TRAINING ON

Urban Flood Risk Mitigation

ORGANIZED BY

NATIONAL INSTITUTE OF DISASTER MANAGEMENT

(MINISTRY OF HOME AFFAIRS, GOI)

IN COLLABORATION WITH

DELHI DISASTER MANAGEMENT AUTHORITY, GOVT. OF NCT OF DELHI

27th to 29th FEBRUARY, 2024

NIDM, Sector-29, Rohini,

Delhi - 110042

TABLE OF CONTENTS

I. INTRODUCTION

1. India holds a prominent position globally when it comes to the impact of hydro meteorological disasters, including floods, storms, mass movements (wet), extreme temperatures, droughts, and wildfires. From 1980 to 2010, India experienced over 400 disasters, with the majority being of hydro meteorological origin. These events have had a profound impact, causing the loss of lives, injuries, and damage to infrastructure affecting millions of people.

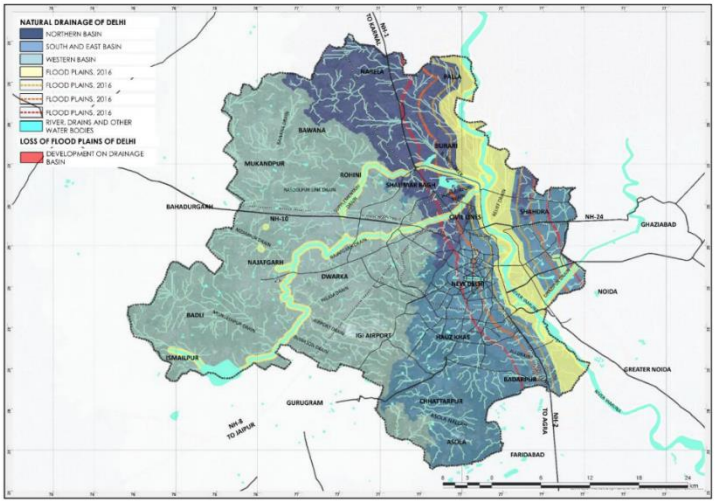
2. The influence of hydrometeorological disasters is on the rise, particularly in India's urban areas, primarily due to recent floods in numerous major cities. Approximately 12% of India's land area, roughly 40 million hectares, is susceptible to riverine and flash floods, with around 8 million hectares at risk of annual flooding. The irregular distribution of rainfall, combined with mindless urbanization, involved the encroachment upon and filling of natural drainage channels and urban lakes to repurpose valuable urban land for construction purposes. This, in turn, has contributed to a rise in instances of flooding within the city. The unlawful filling of urban water bodies, as seen in Delhi, has become widespread. Of the approximately 800 water bodies that once existed in Delhi, only around 600 remain today; the rest have disappeared. The city has also seen the emergence of numerous illegal colonies, with planning and regulations often disregarded, leading to the narrowing of natural drainage systems. This situation poses a significant threat to the city's well-being and has made it vulnerable to urban flooding.

Vulnerability profile of Delhi

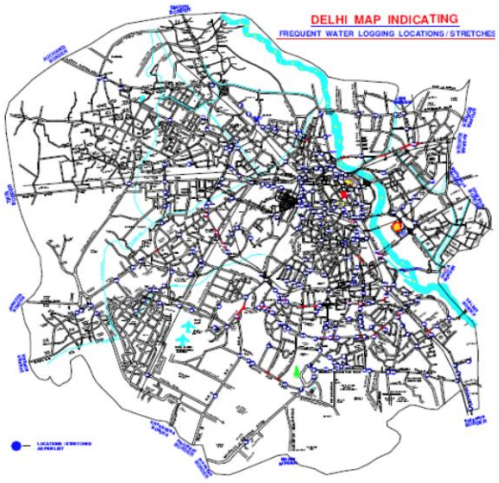
3. Delhi is prone to multi-hazards and is vulnerable to negative climate variabilities manifestations such as floods, earthquakes, extreme weather events (heat waves and cold waves) besides anthropogenic disasters. The state falls in a high-intensity seismic zone-IV. Additionally, there are thirteen zones based on the flooding risk concerning the incremental rise in the water level of the Yamuna (DDA, 1993). In National Disaster Risk Index, Delhi is the most vulnerable among UTs.

4. The flow of the Yamuna River as it passes through Delhi is primarily affected by the water discharge from the Tajewala Headwork, located 240 kilometers upstream. When heavy rainfall occurs in the river's catchment area, surplus water is discharged from Tajewala. The time it takes for the water level of the Yamuna in Delhi to increase depends on the river's flow downstream, typically taking approximately 48 hours. This increase in water level can also lead to a backflow effect in the city's drainage system. Additionally, Delhi faces the risk of flooding due to its network of 98 drains, which have catchment areas that extend well beyond the city's boundaries.

Since 1900, Delhi has experienced nine major floods in the years 1924, 1947, 1976, 1978, 1988, 1995, 1998, 2010 and 2013 when the Yamuna River crossed its danger level of 204.83 m. The year 1978 witnessed the worst ever flood in Delhi when water level in Yamuna River in Delhi reached at 207.49 m with discharge 2.53 lac cusec at old railway bridge (7.0 lac cusec discharge was released from Tajewala) when 130 villages and 25 urban colonies in Delhi were submerged in water. The river has crossed its danger level 20 times in the last 33 years (DDMA, 2014-2015).



Drainage pattern of Delhi and its flood plains (Gupta, 2017)



Waterlogging locations on Delhi (Gupta, 2017)

5. Rapid urbanization coupled with inadequate drainage system has led to an increase in incidents of urban flooding which is clearly evident from the recent flooding in Gurugram (Kumar et al. 2016). The inhabitants of north-east, east, north and central Delhi are highly vulnerable to flood disaster as population density increases the risk of flood disaster (Maples and Tiefenbacher 2009).

Flood Risk Management

While floods are indeed natural occurrences, their frequency and impact can be mitigated and constrained through appropriate measures and comprehensive risk management strategies. In the effort to address extreme flood events and their adverse consequences on people and property, experts and scientists advocate a departure from the traditional approach of "flood protection" towards "flood risk management." The pursuit of absolute protection is deemed impractical and unsustainable due to exorbitant costs and inherent uncertainties. Consequently, the concept of "flood risk management" is gaining increasing prominence in both the literature and practical implementation of flood risk management.

URBAN FLOOD RISK MITIGATION

The core objective of flood risk management is to diminish the likelihood and/or the severity of flood-related incidents. Empirical evidence demonstrates that the most effective approach involves the establishment of flood risk management programs that encompass the following components:

- **Prevention**: preventing damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas; by adapting future developments to the risk of flooding; and by promoting appropriate land-use, agricultural and forestry practices;
- **Protection**: taking measures, both structural and non-structural, to reduce the likelihood of floods and/or the impact of floods in a specific location;
- **Preparedness**: informing the population about flood risks and what to do in the event of a flood;
- **Emergency response**: developing emergency response plans in the case of a flood;
- **Recovery and lessons learned**: returning to normal conditions as soon as possible and mitigating both the social and economic impacts on the affected population.

Integrated flood risk management aims to minimize the human and socio-economic damages attributable to flooding. Typically, following a significant flood event, there is a widely recognized need for a robust and comprehensive approach to managing flood risks. Nevertheless, crafting a strategy based on risk assessment proves to be a formidable undertaking. Sustaining political backing for flood risk management across all relevant policy domains is a challenging endeavor. Consequently, flood risk concerns often take a backseat in political and administrative decision-making processes. Moreover, the execution of a strategic flood risk management approach necessitates ongoing collaboration among various national and regional entities, including water authorities, local planning bodies, civil protection agencies, and regional organizations. However, collaboration always imposes substantial demands in terms of time, finances, and human resources. Thus, in numerous instances, merely calling for a strategic approach to flood risk management is insufficient.

2. SUMMERY

The three-day training program titled **"Training Programme on Urban Flood Risk Mitigation" organized by the National Institute of Disaster Management (NIDM) in collaboration with Delhi Disaster Management Authority (DDMA)**, took place from February 27th to 29th, 2024, at NIDM, Sector-29, Rohini, Delhi. The training was attended by 67 senior participants representing various government departments such as Central Water Commission, Delhi Jal Board, Directorate of Education Delhi, Irrigation and Flood Control Department, Municipal Corporation of Delhi, Delhi Disaster Management Authority (DDMA), Delhi Police, Directorate General of Health Services (DGHS), BSES Rajdhani Power Limited, and Delhi Urban Shelter Improvement Board (DUSIB) etc.

The first day commenced with a comprehensive discussion on past flood events, focusing on rescue and relief efforts, followed by a case study highlighting the management of flood waste. The day concluded with valuable insights from experiences during recent floods, providing a solid foundation for understanding disaster management strategies.

The second day shifted the focus towards proactive measures, starting with a recap of previous discussions and delving into early warning systems and flood forecasting. Challenges faced in urban flood management were addressed, along with sustainable solutions such as green infrastructure and nature-based approaches.

On the final day, participants explored the role of technology in flood mitigation, with sessions highlighting the importance of geographical information systems (GIS) in disaster response. Throughout the program, interactive sessions facilitated the exchange of ideas and best practices among participants, fostering collaboration to enhance flood resilience in urban areas.

3. SESSION WISE - SUMMARY

The inaugural session of the training Programme on "Urban Flood Risk Mitigation" was all about to how to acquaint and involve the concerned state, district authorities and line departments on flood risk management. Dr. Garima Aggarwal, Senior Consultant at the National Institute of Disaster Management (NIDM), set the context for the training programme by highlighting the urgent need for flood risk mitigation and minimizing the socio-economic and infrastructure related damages associated with urban flooding.

The inaugural address was delivered by Shri Rajendra Ratnoo (IAS), Executive Director NIDM, emphasized the crucial need for collaboration among national and regional entities to effectively tackle urban floods. Highlighting the importance of involving water authorities, local planning bodies, civil protection agencies, and regional organizations in flood risk mitigation efforts, he underscored the challenges posed by urbanization and population growth in Delhi. Shri Ratnoo emphasized the shift from mere flood protection to comprehensive flood risk mitigation strategies. Additionally, he stressed the significance of political backing and collaboration among various entities to address the complex issue of urban flooding. In the last Shri Surendra Thakur, Joint Director of NIDM, delivered the concluding remarks and vote of thanks. During the inaugural session Shri Sandeep Yadav, SDM East District were also present.

URBAN FLOOD RISK MITIGATION

Session 1: Wetland Reclamation and its impact on flood mitigation by Mr. Ramveer Tanwar (Pond-Man of India) Environmentalist.

In the first session of Day 1, Mr. Ramveer Tanwar, renowned as the "Pond-Man of India" and a distinguished environmentalist, talked about his passionate exploration of wetland reclamation and its profound impact on flood mitigation. He highlighted how ponds contribute to cooling the Earth, especially in the face of recent urban floods seen in cities like Delhi and Bengaluru. He shed light on the intricate relationship between wetlands, urban heat islands, and the achievement of sustainable development goals (SDGs). Tanwar's comprehensive overview also shed light on the critical challenges facing water bodies such as, Eutrophication, Disturbance of Catchment Area, Encroachment, Direct-Sewage, Siltation and Solid waste etc. Through his stories of regenerating ponds, he inspired hope and emphasized the ongoing efforts needed to protect these crucial ecosystems. Tanwar's journey wasn't without its challenges, as he initially worked tirelessly on pond restoration projects before gaining widespread recognition. He shared candidly about the hurdles he faced before being noticed, underscoring the perseverance and dedication required for such impactful work. He also shared a transformative moment in his journey when he was recognized by the Prime Minister of India during the "Mann ki Baat" program, which further motivated him to elevate his efforts.

Session 2: Rescue & Relief during the Delhi Floods and Lessons Learnt by Shri Abujam Bijoy Kr. Singh, Commandant, 16th BN. NDRF

In the second session led by Shri Abujam Bijoy Kr. Singh, attendees were provided with invaluable insights into disaster management and relief efforts during the Delhi floods of 2023. Mr. Singh began by tracing the evolution of the Disaster Management Framework in India, highlighting key milestones such as the Disaster Management Act of 2005, the Policy of 2009, and the establishment of the NDRF. He elaborated on the structure of NDRF teams and their distribution across various locations, emphasizing their crucial role in disaster response and relief operations.

After that he delved into the specifics of the Delhi floods in 2023, outlining the swift deployment of NDRF teams and their immediate response actions. He shed light on the role played by the NDRF in conducting rescue and relief operations, saving lives, and providing aid to affected communities. Additionally, he discussed the challenges faced by NDRF teams during such operations, including logistical hurdles, communication barriers, and the dynamic nature of disaster scenarios. Throughout the session, attendees gained a deeper understanding of the complexities involved in disaster management and the commendable efforts of the NDRF in mitigating the impact of natural calamities.

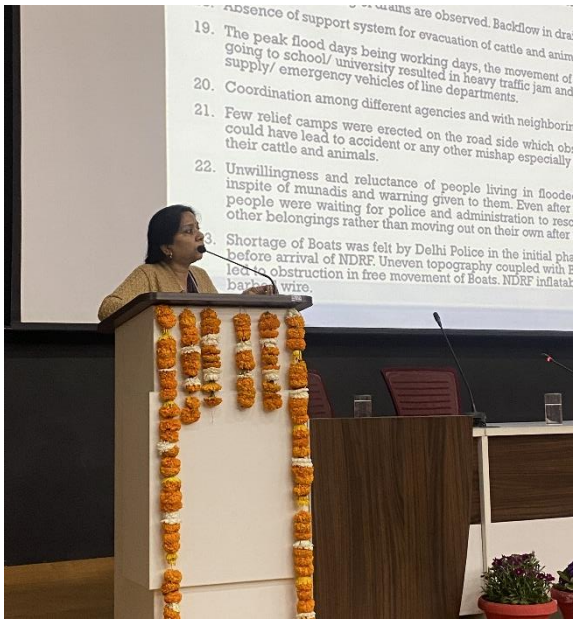
Session 3: Managing Flood Waste – Case Study of Srinagar Floods – 2014 by Dr. G.N. Qasba, Former Commissioner, Srinagar Municipal Corporation

In the third session Dr. G.N. Qasba, talked about the management of flood waste through a case study of the devastating floods that struck Srinagar in 2014. Dr. Qasba painted a vivid picture of the unprecedented rainfall, loss of lives, displacement of thousands, and extensive economic damages incurred during the calamity. The session highlighted the critical infrastructure damage, including inundated hospitals, closed schools, and disruption of government services and media operations.

Post-flood challenges, such as the risk of epidemic outbreaks and the urgent need for waste management and disinfection, were discussed in detail. Dr. Qasba elaborated on the swift initiatives undertaken by the Srinagar Municipal Corporation, including the establishment of a virtual roadside office, mobilization of sanitation and cleaning operations, and the vaccination of field staff. Through meticulous organization and focused efforts, the Corporation successfully conducted the largest sanitation and cleanliness drive in Srinagar, preventing any disease outbreaks related to the floods. Attendees left the session with a deeper understanding of the complexities

involved in managing flood waste and the importance of swift and coordinated actions in mitigating post-disaster challenges.

Session 4: Experience of Delhi Disaster Management Authority during Yamuna Floods 2023 by Dr. Mukta Girdhar, Sr. Consultant, DDMA (HQ)

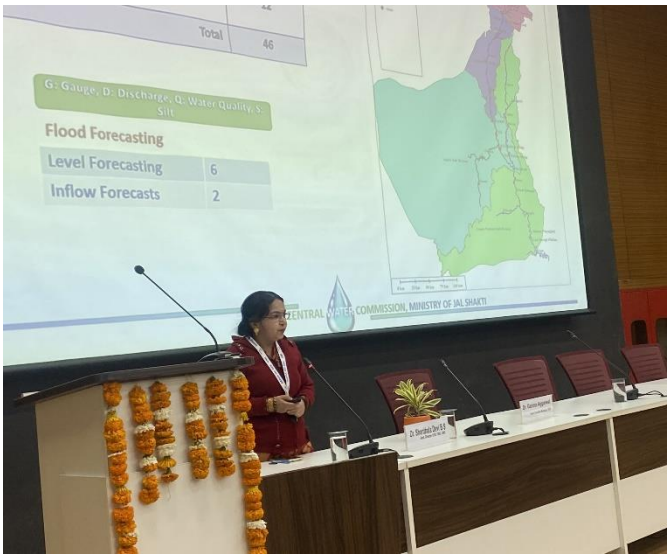


In the fourth session Dr. Mukta Girdhar, shared a comprehensive overview of the experiences and challenges faced by Delhi Disaster Management Authority during the Yamuna floods of 2023. Dr. Girdhar highlighted various obstacles encountered during the floods, including disruptions in sewerage services, mismatched water holding capacities of drains, and coordination issues among different departments. The session also shed light on the unprecedented nature of the floods, with the river Yamuna reaching its highest water level ever recorded.The shortage of boats during the initial rescue and evacuation operations, before the arrival of the National Disaster Response Force (NDRF), underscored the need for better preparedness measures.

Dr. Girdhar outlined a series of immediate and long-term measures to address such challenges, including stockpiling flood-fighting equipment, removing obstructions in river flow, and enhancing desilting efforts through scientific methods and technology. For long-term resilience, suggestions were made for the development of green infrastructure, such as rainwater harvesting and permeable pavements, to mitigate flooding risks. Additionally, a comprehensive study of the drainage system and the establishment of a dedicated State Disaster Response Force for Delhi were proposed as essential measures.

Session 5: Early Warning & Flood Forecasting by Dr. Shanthala Devi B S Assistant Director Upper Yamuna Division YBO, CWC

URBAN FLOOD RISK MITIGATION



Dr. Shanthala Devi B. S. delivered the session on early warning and flood forecasting. During the session, she provided updates on flood forecasting stations and subdivisions in Delhi. Additionally, she shared information on flood forecasting websites and highlighted the bulletins issued by CWC during the monsoon period, including alerts and red alerts. Dr. Shanthala also discussed the methods employed by CWC to disseminate advisories and forecasts nationwide. She also emphasized the pivotal role played by CWC in flood forecasting during the Delhi floods of 2023. This included the utilization of data from flood forecasting stations, timely issuance of bulletins and alerts, and effective dissemination of advisories to relevant authorities and the public.

Session 6: Urban Flood Risk: Challenges and Solutions by Dr. Garima Aggarwal Senior Consultant, NIDM

Dr. Garima Aggarwal discussed about the challenges and potential solutions surrounding urban flood risks. She explained why floods are a big concern in cities and what causes them. By showing examples and pictures, she helped us understand how floods affect different cities. Dr. Aggarwal further contextualized urban flood risk within the framework of global and national initiatives, highlighting the interconnectedness with Sustainable Development Goals (SDGs), the Sendai Framework for Disaster Risk Reduction (SFDRR), and the Prime Minister's 10-point agenda. She mentioned initiatives like the Smart Cities Mission in India, which aims to make cities more resilient to disasters like floods. Dr. Aggarwal gave suggestions on how to prevent floods and how to recover after they happen, including building better infrastructure and planning ahead.

Dr. Aggarwal's session culminated in a series of actionable recommendations aimed at mitigating and preventing urban flood risks, including the development of disaster-resilient infrastructure and recovery

planning strategies. Overall, Dr. Aggarwal's session gave us a better understanding of urban flood risks and how we can tackle them to make our cities safer.

Session 7: Fire Risk Assessment & Audit of Medium & Small-Scale Industrial Units (Case studies/ Best Practices), Shri R.C. Sharma, Former Director, Delhi Fire Service

Dr. Chandan Ghosh, retired Professor started with the role of green infrastructure in mitigating urban floods. Dr. Ghosh shed light on the significance of integrating nature-based solutions into urban planning to address flooding challenges effectively. He emphasized the importance of adopting new technologies and simulation methods to better understand and predict flood risks in urban areas. Dr. Ghosh also highlighted the detrimental impact of faulty construction methods on exacerbating flooding and emphasized the need for resilient infrastructure designs.

Moreover, he discussed innovative sewerage cleaning solutions and pond cleaning techniques as essential components of urban flood mitigation strategies. By incorporating green infrastructure elements such as permeable pavements, rain gardens, and green roofs, cities can enhance their capacity to absorb and manage excess rainfall, thus reducing the risk of flooding. Dr. Ghosh's session underscored the importance of robust infrastructure and comprehensive flood management approaches in building climate-resilient cities.

Session 7: Nature Based Solution for Urban Flood Risk Mitigation by Dr. Sreeja Nair, Fellow, TERI (Online)

Dr. Sreeja Nair, presented an online session on Nature-Based Solutions for Urban Flood Risk Mitigation, emphasizing the critical linkages between environmental degradation and heightened disaster risk. Through the lens of eco-DRR (Ecosystem-based Disaster Risk Reduction), Dr. Nair highlighted the effectiveness of nature-centric approaches in mitigating flood risks in urban areas.

Key points included the role of vegetation in stabilizing slopes, wetlands and floodplains in controlling floods, and coastal ecosystems like mangroves, saltmarshes, and sand dunes in buffering against coastal hazards. With climate change exacerbating extreme events, these natural defenses become increasingly vital. Dr. Nair introduced various tools and approaches for eco-DRR, including conservation of wetlands, land-use planning, watershed management, forest management, protected area management, coastal zone management, and community-based disaster risk management.

In summary, Dr. Nair's session underscored the importance of integrating nature-based solutions into urban planning and disaster risk reduction strategies, offering sustainable and effective means to combat the growing threat of urban flooding in the face of environmental degradation and climate change.

Session 8: Role of GIS in Flood Mitigation: Case Study of Yamuna Floods by Dr. Rupendra Singh, Jawaharlal Nehru University

In the case study of the 2023 Delhi flood, Dr. Singh demonstrated how GIS is important in assessing the extent of damage and planning recovery efforts. GIS helps in predicting flood events by analyzing various factors such as rainfall, topography, and land use. It also enables real-time monitoring of flood-prone areas using satellite imagery and sensors. By integrating various spatial data layers, such as inundation maps, population density, and infrastructure locations, GIS facilitates the identification of areas most affected by the flood. This information enabled authorities to allocate resources effectively, prioritize relief efforts, and implement targeted interventions to mitigate the impact on affected communities. The utilization of GIS in post-flood analysis not only enhanced the efficiency of response and recovery operations but also provided valuable insights for future flood preparedness and management strategies.

Session 9: Discussion: Experiences, challanges faced and lessons learnt during "Yamuna Floods – 2023"

The session was moderated by Mr. Shreyash Dwivedi from NIDM and Ms. Anjali Diwakar from DDMA, East Delhi and the session started with the discussion on the experiences, challenges, and lessons learned during the Yamuna Floods of 2023 by district officials of Delhi Disaster Management Authority. Officials from all six flood-affected districts under DDMA shared their firsthand experiences and the hurdles they encountered. The session provided a platform for an open exchange of insights, allowing officials to reflect on the effectiveness of their response efforts and identify areas for improvement. Challenges such as coordination issues between agencies, communication breakdowns and inadequate infrastructure and resource constraints were discussed in detail.

This collaborative discussion laid the groundwork for future initiatives about to create more resilience against flood emergencies. By addressing the identified shortcomings and building upon the lessons learned, the authorities can work towards a more cohesive and effective response to mitigate the impact of future flood events in the Yamuna basin and beyond.

***

4. VELEDICTORY SESSION

During the valedictory session, Shri Amir Ali Khan, Head of Department (RID) at NIDM, Dr. Shanthala Devi B S, Assistant Director of the Upper Yamuna Division at YBO, CWC, and Dr. Garima Aggarwal, Course Coordinator, were present.

The session commenced with participants sharing their experiences and feedback about the training, expressing appreciation for the well-facilitated arrangements. Dr. Garima Aggarwal then presented a comprehensive report summarizing the proceedings of all three days, highlighting key takeaways and insights gained. After that Shri Amir Ali Khan, HoD (RID), NIDM, talked about importance of building robust infrastructure to withstand disasters and better coordination in managing urban floods. He stressed the need for early warning systems, reinforced infrastructure like barrages and gates, and improved communication among stakeholders. Dr. Shanthala Devi B S extended her gratitude to NIDM for including CWC in this essential training initiative. Following this, certificates were distributed to the participants, acknowledging their successful completion of the training program.

Lastly, Shri Shreyash Dwivedi, Programme Coordinator at NIDM, delivered the formal vote of thanks, expressing heartfelt appreciation to all. This included trainers, organizers, participants, and supporting staff, whose collective efforts ensured the program's effectiveness and impact.

5. KEY TAKEAWAYS

1. **Enhancement of Infrastructure to deal with water logging:** Develop a comprehensive plan and maintenance of pumping infrastructure in flood-prone regions of Delhi. Collaborate with relevant departments and agencies to procure pumping systems, ensuring their strategic placement and functionality to optimize water drainage during monsoons. Updation of various flood management tools on India Disaster Resource Network (IDRN) would also help during flood situations and contribute significantly to the overall flood mitigation strategy in Delhi.
2. **GIS-Based Future Planning and Flood Zone Mapping:** Implementation of Geographical Information System (GIS) for identification and mapping flood zones, shelter points during flooding incidents would emphasize its utility for sensible future planning. This GIS system should not only serve the immediate need for shelter identification but also contribute to inform urban planning by delineating flood-prone areas. This dual-purpose application ensures that the GIS infrastructure supports both emergency response efforts and long-term urban development strategies.
3. **Interdepartmental Coordination:** Establish and formalize protocols for periodic interdepartmental coordination through scheduled meetings. Conduct training sessions at the district level to enhance communication and collaboration among relevant departments, including the Municipal Corporation, Disaster Management, Delhi Jal Board, Energy Supply, Emergency Management (Traffic, Boat Club, NDRF Aapada Mitra, etc.), and Urban Planning (DDA, PWD, etc.). This initiative would foster a culture of information sharing and collective decision-making during emergency scenarios.
4. **Centralized Information Hub for Emergency Response:** Development of a centralized platform for streamlined information sharing and coordination during flood emergencies. This platform should facilitate real-time communication among various departments, ensuring that all stakeholders have access to the latest information. Implement sophisticated technologies, such as a dedicated mobile application or web portal, to facilitate efficient data exchange and decision-making.
5. **Comprehensive Information, Education, and Communication (IEC) Campaign:** Initiate an extensive IEC campaign to disseminate crucial information among residents regarding flood risks, preparedness measures, and emergency protocols. Utilize diverse communication channels, including social media, local newspapers, and community engagement programs. Ensure that the public is well-informed about evacuation procedures, emergency contacts, and the importance of cooperation during flood situations.

6. PHOTOGRAPHS

URBAN FLOOD RISK MITIGATION

URBAN FLOOD RISK MITIGATION

URBAN FLOOD RISK MITIGATION

URBAN FLOOD RISK MITIGATION

URBAN FLOOD RISK MITIGATION

Annexure –I

Training Programme on
Urban Flood Risk Mitigation

Organized by
National Institute of Disaster Management (Ministry of Home Affairs, GoI)
In collaboration with
Delhi Disaster Management Authority, Govt. of NCT of Delhi

Date: 27 – 29 Feb, 2024 **Venue: NIDM, Rohini Campus**

PROGRAMME SCHEDULE

Time	Learning Session/ Theme	Key Speakers
Day 1: Inaugural Session (27 Feb. 2024)		
10.00 am – 11.00 am	Registration and Tea	**NIDM**
11.00 am to 11.10 am	Welcome Address & Context Setting	**Dr. Garima Aggarwal** Senior Consultant, NIDM
11:10 am to 11:20 am	Address	**Dr. Amir Ali Khan** HoD, RID, NIDM
11:20 am to 11:40 am	Key Addresses	**DDMA Representative**
11:40 am to 12:40 pm	**Special Address and Presentation on "Wetland Reclamation and its impact on flood mitigation"**	**Shri Ramveer Tanwar** Pond-Man of India (Special Invitee)
12:40 pm to 12:50 pm	Inaugural Address	**Shri Rajendra Ratnoo** Executive Director, NIDM
12:50 pm to 12:55 pm	Concluding Address	**Shri Surendra Thakur** Joint Director, NIDM
12:55 am to 01:00 noon	**Group Photograph**	
01:00 pm to 02:00 pm	**Lunch Break**	
Technical Session		
02:00 PM - 03:00 PM	**Session 1:** Rescue & Relief During the Delhi Floods and Lessons Learnt	**Shri Abujam Bijoy Kr. Singh** Commandent

		16th BN. NDRF
03:00 PM - 03:15 PM	**Tea Break**	
03:15 PM - 04:30 PM	**Session 2:** Managing Flood Waste – Case Study of Srinagar Floods - 2014	**Dr. G.N. Qasba** Former Commissioner Srinagar Municipal Corporation
04:30 PM – 05:15 PM	**Session 3:** Experience of Delhi Disaster Management Authority during Yamuna Floods 2023	**Dr. Mukta Girdhar** DDMA (HQ) / DDMA East
Day 2 (28 Feb. 2024)		
10:00 AM - 10:15 AM	**Recapitulation of Day 1**	**Mr. Shreyash Dwivedi** NIDM
10:15 AM - 11:30 AM	**Session 4:** Early Warning & Flood Forcasting	**Dr. Shanthala Devi B S** Assistant Director Upper Yamuna Division YBO, CWC
11:30 AM - 11:45 AM	**Tea Break**	
11:45 AM - 01:00 PM	**Session 5:** Urban Flood Risk : Challenges and Solutions	**Dr. Garima Aggarwal** Senior Consultant, NIDM
01:00 PM - 02:00 PM	**Lunch Break**	
02:00 PM - 03:30 PM	**Session 6:** Green Infrastructure and Its Applicability in Urban Flood Mitigation	**Dr. Chandan Ghosh** Retd. Professor, NIDM
03:30 PM - 03:45 PM	**Tea Break**	
03:45 PM – 05:00 PM	**Session 7:** Nature Based Solution for Urban Flood Risk Mitigation	**Dr. Sreeja Nair** Fellow, TERI
Day 3 (29 Feb. 2024)		
10:00 AM - 10:15 AM	**Recapitulation of Day 2**	**Ms. Anjali Diwakar** DPO, DDMA, East
10:15 AM - 11:30 AM	**Session 8:** Role of GIS in Flood Mitigation: Case Study of Yamuna Floods	**Dr. Rupendra Singh** Jawaharlal Nehru University
11:30 AM – 11: 45 AM	**Tea Break**	
11: 45 AM - 01:30 PM	**Session 9: Discussion: Experiences, challanges faced and lessons learnt during "Yamuna Floods – 2023" (Moderated & Coordinated by NIDM / DDMA East)** • Experience Sharing by the CEOs, DDMA and other departments of Affected Disctricts (East, North, North East, South East, Shahdara & Central Delhi)	

	• Experience sharing by Experts	
01:30 PM - 02:30 PM	**Lunch Break**	
02:30 PM - 04:00 PM	**Valedictory session**	**NIDM/DDMA (HQ)**
04:00 PM	**High Tea**	