Gujarat Flooding: Impact Review of Flooding in Vadodara City Due to Extensive Rainfall

Vadodara (formerly known as Baroda) is the third-largest city in the Indian state of Gujarat, after Ahmedabad and Surat which has an estimated population of over 20 lakh according to the 2010–11 census. It is the administrative headquarters of Vadodara District and is located 141 kilometers from the state capital Gandhinagar, on the banks of the Vishwamitri River. Vadodara features a semi-arid climate due to the area's high potential evapotranspiration. Aside from the monsoon season, the climate is dry.

The city of Vadodara witnessed daunting flash floods following spells of intense day long rains starting from 31st of July 2019, bringing back memories of what the city had witnessed in June 2005 and then again in the monsoon of 2014. As reported by the State Emergency Operation Centre, the city has recorded around 500 mm of rainfall on 1st August 2019, out of which 286 mm was recorded in a short span of 4 hours and a cumulative of 424 mm was recorded in 6 hour duration. Heavy rainfall was also reported at some other parts in and around Vadodara district such as Dabhoi town (152 mm), Karjan (137 mm), Waghodiya (124 mm), Halol in Panchmahal district (143 mm) and Sankheda in Chhota Udepur district (117 mm).

Following the heavy downpour on 1st August, water had accumulated in almost every thoroughfare in the city paralyzing normal life. The nearby Ajwa dam's water level increased to 209.45 feet against its warning level of 215 feet, followed by which more than 9,500 cusecs of water was released into the Vishwamitri river. The usually dry Vishwamitri river which flows through the heart of the city, had risen dramatically to 23 feet and later towards its danger level of 26 feet, due to the inflow of more water resulting from rains in the upper catchment area of Vishwamitri river. The river swelled and breached its banks, adding to the storm water accumulated on the city roads, which ultimately converted the water-logging into a flood situation in the city. The city received moderate to light rainfall on 2nd and 3rd of August.

Flooding disrupted traffic movement due to the closure of all the eight bridges in the city and also led to stalling of air and rail services. The storm water had inundated the Sayajibaug zoo, government run SSG hospital and all the key markets affecting formal and informal workers throughout the city. The airport, which is on the outskirts of the city, was temporarily closed and operations were interrupted till 2nd August due to storm water accumulation on the runway. The rail route via Vadodara is an important route between Mumbai and Delhi and services were rerouted to ensure continuity of rail services, besides cancellation of several trains. State transport bus services to the city were either terminated at Nizampura on the city outskirts or were diverted through the city by-pass. Many houses were damaged and ground-floor houses of high-rise buildings got inundated up to waist-deep water. Several crocodiles from Vishwamitri river reached the housing colonies particularly those close to the river banks posing threat to the residents and stray animals of the city.

The following map highlights the pincodes in the city area that were affected by inundation due to the unprecedented rainfall and ensuing flooding of the Vishwamitri River.

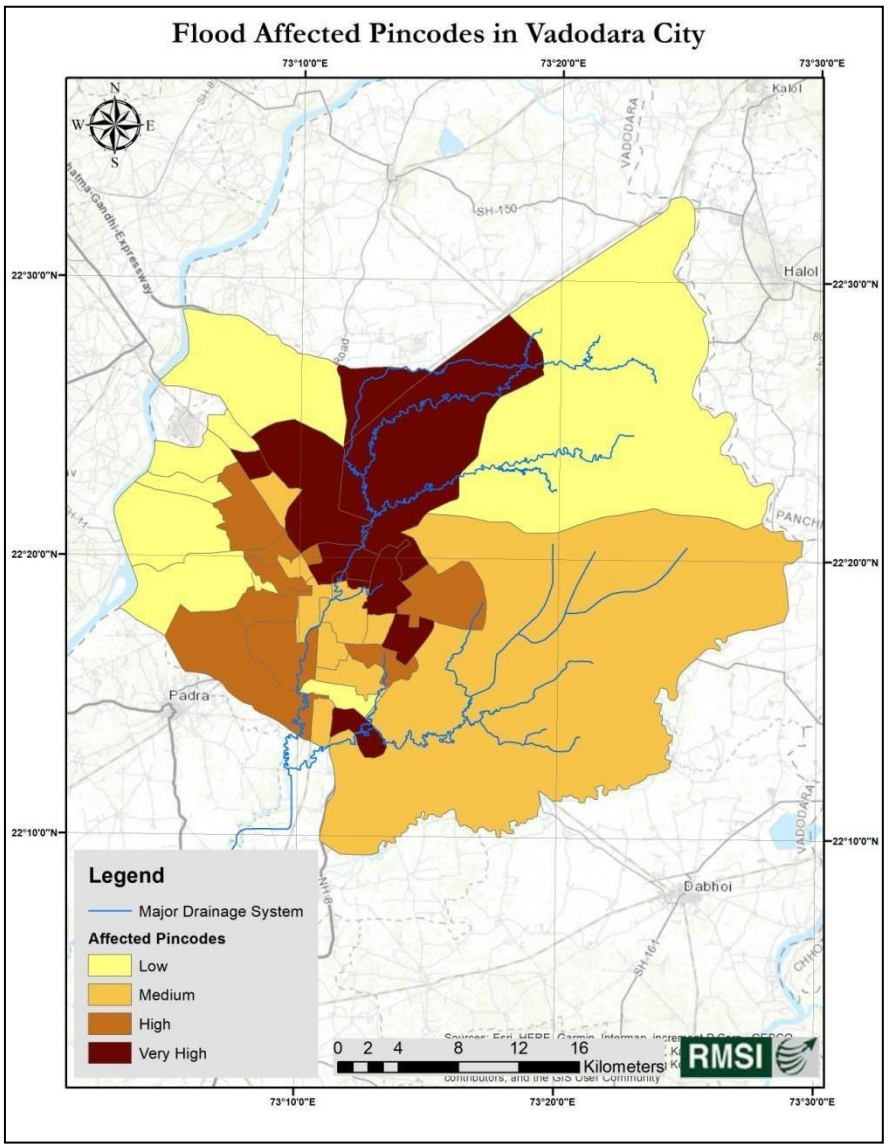

Figure 1: Flood affected pin-codes in Vadodara City

Teams from the National Disaster Response force (NDRF), State Disaster Response Force (SDRF) and two columns of the Indian Army and the state's fire service were deployed for evacuation and provision of relief to affected community members and to respond to the grave situation. There were incidences of building collapses that added to the complexities of emergency response and added casualties. Nearly 7,000 people had been rescued and 4,000 shifted to safer locations from over two dozen low-lying areas by the NDRF and several thousands of food packets were distributed across the city by the responding agencies.

Vadodara district was reeling under a substantial rainfall deficit of 43% this monsoon season till the time of the deluge (from 1st June to 30th July) and had never before witnessed such torrential downpour in recorded history. The previous record rainfall for July was 297.4 mm recorded over 24-hours on July 1, 2005. The average rainfall in Vadodara for the month of July is 299 mm and the annual average rainfall was around 1000 mm. Almost double the magnitude of the highest ever recorded single day rainfall and of the average rainfall for the month of July, was recorded on a single day from 31st July to 1st August 2019. This unprecedented rainfall was witnessed only over the city of Vadodara.

The city is prone to urban floods and has witnessed severe floods earlier in 1994, 1996, 2005 and 2014. During the period of 1991-2014, the built-up area increased about 42% from 72 to 102 km² indicating increasing urbanization. Recent studies show that the number of slums has also increased by a great extent from 192 slums in 1972 to 397 in 2013, especially along the banks of Vishwamitri river. Various newspapers have reported substantial loss in wetlands, improper solid waste management and the reclamation of water bodies for developing built-up areas resulting in increased vulnerability to urban floods in the city. The width of the Vishwamitri river has reduced as a result of encroachments and is also subjected to substantial inflow from the city's sewage and effluents from nearby industries. Unplanned construction in the low lying areas has obstructed the flow of water into the natural sinks that has resulted in water logging in these areas. The city's poor storm water drainage system is also reported to be inadequate to cope with such extreme intensity rainfall as that which occurred on 1st August.

This year, the complex weather system has resulted in unpredictable and extreme rainfall events in different parts of the country. As floods and flash floods continue to wreak havoc across the country, the call for disaster-risk conscious development gets louder.