 |
| 2 | Mango | 69,000 | 6,616.00 |
| 3 | Lime | 10,400 | 214.00 |
| 4 | Sapota | 1,043 | 77.00 |
| 5 | Pomegranate | 4,51,000 | 11,185.00 |
| 6 | Guava | 10,100 | 222.00 |
| 7 | Date Palm | 52,115 | 6,358.00 |
| | **Total** | **5,96,158** | **24,813.00** |

# Annexure-11

## Damages and Losses in Roads & Buildings

| S. No. | Items | Damages in terms of Quantity | Amount (Rs. in Lakh) |
|---|---|---|---|
| 1 | Road Surface (IR) | 5318.08 | 18844.52 |
| 2 | Road Surface (PR) | | 19269.1 |
| 3 | Structure Bridges/Minor Bridges (IR) | | 4202.19 |
| 4 | Structure Bridges/Minor Bridges (PR) | | 27482.24 |
| 5 | Machinery Cost | 880 + 891 (Labours) | 444.33 |
| **Total** | | | **70242.38** |

## Damages and Losses to the Forest and Environment

| S. No. | Items | Damages in Terms of Quantity | Amount (Rs. in Lakh) |
|---|---|---|---|
| 1 | Building | 53 | 49.03 |
| 2 | Communications structures | 1 | 0.8 |
| 3 | Roads in km | 21 | 7.5 |
| 4 | Grass Godowns | 22 | 25.6 |
| 5 | Grass | 289000 | 26 |
| 6 | Damage to trees in forest area | 532 | 133 |
| 7 | Damage to trees in territorial/social forest tree plantation | 219 | 54.75 |
| 8 | Damage to trees in National park / sanctuaries | 16775 | 167.75 |
| 9 | Damage to plants in Nursery | 169464 | 16.95 |
| 10 | Other damages | 1949 | 66.03 |
| 11 | Damage to trees on roads | 6052 | 1513 |
| | **Total** | | **2060.41** |

# Annexure-12

## Cumulative Damage and Loss Information

(**Source:** Commissioner of Relief, Govt. of Gujarat)

| S. No. | Name of Departments | Total Loss | Eligible Under SDRF | Fund Required from Central Government |
|---|---|---|---|---|
| 1 | Revenue Department (Immediate Relief) | 375.07 | 375.07 | 375.07 |
| 2 | Housing | 1386.65 | 735.36 | 735.36 |
| 3 | Panchayat | 70.81 | 70.81 | 70.81 |
| 4 | Energy & Petrochemicals | 90947.60 | 48954.00 | 48954.00 |
| 5 | Animal Husbandry | 464.39 | 464.39 | 464.39 |
| 6 | Agriculture & Horticulture | 121255.00 | 10279.00 | 10279.00 |
| 7 | Roads & Buildings | 70242.38 | 8244.00 | 8244.00 |
| 8 | Forest & Environment | 2060.41 | - | - |
| 9 | Health | 66.00 | 10.00 | 10.00 |
| 10 | Education | 2187.97 | 855.84 | 855.84 |
| 11 | Port & Transport | 7254.39 | 16.89 | 16.89 |
| 12 | Food & Civil Supplies | 101.70 | 101.70 | 101.70 |
| 13 | Urban Development | 979.53 | 1.52 | 1.52 |
| 14 | Women & Child Development | 264.51 | 261.33 | 261.33 |
| 15 | Water Supply | 208.00 | 47.83 | 47.83 |
| 16 | Cottage & Rural | 5.40 | 0.00 | 0.00 |
| 17 | Airstrips | 208.55 | 0.00 | 0.00 |
| 18 | Industries & Mines | 916.80 | 0.00 | 0.00 |
| 19 | Tourism | 377.00 | 0.00 | 0.00 |
| **Total** | | **299372.16** | **70042.67** | **70042.67** |

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