सत्यमेव जयते

GUJARAT FLOOD 2017
A CASE STUDY

National Disaster Management Authority
Government of India

Gujarat Flood 2017
A Case Study

Prepared by

National Disaster Management Authority

and

Gujarat Institute of Disaster Management

राष्ट्रीय आपदा प्रबंधन प्राधिकरण
National Disaster Management Authority
भारत सरकार
Government of India

सत्यमेव जयते

FOREWORD

Almost all parts of Gujarat are prone to floods with the State historically recording an average of four flood events in a decade. The past decade and half has been even worse with seven flooding events, including the most recent in 2017.

The State recorded an exceptionally heavy rainfall during July 2017. This led to a very heavy inflow into the dams and consequent flooding in large parts of the State with Aravalli, Banaskantha, Morbi, Patan and Surendranagar districts among the worst affected.

The floods resulted in loss of lives, livestock, crops, durable assets, and damage to public and private infrastructure. The Govt. of Gujarat ensured speedy restoration of essential services and quick disbursement of financial assistance.

In this backdrop, this study was taken up to document the best practices adopted by Gujarat and the lessons learnt, especially in preventing the outbreak of epidemics in the flood-affected areas and the use of drones to supply relief material to stranded persons.

This study also highlights long-term measures being undertaken by the State to improve the resilience of its people besides making recommendations for strengthening institutional arrangements towards the same.

The study also brings to the fore the need to form empowered committees to take timely decisions on the regulation and release of water from the dams/reservoirs/tanks. In this case, suitable institutional arrangements should also be made between Gujarat and Rajasthan to improve preparedness as the two States share the catchment areas of several rivers.

We acknowledge the support and cooperation extended by the Govt. of Gujarat in our efforts to document the best practices adopted during the 2017 floods. We are sure that this study will help other State Governments plan flood preparedness, response and rehabilitation efforts.

Shri Kamal Kishore
Member, NDMA

Dr. D.N. Sharma
Member, NDMA

Lt. Gen. N.C. Marwah (Rtd.)
Member, NDMA

Shri R.K. Jain, (IAS Rtd.)
Member, NDMA

एन.डी.एम.ए. भवन, ए-1, सफदरजंग एन्कलेव, नई दिल्ली-110029/ NDMA Bhawan, A-1, Safdarjung Enclave, New Delhi-110 029
दूरभाष/Tel.: +91 11 26701700 फैक्स/Fax : +91 11 26701831

Dr. V. Thiruppugazh, IAS
Joint Secretary

सत्यमेव जयते

National Disaster Management Authority
Government of India
NDMA Bhawan
A-1, Safdarjung Enclave
New Delhi-110 029
Tel.: +91 11 26701747 Fax: +91 11 26701816
E-mail : jspp@ndma.gov.in

ACKNOWLEDGEMENT

Flood is one of the most common disasters and affects a large number of people in India. Recurrent floods and resulting losses make it imperative that each of these events is studied to identify the causes, improve planning and preparedness, strengthen early warning systems, and put adequate systems in place to prevent a reoccurrence or ensure quick and efficient rescue and relief, as the case may be.

Such studies also help us document best practices as well as identify gaps, which may come handy not only in comprehensive disaster management planning but also during rescue and relief operations in case of an eventuality. Such studies also bring out novel and innovative practices which may aid the management of such hazards in an effective and efficient manner.

Various innovative practices were adopted by the State Govt. to effectively tackle the situation. Proactive media handling to nip rumours in the bud and dissemination of timely and correct information, massive and organised cleanliness drive to prevent the outbreak of epidemics, and use of drones to supply relief material are some of the innovative practices adopted by Gujarat. Yet another initiative that deserves mention is the designation of Municipal Corporations as regional rescue centres.

I thank Shri Pankaj Kumar, Principal Secretary, Revenue and Shri A. J. Shah, Commissioner of Relief, Government of Gujarat, who were instrumental in facilitating the study. I would also like to thank the officials and staff of the State emergency Operation Centre (SEOC) for their insights into the entire operation.

Shri P. K. Taneja, Director General, Gujarat Institute of Disaster Management (GIDM), was instrumental in facilitating the study. I highly appreciate the efforts taken by his team to arrange site visits as well as facilitate our interaction with officials, affected community members and other stakeholders, without which this study could not have been completed.

My special thanks and gratitude are due to the Government of Gujarat for facilitating the NDMA team during its visit, and for extending all possible help and cooperation in conducting this study.

I take this opportunity to thank the Members of NDMA for their unwavering support to this study tour as well as to other initiatives towards Disaster Risk Reduction (DRR). My special thanks are due to the team members who helped conduct the study and finalise this report. I would also like to thank the organisation and its staff for the institutional support.

V. Thiru

Dr. V. Thiruppugazh,
Joint Secretary (Policy and Plan), NDMA

1 Introduction

1.1 Situated on the western coast of the country, Gujarat lies between latitude 20° 07' and 24° 43' N and longitude 68° 10' and 74° 29' E. The State has an area of 1,96,024 sq. km. which constitutes 5.96% of the total geographic area of the country. As per Census 2011, the total population of the State is 6.04 crore comprising 3.15 crore males and 2.89 crore females.

1.2 The State comprises three regions, viz. the peninsula, traditionally known as Saurashtra, which is essentially a hilly tract sprinkled with low hills; Kutch on the north-west is barren and consists of the famous Rann of Kutch; and the mainland, extending from the Rann of Kutch and the Aravalli hills to the river Damanganga, is on the whole a level plain of alluvial soil. The plains of Gujarat are watered by four major rivers- Sabarmati, Mahi, Narmada and Tapi. The average annual rainfall over different parts of the State varies widely from 300 mm in the western half of Kutch to 1500 mm in the southern part of Valsad and the Dangs. During the summer season, the temperature ranges from a minimum of 25 degrees to a maximum of 45 degrees. During winter season, the temperature ranges from a minimum of 15 degrees to a maximum of 35 degrees.

1.3 Most parts of the State are relatively flat but the hill ranges and plateaus in the east have steep slopes. Gujarat has both sandy as well as clay-rich soils. Deccan volcanic covers large parts of the State. Both deep black cotton soils as well as rocky shallow soils are found in the Deccan Trap region. The rocky highlands of Saurashtra and eastern ranges have high slopes and low permeability zones, which have high rainfall-runoff ratios. Rainstorm in these areas may lead to flooding due to high runoffs. Most regions of Gujarat have been geologically active and have seen major transgression and recession of the sea in recent past. This has given rise to a variety of soils ranging from coastal sands to mud flats.

1.4 Kutch and Saurashtra are mostly arid and have small watersheds and river catchments. The lower reaches of the Sabarmati, Mahi, Narmada and Tapi river basins lie in mainland Gujarat. Since heavy rainstorms are common and the lower reaches of these basins are flat, flooding affects a number of stretches. Rainstorms are also common at the western edge of the Aravallis and the Satpuras in north

and northeast, which cause flood discharge in Banas, Sabarmati and Mahi rivers. As these rivers disgorge hilly terrain to flat lands, floodwaters spread out and damage large populated stretches en route. Cities like Ahmedabad, Vadodara, Surat, Bharuch, Navsari and Valsad lie in such flat alluvial plains.

1.5 Southern Gujarat is endowed with moderate to high rainfall, with substantial water resources concentrated in Narmada and Tapi, which have their catchments in the Central uplands of the Indian peninsula. Occasional heavy rainstorms in their middle and upper catchments can cause heavy flooding in these river basins.

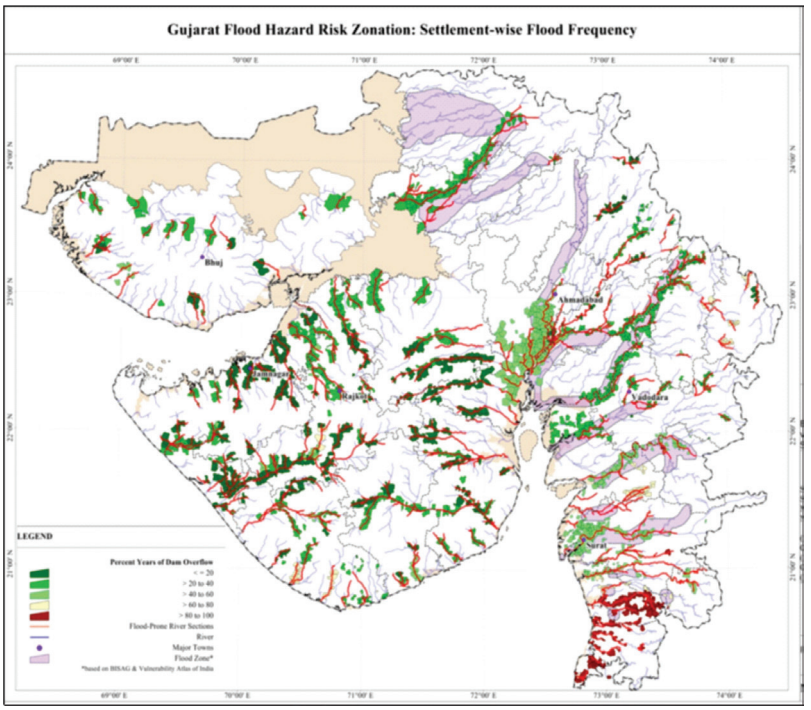
2 History and Vulnerability to Floods

2.1 Almost all the major rivers flowing through the State pass through a wide stretch of very flat terrain before reaching the sea. These flat lowlands of the lower river basins are prone to flooding due to occasional heavy rainstorms in the middle and upper basins. Fairly impervious catchments and steep sloping upper catchments can concentrate runoff to cause heavy short duration floods, which can be devastating in the small river basins of Saurashtra and Kutch.

2.2 Saurashtra and Kutch regions are surrounded by the sea. The convective upwelling of humid air over these landmasses cools as the air mass rises up, resulting in humid air quickly reaching saturation temperature and consequent heavy downpours. Favourable conditions for these events happen occasionally during the monsoons. In northern and central Gujarat, monsoon circulation is shallow and overrun by dry air from north circulating anti-cyclonically, inhibiting proper cloud formation over the region. Due to this, these regions receive low rainfall with a highly variable distribution in spite of high perceptible water content in the atmosphere. Rainfall in this region mostly occurs in spells associated with depressions originating in the Bay of Bengal, and passing across the country and curving over Rajasthan and Northern Gujarat. These downpours can result in severe floods in parts of Rajasthan and Gujarat. These impacts can extend into flat alluvial plains of central Gujarat. In the arid and semi-arid zones, the extreme rainfall is about 50-70% of the average rainfall.

2.3 In years with heavy rainfall, it is likely to experience major floods. Most of the dams built in these regions have small storage areas compared to the catchment size. While their design ensures that they remain completely filled most of the years, they are likely to overflow during higher than normal rainfall years. This overflow and natural runoff downstream of the dam can combine to cause major floods in flat lowlands found in the lower basin areas. While the dams are able to protect the 'covered area' from drought and floods during normal years, they are largely ineffective during heavy rainfall years.

2.4 Several floods have ravaged the State since historical times with an average of four flood events in a decade. The past decade and half has been even worse as six flooding events occurred in 2003, 2004, 2005, 2006, 2013 and 2015. The floods are reported once almost every two years in the less developed districts of Gujarat,



located in Saurashtra, Kutch and Northern Gujarat. Ahmedabad, Surat and Bharuch cities have also been affected as they are located on the flat alluvial plains of major rivers.

2.5 In 1997, flooding affected Mehsana, Gandhinagar, Ahmedabad, Kheda, Sabarkantha, Vadodara, Banaskantha and Surendranagar. The 1998 flood was one of the most severe in remembered history and caused medium to heavy damage across the State. Heavy rains and consequent flooding in 2004 also caused widespread damage particularly in the Surat, Navsari and Bharuch districts. The flood of 2006 affected 20 districts, 132 talukas and more than 8,000 villages while the 2013 flood affected 14 districts and around 1568 villages. In 2015, heavy rain and flood also caused widespread damage particularly in Amreli and Banaskantha districts.

2.6 In 2004, Gujarat State Disaster Management Authority (GSDMA), as part of preparing the Hazard Risk and Vulnerability Atlas for the State, prepared a flood hazard map for the State.

2.7 The Figure above shows that almost all parts of Gujarat are flood prone, irrespective of size of their catchment areas. It has to be noted that the flood prone villages, as classified by the Flood Control Cell of the State Govt., is based on the settlements affected. The Flood risks in Saurashtra are lower than the flood risks in the plains of Southern Gujarat. The relatively flat plains in the lower basin areas with hilly catchments in the upper parts of South Gujarat accentuate flood risks.

3 Floods of 2017 and Rationale of the present Study

3.1 Gujarat receives more than 90% of its annual rainfall during the southwest monsoon season extending from June to September. During July 2017, extremely heavy rainfall was recorded in Banaskantha, Patan, Surendranagar, Aravalli and Morbi districts. The average rainfall in Gujarat (in last three decades) ranges from less than 380 mm in Kutch to more than 1300 mm in South Gujarat. The State's average annual rainfall for the period 1987-2016 is 810 mm. By July 2017, the State had received 81.26% of the rainfall of the season.

3.2 In 2017, the monsoon commenced early with heavy rainfall for 3-4 days in July in north region of Gujarat. Usually, Gujarat gets its rainfall either from the system developed in the Bay of Bengal or the Arabian Sea. In 2017, both the systems got activated simultaneously. Moreover, low-pressure areas over the system emerging from the Bay of Bengal, which travelled across central India to reach Gujarat, particularly Banaskantha, Patan, Aravalli, Surendranagar and Morbi districts, aided the heavy downpour. By July 21st 2017, the State had received almost half (45.90%) of the entire season's average rainfall. In the next seven days, it received a quarter of the season's rainfall (26.57%). Surendranagar was first hit by heavy downpour that started from July 14. The district received over 110 mm of rainfall – nearly 20% of its annual average in nearly 24 hours on July 21-22, 2017. Banaskantha too recorded a whopping 257 mm of rainfall, nearly 40% of the annual monsoon rainfall in nearly 24 hours on July 24-25, 2017. The flood situation compounded further with a major breach in the Narmada canal near Khariya village, Kankrejtaluka, Banaskantha. State reservoirs, both natural and man-made, were already full. Unprecedented rainfall during July 2017 resulted into very heavy inflow into the dams such as Sipu, Dantiwada, Machhu, Dharoi across rivers such as Banas, Bhogavo, Sipu, Sabarmati etc.

3.3 Banaskantha reported 163.02% of annual average rainfall particularly during 24th-27th July, 2017. Dantiwada taluka and Deodar taluka recorded 252.55% and 226.82% rainfall respectively against their annual average rainfall during that period.

3.4 Patan received 138.28% rainfall against annual average during 24th July - 27th July, 2017. Radhanpur and Sidhpur talukas, with 170.38% and 156.44% rainfall against

annual averages respectively, were on top amongst districts that received highest rainfall during that period.

3.5 Ahmedabad district, City taluka and Bavlataluka reported 81.16%, 107.86% and 115.60% rainfall respectively during 23 - 27 July, 2017. During 24 - 27th July, 2017, Gandhinagar district, Kaloltaluka and Gandhinagartaluka received 127.24%, 194.12% and 107.11% rainfall respectively against their annual average rainfall.

3.6 Flash floods caused widespread devastation in Banaskantha. In fact, heavy downpour as well as outflow of water from dams severely affected many districts. Sipu and Dantiwada dams, which reported an outflow of 2.5 lakh cusecs and 2.3 lakh cusecs of water respectively, were put on high alert.

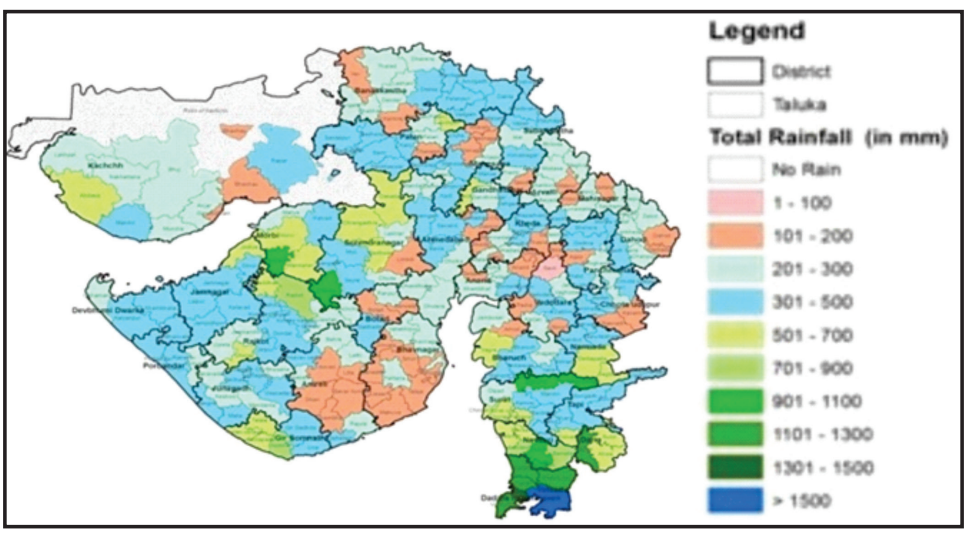


Fig 1 - Taluka wise cumulative rainfall (In mm) at 8:00 Hrs on 21st July 2017

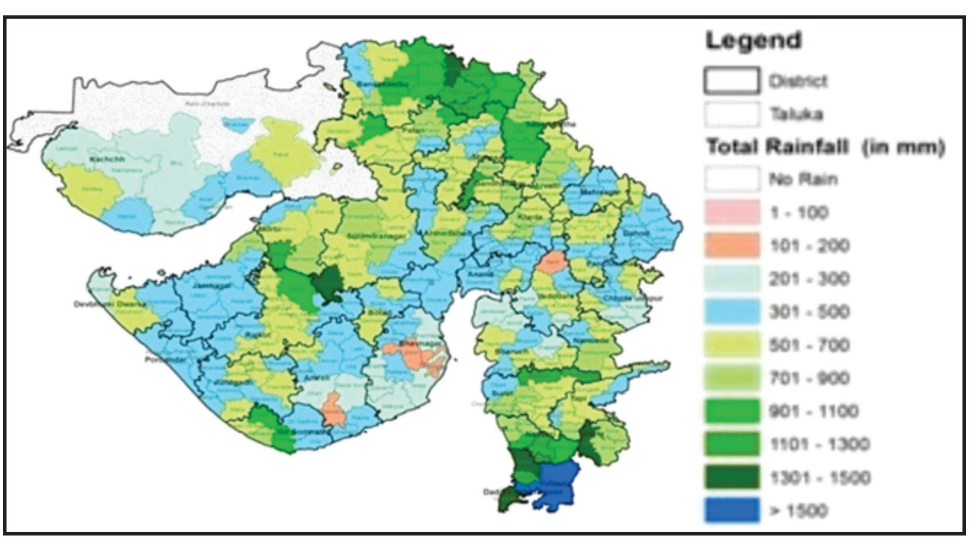
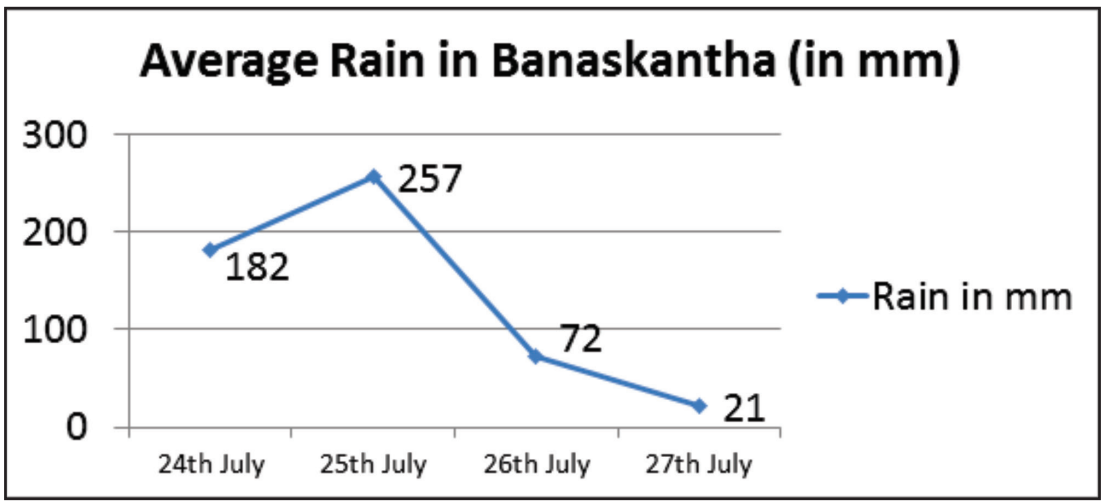
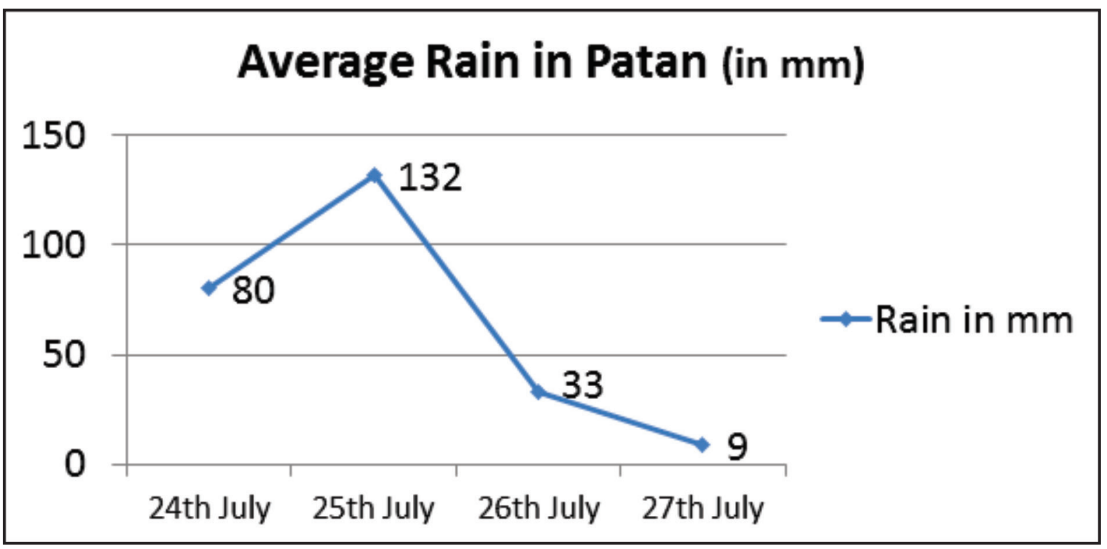


Fig 2 - Taluka wise cumulative rainfall (In mm) at 8:00 Hrs on 27thJuly 2017



Graph showing rain intensity readings from 24th July to 27th July 2017 of each day mentioned for Banaskantha District



Graph showing rain intensity readings from 24th July to 27th July 2017 of each day mentioned for Patan District

3.7 Excessive rainfall over a very short span of time (21-28 July, 2017) led to water logging, overflow of dams, flash floods, etc. During the same time, Patan, Banaskantha, Surendranagar and Morbi received a rainfall of 138.28%, 158.33%, 125.68% and 147.82% against their average annual rainfall respectively.

3.8 Following table shows rainfall data of the worst affected districts during the above mentioned period:

District	Average Rainfall (1987-2016) (mm)	Rainfall up to July 23, 2017(mm)	Rainfall July 24 to 27, 2017(mm)	Rainfall % of 4 days against average rainfall	Total Rainfall up to July 27, 2017(mm)	Total Rainfall against Average Rainfall (%)
Aravalli	856	369	297	34.7	665	77.68
Banaskantha	600	579	372	62.0	950	158.33
Morbi	491	643	83	16.9	726	147.82
Patan	568	527	248	43.7	775	136.52
Surendranagar	555	621	76	13.7	697	125.68
Average	**614**	**547.8**	**215.2**	**34.2**	**762.6**	**129.206**

3.9 On 24 July, 2017, the upper catchment area of Banas river basin in Rajasthan experienced heavy rainfall leading to a high discharge of 2.5 lakh cusecs of water from Dantiwda Dam against a discharge of 20,000 cusecs. This led to inundation and flooding, especially in Banaskantha and Patan districts.

3.10 Consequent floods submerged large areas resulting in heavy loss of lives and damage to public and private properties. Many houses got washed away and many were filled with mud up to 4 feet, trapping people and damaging various infrastructures.

Rationale of the present Study

3.11 Hon'ble Prime Minister of India outlined a ten-Point Agenda for Disaster Risk Reduction (DRR) in his inaugural address during the Asian Ministerial Conference on Disaster Risk Reduction in November 2016. One of the highlights of the agenda points included learning lessons from each disaster and applying them for better management of any future disaster.

3.12 Taking a cue, NDMA conducted a study of Chennai Floods of 2015 and Vardha Cyclone of 2016 in consultation with Government of Tamil Nadu during June 2017. A study report containing the 'Lessons Learnt and Best Practices adopted by Government of Tamil Nadu' before, during and after these disasters was released by the Hon'ble Union Home Minister on the 13th Formation Day of the National Disaster Management Authority. NDMA shared this study report with all the States and Union Territories to help them improve their preparedness to mitigate the impacts of floods by adapting best practices in their States/UTs. The report has been described as useful by many States/UTs.

3.13 Based on the feedback, this study was taken up to document the best practices adopted by Gujarat for 2017 flood so that lessons learnt may be put to use by other States/UTs for flood preparedness. Teams from both National Disaster Management Authority and Gujarat Institute of Disaster Management (GIDM) were constituted. Some of the team members visited the worst flood-affected areas, especially Banaskantha District, and interacted with officials, affected community members and other stakeholders. The composition of the teams is placed at Annexure I.

Objectives of the Study

3.14 The objectives of the study consisted of the following:

- To evaluate the impact of the 2017 flood in Gujarat, especially in Banaskantha district. To identify lessons learnt by district administration from flood management and subsequent measures taken to prevent the outbreak of epidemics.
- Suggest recommendations and disseminate the best practices to other States and stakeholders.

Field Visit and Interaction with Government Officials and other Stakeholders

3.15 The team from NDMA reported to Gujarat Institute of Disaster Management (GIDM), Gandhinagar, Gujarat on 30th August 2017. Preliminary discussion and *modus operandi* to undertake study was decided after discussion among the team members from both NDMA and GIDM. Shri P. K. Taneja, DG, GIDM also briefed the team members about the floods of 2017 and various steps taken by the Government of Gujarat and concerned District Administration to mitigate its impact. Afterwards, team members visited Banaskantha, one of the worst affected districts, on 30th and 31st August 2017. Team members also interacted with Shri Pankaj Kumar, IAS, Principal Secretary, Revenue, Government of Gujarat on 01st September 2017.

4 Management of Floods by Government of Gujarat – An Overview

Introduction

4.1 Unprecedented rains lashed major parts of Gujarat in the 3rd and 4th weeks of July 2017 with the development of low-pressure zone. The districts of North Gujarat along with Banaskantha, Patan and Surendranagar were the worst affected.

Visit to the Office of Principal Secretary, Revenue, Government of Gujarat

4.2 NDMA Team visited the office of Principal Secretary, Revenue on 01st September 2017 and interacted with Shri Pankaj Kumar, IAS, Principal Secretary and Shri A. J. Shah, IAS, Commissioner of Relief. Principal Secretary gave a detailed account of the flood of 2017 and measures taken by Government of Gujarat. The Team also visited State emergency Operation Centre (SEOC) and interacted with officials. Information received during these interactions is mentioned in the subsequent paragraphs.

Preparedness Measures by State Government

4.3 Government of Gujarat had taken several preparedness measures pre-monsoon to deal with any disaster situation. One of such measures included updation of District Disaster Management Plans. State government held a review meeting with all the Resident Additional Collectors and directed them to update all the information related to flood preparedness measures. Subsequently, all the District Disaster Management Plans were revised.

4.4 Government of Gujarat has constituted a Weather Watch Group which meets every week during the monsoon season. This group collects information, interprets it and subsequently disseminates it. The composition of the Weather Watch Group is at Annexure II. In 2017 Monsoon Season, frequent meetings with the Weather Watch Group were held and weather forecasts were converted into district-wise warnings and these warnings were further disseminated to the concerned district. It was noted that by and large these weather predictions and warnings were accurate.

4.5 The State government was also in continuous touch with the India Meteorological Department (IMD) to keep a watch on weather conditions and rainfall. Administrative

machinery in the Districts concerned were made aware of the IMD's forecast and directed to widely disseminate the information and plan prior evacuation of people along with their belongings to safer places. In all, about 1,12,878 people of which 68,672 people were from Banaskantha and Patan, were evacuated in time thus preventing a huge loss of life.

4.6 Based on the IMD forecast, State Government prepositioned teams of NDRF, SDRF, Fire & Emergency Services, etc. in the districts as a precautionary measure. State Government also requested Army, BSF and Air Force to be ready for deployment in case of need.

State of Preparedness –Media Handling

4.7 Collectors of all 33 districts are registered on Twitter. The govt. published a combined list of these Twitter accounts to enable people to reach out to the district administration in disaster situations. Twitter also served as a two-way communication channel. The Government encouraged people to tweet about the ground-level situation in their areas along with photographs. This not only helped in assessing the ground-level situation but also helped the administration in prioritising areas for rescue and relief operations. In Vapi, the rescue teams were directed through using twitter messages. This transparent system instilled confidence among people about the level of alertness of the administrations to handle emergency situations.

4.8 Four WhatsApp groups - Revenue Department, Crisis Management, Crisis Core and Gujarat Rescue (Gujarat Govt. and Defence Forces) - were formed. These communication channels helped in disseminating forecasts and warnings, giving instructions and receiving feedback among internal stakeholders.

4.9 The entire collectorate, including the lower-level field officials, was active on Twitter. This served as an important medium for communicating with the public.

4.10 The role of media becomes important in any crisis. In a disaster situation, media looks for accurate and timely information. Leveraging the wide government network, the State Govt. sent out precise and continuous information through Twitter. Local as well as national media houses picked up that information as Breaking News. For example, two people were stranded on an island in Bhogavo river overnight. Various attempts to rescue them failed. They were finally rescued by Coast Guards. The District Collector of Surendranagar was tweeting out live videos of the on-going operations. Specific information such as the names of the closed roads, traffic

diversions, etc. was published on Twitter. These efforts attracted a lot of appreciation from the public.

4.11 Normally in such disasters, rumours are a common feature and that take their toll. However, only one instance of spread a rumour was reported through the entire flooding period. One evening, all the channels were carrying a report about the Sipu Dam failure. Had this been true, it would have meant an outflow of at least 2.3 lakh cusecs of water and consequently devastation of entire area downstream of the dam. The Revenue Department immediately confirmed the facts from the Irrigation Department. An official tweet, stating that the Dam was safe, was broadcasted. The channels picked up the information and the rumour died down instantly. Secretary (Irrigation) interacted with the media channels many times soon afterwards and provided exact technical output. Timely and effective communication thus became the crux of successive crisis management. It enabled to check any panic situation.

4.12 Two Press briefings were held daily- one in the morning and other in the evening - at the State Emergency Operation Centre.

Rescue Operations

4.14 Gujarat Government also appreciated the work done by NDMA on social media. “Do’s and Don’ts” for preparedness and response to various disasters is a good initiative for awareness generation. NDMA keeps a close watch on disaster situations across the country and captures real time information about disaster situations across the country. Gujarat Government re-tweeted NDMA’s tweets so that it reaches a larger audience.

4.15 On the very first day, a meeting of senior-level officers of all agencies that were to be engaged in rescue operations (e.g., Army, Air Force, NDRF, SDRF and Coast Guard) was organized. A WhatsApp group (Gujarat Rescue) of all these agencies and the administration was formed so that any requirements for rescue, relief, air sorties, etc. are communicated to all the concerned instantaneously. One liaison officer from each of these agencies was included in this group.

4.16 In addition, an officer from each of these agencies was present in the State EOC (SEOC) 24X7.

4.17 A videoconference was conducted at night on July 25, 2017 with the Collectors of Banaskantha and Patan from the State Headquarters in which Heads of the Defence Forces stationed in Gujarat also participated. This was to boost the morale of the district administration and to take stock of the situation.

4.18 Army set up base camp hospitals in Dharah, Kankrej with the help of State administration. While State supplied medicines, Army provided healthcare workers and doctors.

4.19 Multiple air sorties were conducted. Indian Oil Corporation cooperated wholeheartedly in refuelling choppers. Again, Deesa air base could only handle four choppers while the requirement was for 17 choppers. Additional helipads were identified and set up quickly so that no time is lost in conducting the sorties once the choppers arrive.

4.20 Thus, a three-tier rescue planning was done for seamless communication- Chief Secretary and top officers from these agencies at the top, middle-level officers in the WhatsApp group and relatively junior officers manning the SEOC.

4.21 During the crucial 4-5 days, two meetings (11 AM and 6 PM) of all Central as well as State agencies, Defence Forces and the India Meteorological Department (IMD) were conducted with the Chief Secretary chairing them. This ensured better coordination among all agencies.

4.22 All choppers from nearby air bases (Jamnagar, Ahmedabad, Jodhpur, Phalodi, Uttarlai) were engaged from 26th July 2017 onwards.

4.23 Inflatable boats were mobilized from Municipal Corporations which were not affected by floods. These 10 boats were then provided to SDRF. Another six additional boats were received from NDRF. Hence, a total of 16 extra boats were deployed which enhanced the capacity to undertake rescue operations (Each NDRF team normally has 3-4 boats).

4.24 In Jamnagar, the Fire Brigade team of the Corporation helped the district administration to carry out combat and rescue operation in other parts of the district.

4.25 Ten NDRF teams were normally stationed in Gujarat (Five each in Ahmedabad and Baroda). Eight teams reached via rail from Pune Battalion.

4.26 As the situation became even more grave, 14 more NDRF teams were flown in from Delhi, Mundli and Arakonam. All these teams landed in Ahmedabad within a span of five hours. All logistics arrangements (vehicles, planning, etc.) were done by the time these teams arrived so that precious time is saved and they are immediately mobilised for the operations at designated locations.

4.27 For example, One NDRF team that came from Ajmer by train had to get down at Sabaramati railway station. However, the train had only a two-minute stoppage

there after which it would take the train another 30 minutes to the next nearest station (Ahmedabad city). Then again, it would take some time to navigate the congested by-lanes of the old city. To expedite the process, the State Govt. coordinated with Railways and the train halted at Sabarmati for 25 minutes which were needed by the NDRF team to de-board. This is an excellent example of State-Centre coordination.

4.28 As South Gujarat was the least affected but receives maximum rainfall in the State otherwise, NDRF teams from South Gujarat were strategically withdrawn and deployed in other areas. This was done in view of the availability of NDRF teams in Pune which could be mobilised at a short notice in case of an emergency.

4.29 The railway colony in Morbi got inundated and an NDRF team was immediately sent for rescue operations.

4.30 A team of three railway officials went to check the tracks and got stranded. They were rescued by NDRF.

4.31 Two deliveries were managed with the help of Air Force. A place was identified just outside the village for the helicopter to land and an ambulance was kept ready. Pregnant women were airlifted from the village, to the designated location where the deliveries took place. In another instance in Rajkot, a woman was taken to a hospital for delivery.

4.32 650 personnel of SDRF (stationed at 11 locations across the State) were also deployed for search and rescue operations. Lack of equipment was a concern. Equipment made available to Municipal Corporations through GSDMA and additional boats received from NDRF were provided to SDRF personnel. They did a commendable job despite shortage of equipment.

4.33 Rescue operations were phenomenal. At least 18,000 people were rescued. Of these, 7,000 were saved by NDRF followed by Army and Air Force.

4.34 A total of 220 BSF personnel (120 from Dantiwada camp and 100 from Ahmedabad) were also used for carrying out rescue operations.

4.35 Personnel from Indian Navy were also used for the rescue operations. Banasriver does not enter the sea, it spreads out in the Rann of Kutch. At least 6-7 lakh cusecs of water were flowing through the Radhanpur and Santalpur areas with overflowing Banas and Sipu rivers. It was decided that air sorties should be conducted to assess the damage to lives, both human and cattle, and choppers from the Navy were used for the same. Personnel from Irrigation Department

were armed with GPS coordinates and conducted air surveys of the entire river from Banaskantha and Dantiwada Dam to Rann at a very low height. This was done to find whether people or cattle have been washed away by the floods. Not a single human or animal body was found and it was confirmed that not a single human or animal has gone missing as not even a single instance of any missing person was reported from that area. Despite the massive flood, there were no undetected human deaths.

4.36 Volunteers also acted as first responders. However, there is no trained volunteer network available in the State for organized response.

4.37 Several deaths from Banaskantha and Patan were reported during these floods, due to the fact that these districts received almost a 100 per cent of their annual rainfall within these 4-5 days, they are a saucer area (aiding water accumulation) and even the neighbouring Rajasthan was registering heavy rainfall.

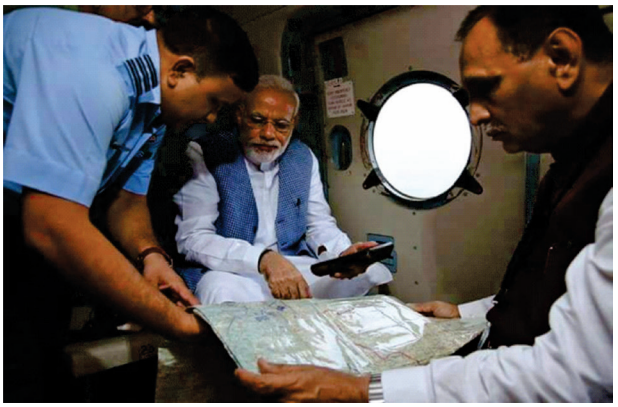
4.38 Massive shifting operations were undertaken by the district administration. In these two districts, around 70,000 people were shifted overnight (45,000 from Banaskantha). More than 1,20,000 people were evacuated across the State. All possible government agencies and other stakeholders (political parties, panchayats, community, mass media) were involved. In fact, a clear village-wise plan complete with the number of people to be evacuated was drawn and followed perfectly, arguably resulting in fewer deaths. The following lessons were drawn to successfully reduce the loss of lives in a disaster situation:

- Focus on DM Plans
- Advance Early Warnings
- Timely evacuation of people to safer locations (along with cattle)
- Swift rescue operations

4.39 These timely interventions also reduced the number of cattle deaths. In a district with a cattle population almost equivalent to the human population, the death toll is much lesser that the previous flood of 2015. A major factor behind this was the timely evacuation. Advanced warning also ensured that people moved out with their cattle.

4.40 The severity of 2017 floods is far greater (5-7 times more) in comparison to 2015 floods. Agricultural losses and damage to crops are the right indicators for judging the severity of a flood (even better that the measurement of rainfall) as they cannot be moved and are open for the devastation.

Hon'ble Prime Minister's Aerial Survey & Directions to Administration



4.41 Hon'ble Prime Minister visited the flood-affected areas and reviewed the relief and rescue operations. He also announced an interim relief package of Rs. 500 crores immediately. This included Rs. 2 lakh additional assistance in case of human death and Rs. 50,000 for those injured.

Hon'ble Chief Minister's Aerial Survey & Directions to Administration

4.42 Hon'ble Chief Minister, Shri Vijay Rupani visited and chaired a high level meeting of State official on 24th July 2017 in the State Emergency Operation Centre (SEOC). He stated that the focus of the administration should be on rescue and relief operations in the affected areas to prevent loss of lives. On the same day he visited Deesa and Palanpur, and held a meeting at Palanpur as well. Shri Rupani also made an aerial survey of Banaskantha on 24th July 2017 to take stock of the situation.

4.43 The Hon'ble Chief Minister was in constant touch with people in the talukas of Dhanera, Tharad, Patan, Radhanpur, Santalpur and others through several meetings that he held with the affected people. He also distributed cheques of financial assistance and relief material to affected people.

Relief Works

4.44 Under the directions of the State Government, relief operations and the actual implementation happens at the district level. Normally, relief operations begin only after the floods recede as the entire administrative machinery is involved in rescue operations. However, in larger districts, different areas experience different stages of flood simultaneously (water might have receded in some areas, other areas still be flooded).

4.45 It was decided that the cash dole distribution should start the moment water recedes from an area. So, both rescue and relief operations were conducted simultaneously (Immediate relief included moving people into safe shelters, arrangements for essentials like food, water, medicines, etc.).

4.46 State Govt. also enhanced the compensation amount as defined under various norms per unit across various heads (households, crop loss, etc.). SDRF norms of Rs. 3,800 per household were increased by Rs. 3,200 to Rs. 7,000 per household.

4.47 The number of days for which the compensation was to be given to each affected person was fixed at 10 days at the rate of Rs. 60 per day at the state-level itself so that there is no difference in the amount of compensation across districts. This standardisation prevented dissatisfaction among people and an issue with a potential to explode was turned into a non-issue.

4.48 In 2015, the cash doles were deposited in the bank accounts of the beneficiaries under the DBT (Direct Benefit Transfer) scheme. However, it was decided that this time, cash doles would be handed out to the affected people in cash so that it is easier for them to purchase essentials. (Arranging for the cash and managing distribution required efforts as many banks were also affected by floods).

4.49 Free distribution of fodder for cattle was also undertaken. Sources for grass supplies (fodder depots across the State) were identified; transportation and distribution arrangements were done. State's strong dairy network (their documentation/list of cattle owners, their distribution network) was used for free distribution of grass to the cattle owners. This was continued for about 15-20 days till the growth of fresh grass.

4.50 Cattle assistance was enhanced from Rs. 30,000 to Rs. 40,000 for each cattle loss. Also, the cap on the number of cattle for which assistance was made available was increased from three to five.

4.51 By 3rd August 2017, the State Government came up with a special package of Rs. 1,500 crores for Banaskantha and Patan. Relief norms were enhanced without exception.

4.52 Different packages were made for different classes of affected people in consultation with them so that tailor-made assistance factored in their needs is provided to them. NDRF/SDRF norms talk of agricultural and cattle compensation. The State Govt. announced packages for even those who are not otherwise covered under these norms.

4.53 A special package was announced for food grain merchants. They wanted to avail themselves of the interest subsidy for which the administration collaborated with the banks. A special package was announced for shop owners and hand-driven lorries for Dhanera city and other parts of Banaskantha and Patan districts.

4.54 No industrial package was required as there are no industries in the affected areas.

4.55 Crop Insurance - Hardly 10-15 % farmers had crop insurance. The Chief Secretary called a meeting of all insurance companies to streamline the process of settling insurance claims. Also, an RBI circular states that banks can restructure farmer loans if a State Govt. circular declares a more then 33 % damage to the crops. Accordingly, the State issued a notification to that effect so that loans are restructured. (Reference of the Circular needs to be provided by GIDM)

4.56 Separately, crop assistance was provided under NDRF/SDRF norms. This assistance was independent of crop insurance compensation. Norms for the same were enhanced in two ways - assistance amount was substantially increased for both crop loss, crop insurance and land erosion and while only up to 2 hectares land is eligible for crop compensation under SDRF norms, it was enhanced to 10 acres. (To be discussed/ clarified by GIDM)

4.57 Disaster Fund (75 % contribution by GoI and 25% contribution by State Govt.) is governed by NDRF/SDRF norms. Over and above this, State Govt. is free to give as much as it wants to from its own funds.

4.58 Electricity Bill for farmers was also waived off for a period of three months.

Relief Package

4.59 The relief camps were opened with immediate effect for people affected. State Government immediately announced financial assistance in case of human death, injury, cash doles and fodder. The disbursement of financial assistance was made in cash through district administration.

4.60 State Government declared special relief package of Rs.1500 Crores for severely affected Banaskantha and Patan districts. Key highlights of package are as under:

- Rs.1336 Crore for Agriculture and land reform
- Waiver of Rs.50 Crore towards electricity bills of farmers affected for three months
- Rs. 20 Crore for financial assistance in case of loss of livestock

- Rs. 15 Crore for trade, commerce and industries
- Rs. 79 Crore for the schemes for relief measures of Revenue Department

4.61 The rates of relief assistance were revised as under:

- Revised from Rs.6800/- to Rs.10000/- for crop loss in non-irrigated area
- Revised from Rs.13500/- to Rs.20000/- for irrigated area
- Revised from Rs.12800/- to Rs.25000/- for land erosion
- Revised from Rs.60000/- to Rs.80000/- for severe land erosion
- Assistance in Cash of Rs.75000/- for affected permanent large cabin shop holder
- Assistance in Cash of Rs.15000/- for affected permanent small cabin shop holder
- Assistance in Cash of Rs.5000/- for affected moving shop on trolley holder
- Waiver of interest on bank loan of up to Rs 10 lakh for two years to the merchants having monthly turnover of more than Rs.5 Lakh

Cattle Grass Distribution at free of cost

4.62 The grass in total quantity of 8,69,510 Kg distributed in Banaskantha by availing it from Dahod. 42,520 kg grass was supplied to Patan from Rajkot. Morbi and Maliya talukas were provided 1,26,750 kg grass despatched from Bhavnagar.

Speedy restoration of essential services (basic infrastructure such as roads, power, water, transportation)

4.63 All information about damage, diversions, restoration shared with the public through press conferences, Twitter, Facebook, etc.

4.64 Among cities, only Dhanera city was fully and Radhanpur was partially inundated. Banking services, Postal Services and Telecommunications were not badly affected.

4.65 Even though the villages were cut-off physically, communication channels were not cut off. Youngsters from these villages used local materials to make temporary boats and went to the nearest unaffected areas to recharge mobile phones' battery in bulk.

Quick action taken for restoration

4.66 Following actions were taken by the State Government and District Administrations to bring situation to normalcy till the date the visits to the affected areas were made by the Study Team:

- 836 roads were restored out of 952 roads for smooth transportation; total length of damage roads 15,048 Kms.
- Restoration of electricity supply in 609 villages of Banaskantha district and 208 villages of Patan district.
- Water supply started in 568 villages out of 712 affected villages of Banaskantha district. Water was provided in 144 villages through water tankers. Similarly, water supply started in 205 villages out of 328 villages of Patan district. Water has been provided to 108 villages of Patan district through water tankers.
- All 2281 trips have been started in Banaskantha district and 2277 trips of Patan district by State Road Transport Corporation.
- Sanitation: Disposal of stored water and removal of mud, disposal of dead animals, complete cleanliness and preventive measures to prevent epidemic.

Use of Drones - New Initiative Adopted

4.67 Some people were stranded at Surendranagar for about 24 hours and rescue agencies were also not able to rescue them. Drones were used to supply food packets, water, blankets and a mobile phone with SIM to keep communication open.

Preventive Measures against diseases

4.68 Post flood prevention of outbreak of epidemic was a challenging task before the State Government. State Government took following measures to prevent any outbreak of vector borne diseases:

- 22,88,826 people were surveyed by 961 teams of Health Department in the affected areas of State and 30410 people were medically treated on the spot.
- 90 Medical Officers and 40 Health Workers have been deputed in the affected areas of Banaskantha and Patan. Presently, health oriented survey and inspections are carrying out by 225 Medical Officers and 2012 Health workers resulting in coverage of 6,31,682 people during survey.
- Adequate quantity of medicine, chlorine tablets and other essential medicines were also made available.

4.69 No outbreak of epidemics was reported. Animal carcass, rotten food grains, etc. were disposed of with proper care. Health and sanitation work was carried out in areas where water logging was reported.

Long-term measures

4.70 The Government has decided to shift these villages on the lines recommended by National Resettlement and Rehabilitation Guidelines. New village sites have already been identified and the modalities need to be worked out.

4.71 The next stage is the process of consultation with the villagers. For this, district-level and State-level Committees are formed. The district-level Committees will start consultation process with affected people who have to be shifted. Drainage study of the entire area and feasibility of interlinking rivers is also required.

5 Prevention of Post Flood Epidemic
– A Case Study of Dhanera Taluka, Banaskantha District

Introduction

5.1 Banaskantha lies in North Gujarat and boasts of geographical diversity – from Aravali hills to Rann of Kutch. It has dry arid climate. It has 14 Talukas with 1,234 villages. As per Census 2011, it has a population of 31,05,000 and a population density of 290 per sq. km. Four rivers - Banas, Ripu, Rel and Saraswati- flow in the district. It has three major dams – Dantiwada , Sipu and Mukteswar. Animal Husbandry, dairy, horticulture, and agriculture are the major economic activities in the district.

Floods of 2017

5.2 Gujarat experienced very heavy rainfall in the last week of July 2017. Banaskantha and Patan were the worst affected, experiencing extremely heavy rainfall during 24th-27th July 2017.

5.3 In the first month of the monsoon season, these areas normally receive around 30% of their annual rainfall. However, in 2017, these districts saw a record breaking 163% and 140% of their annual rainfall during the same period.

5.4 Dhanera taluka in Banaskantha recorded 231 mm and 275 mm rainfall on 24th and 25th July respectively, while Dantiwada taluka recorded 342 mm and 463 mm rainfall in these two days.

Table 5.1 Episodes of extremely heavy rainfall in Banaskanta

Taluka	Rainfall in mm	Rainfall in mm
	24th July	25th July
Amirgadh	246	337
Bhabhar	92	174
Danta	179	167
Dantiwada	342	463
Deesa	212	210
Deodar	172	284
Dhanera	231	275

Kankrej	120	154
Lakhani	221	305
Palanpur	255	380
Suigam	72	122
Tharad	119	180
Vadgam	200	357
Vav	82	187

5.5 More than 64 inches rainfall was recorded within 48 hours at Mount Abu, Rajasthan, and hence, water from the highlands flowed to Banaskantha.

5.6 Very heavy rainfall in North Gujarat and parts of Rajasthan necessitated the release of 2.3 Lakh cusecs of water from Dantiwada dam on 24th July 2017. Another 2.48 lakh cusecs were released from Sipu dam against 20,000 cusecs during the normal monsoon.

5.7 Dhanera, which has a population of 30,000, was flooded up to 10 feet. The town was totally cut off for 48 hours as all of its approach roads were inundated. Power and telecommunication lines had also crashed.

5.8 The Banas river catchment area received very heavy rainfall on 24th and 25th July 2017. Little Rann of Kutch, which drains Banas river, got saturated due to very high inflow of water. Tharad, Dhanera, Kankrej, Lakhani, Suigam and Deesataluka of Banaskantha district; and Santalpur, Sami and Harij taluka of Patan District were heavily flooded.

Preparedness measures

5.9 Having received the forecast warning from the Indian Meteorological Department (IMD), the State Government was geared up for the worst. The local administration were intimated 3-4 days in advance so that they have sufficient time to prepare for the upcoming situation. The government also made sure that central agencies like NDRF, Army and Air Force were positioned at strategic locations.

5.10 State Government ordered all districts to be on high alert and a and a total of 1,12,878 persons (68,572 people from Banaskantha and Patan) were evacuated and moved to safe locations. These people were provided temporary shelters complete with food and primary health assistance arrangements. This timely action saved lives that would otherwise have been exposed to severe threat.

5.11 The Hon'ble Chief Minister, Shri Vijay Rupani, supervised the overall operations. He conducted regular review meetings directed all concerned State agencies to ensure immediate rescue and adequate relief operations.

5.12 Shri Rupani visited the flood-affected areas of Palanpur and Deesa on July 24, 2017 to review the situation and provide necessary guidelines to the administration to take effective measures. He also reviewed the conditions in Banaskantha and Patan and directed the administration to ensure that there is no loss of life in the region.

Visit to Palanpur

5.13 The NDMA/GIDM team visited Palanpur on 30th August 2017 and interacted with district officials. During an initial meeting in the office of Assistant District Collector, Dr. Navnath Gavhane, IAS (Probationer) gave a detailed account of various measures related to response and relief work taken by the district administration. Shri Dilip Rana, District Collector, gave a detailed power point presentation about the precautionary measures taken by the District Administration. He also highlighted the measures taken for prevention of outbreak of post flood epidemic.

Visit to Dantiwada and Sipu Dams

5.14 The team also visited the Dantiwada and Sipu dams and interacted with concerned officials and engineers on 31st August 2017. A detailed on-site presentation was given by the Dam site by the engineers about the breach of training wall(s).

IEC/ Information and warning/ alert Dissemination

5.15 As soon as the district administration received the heavy rainfall warning. It pressed the public address system of the Revenue Department and Police vans into service. Warning SMSs were sent to all the officials of the, representatives of Panchayati Raj Institutions, functionaries of the Urban Local Bodies and general public. Social Media – particularly WhatsApp and Twitter - were also extensively used for dissemination of warning and alerts. Print and Electronic media were requested to widely disseminate the warnings and alerts.

Sat, 22/07/2017

હાલ વરસાદ ની પરિસ્થિતિ મા કોઇ કોઇ ગામો મા પાણી ભરાઈ ગયા હોય્ તેવી સ્થિતી છે તો લોકોને સલામત સ્થળે ખસી જવા વિનંતી છે. કલેકટર બનાસકાંઠા
18:57

Wed, 26/07/2017

મૌસમ વિભાગ દ્વારા હજુ પણ વરસાદ પાડવાની આગાહી આપવામાં આવી છે જેથી સર્વ નાગરિકોને સલામત સ્થળે ખસી જવા વિનંતી છે કલેકટર બનાસકાંઠા
17:07

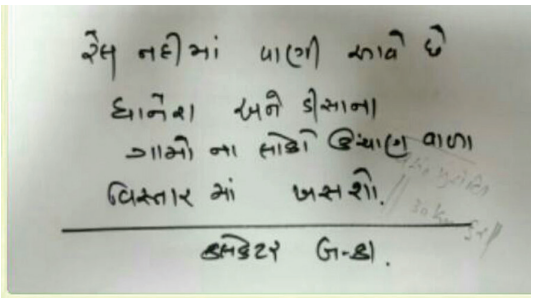
મૌસમ વિભાગ દ્વારા હજુ પણ વરસાદ પાડવાની આગાહી આપવામાં આવી છે જેથી સર્વ નાગરિકોને સલામત સ્થળે ખસી જવા વિનંતી છે કલેકટર બનાસકાંઠા
17:36

Mon, 24/07/2017

દાંતીવાડા ડેમમાં વરસાદી પાણીની આવક વધતાં ડેમના દરવાજા ખોલવાના થતાં હોઇ નદી કિનારાના ગામોના લોકોને સાવચેત રહેવા તથા સલામત સ્થળે ખસી જવા અને જરૂરી તકેદારી રાખવા જણાવવામાં આવે છે કલેકટર બનાસકાંઠા
14:03

સીપૂ ડેમના દરવાજા ખોલવામાં આવેલ છે. જેથી વરસાદી પાણીની આવક વધતાં ભયજનક સપાટી થતાં નીચાણવાળા વીસ્તારોમાં તથા નદીકાંઠાના વિસ્તારોમાં રહેતા લોકોને સાવચેત રહેવા તથા સલામત સ્થળે ખસી જવા અને જરૂરી તકેદારી રાખવા જણાવવામાં આવે છે કલેકટર બનાસકાંઠા

16:33



Thu, 27/07/2017

ભારે વરસાદના કારણે તળાવો અને નાળા ભરાઈ ગયા છે ન્હાવા કે સેલ્ફી લેવા જવું નહીં નદી / તળાવમાં સેલ્ફી લેતા, ન્હાતા ઘણા લોકોએ જાન ગુમાવેલછે તળાવ/ નાળામાં જતાં ટાળવું / ન્હાવા પડવું નહીં કલેકટર બનાસકાંઠા

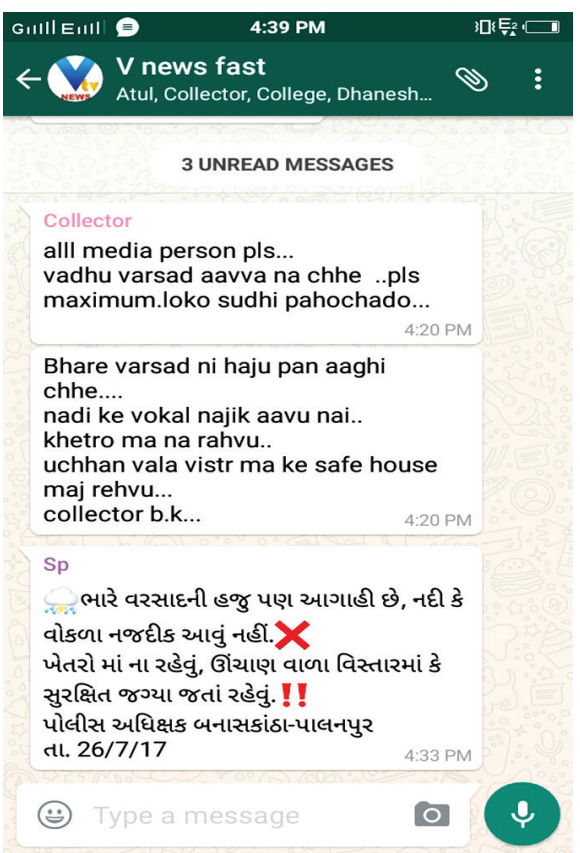
13:53

દાંતીવાડા ડેમમાં પાણીની આવક વધતાં 10 હજાર ક્યુસેક પાણી નદીમાં છોડવામાં આવનાર હોઇ તાત્કાલિક ઊંચાણવાળા વિસ્તારમાં ખસી જવા વિનંતી છે કલેકટર બનાસકાંઠા

17:39

બનાસકાંઠા જીલ્લામાં તેમજ ઉપરવાસમાં ભારે વરસાદ પડવાથી નદીઓમાં તેમજ નીચાણવાળા વીસ્તારોમાં પાણી ભરાઈ ગયેલ હોઇ લોકોને સાવચેત રહેવા અને સલામત સ્થળે ખસી જવા તથા જરૂરી તકેદારી રાખવા જણાવવામાં આવે છે કલેકટર બનાસકાંઠા

20:54



Prevention of Post Flood Epidemics – A Case Study of Dhanera Taluka, Banaskantha District

5.16 Dhanera Taluka of the Banaskantha district was the worst affected by the flood. Its Agricultural Product Marketing Complex (APMC) was completely submerged and the rotting of the stored food grains posed a potential health hazard. In such a situation, chances of outbreak of epidemics were very high. The State Government deputed a senior IAS officer to organize cleaning up operations in the taluka within five days.

Health and Sanitation Drive:

5.17 The rotting grain in the APMC and garbage strewn across the streets created a potential health hazard. A massive health and sanitation operation was launched under the direction of the Chief Minister himself. The Municipal Commissioner of Surat was deputed to head the operations.

5.18 About 64 dumpers, 70 JCBs, 3 earth movers, 23 tractors, 5 super suckers, 2 mud pumps, 2 fire tankers and 7 fogging machines were deployed. 466 safai karmachari, 36 supervisors, 9 officers were engaged for the cleaning operations. The entire town was cleaned and disinfected. A total 9,164 MT of rotting grain was removed; 234 APMC godowns and 64 APMC sheds were cleaned. At least 10,935 MT of garbage was removed from the town within a week. 27.15 lakh litres of slurry.

- A door-to-door health survey was done by 14 medical officers and 42 health workers. Essential services - electricity, telephone and banking - were fully restored quickly.
- Distribution of *ex-gratia* compensation and cash assistance for the affected people has completed.

Special relief works done at Dhanera

5.19 Special relief works were executed under the direct supervision of Hon'ble Chief Minister, which mainly included Health, Sanitation, Water Supply and Electricity Supply etc. The cleanliness drive was completed by the team, which included 466 sweepers and 36 managerial staff of Surat Municipal Corporation and Vadodara Municipal Corporation, by using 33 tractors, 70 JCBs, 2 loaders, 3 de-watering pumps, 3 Hitachi Machines, 8 Jetting Machines, 5 Super Sucker Machines, 2 Mud Pumps, 2 Fire tenders, 7 fogging machines and 64 dumpers. Further, 17 metric ton of Malathion Powder was sprayed.

5.20 Total 7,651 metric ton of solid waste and 16 lakh litres slurry were disposed. 100% residential areas were cleaned with the help of tractors and JCBs by 7 Health and Sanitation Teams. Fogging and spraying done in 2,438 houses using 8 fogging machine by Health Department.

5.21 Door-to-door survey has been completed, which covered 3,650 houses by a team of 14 medical officers and 42 health workers. Nine medical teams attended to 1,299 OPDs.

6 Recommendations

Recommendations

6.1 Suitable institutional arrangements should be made between Gujarat and Rajasthan so as to improve preparedness for any probable flood in Banas and Sipu rivers as the two States share the catchment areas of both the river systems.

6.2 Formation of high level Expert Committee for the Dantiwada dam on Banas and Sipu rivers. This committee in consultation with the State government should take decision on-site to appropriately regulate and release water from upstream lakes/ tanks keeping in view hydrological and meteorological forecasts issued for the region. During heavy rainfall, this committee with information to the State Governments may take decisions on releasing water from lakes/ tanks/ water bodies after reviewing the inflow forecasts.

6.3 Training Walls should invariably be designed as Reinforced Cement Concrete (RCC) structures instead of coarse rubble masonry as practised in the earlier construction. Coarse rubble masonry may not withstand heavy flood as was experienced in case of Dantiwada dam during 2017 floods.

6.4 Gujarat adopted and identified Municipal Corporations as regional rescue centres and mandated therewith one of their regular activities so that they are able to operate functionally during any crisis. Such association actually helped during the floods in Gujarat. Similar practices may be replicated by other States.

6.5 Regular monitoring of flood preparedness in the vulnerable areas, collection and compilation of post disaster data, documentation of best practices and lessons learnt has to be done by the state/ district(s). This can further be used for capacity building activities.

Annexure I

Composition of Team

National Disaster Management Authority	
1	Dr. V. Thiruppugazh, IAS, Joint Secretary, Policy & Plans
2	Dr. Pavan Kumar Singh, Senior Research Officer
3	Shri Nawal Prakash, Senior Research Officer
4	Shri Shankar Mahto, Senior Consultant, Floods
Gujarat Institute of Disaster Management	
1	Shri P K Taneja, IAS, (Retd.), Director General, GIDM
2	Shri Nisarg Dave, Assistant Professor (i/c)
3	Dr. Madhumita Tripathy, Research Scientist
4	Shri Pratik Patel, Jr. Executive
5	Dr. C. P. Geevan, Independent Consultant

Annexure II

Weather Watch Group

1.	Relief Commissioner
2	Addl. Chief Secy. , UDD
3	Secretary Irrigation
4	CEO, GSDMA
5	Commissioner of Health & Medical Service
6	Information Commissioner
7	Principal Chief Conservation of Forest
8	Chief Engineer, Narmada Water Resources &Kalpasar Department
9	Director of IMD, AWD
10	Director Ag.
11	Director of BISAG
12	VC, Gujarat Maritime Board
13	Chief Engineer, CWC
14	Scientist, ISRO
15	Chief Engineer, Electricity
16	Commissioner, Fisheries
17	Chief Engineer, Sardar Sarovar Narmada Nigam Limited
18	Chief Engineer, Road& Building
19	Chief Traffic & Call System Manager, State Transport Corporation
20	Liaison Officer, NDRF
21	A.C.O., Air Force
22	L.O, Army
23	C.O – Coast Guard
24	Director / Dy. Secy. - Revenue Department

National Disaster Management Authority
Government of India
NDMA Bhawan
A-1, Safdarjung Enclave
New Delhi - 110 029

VPS/2018/marketingvps2013@gmail.com