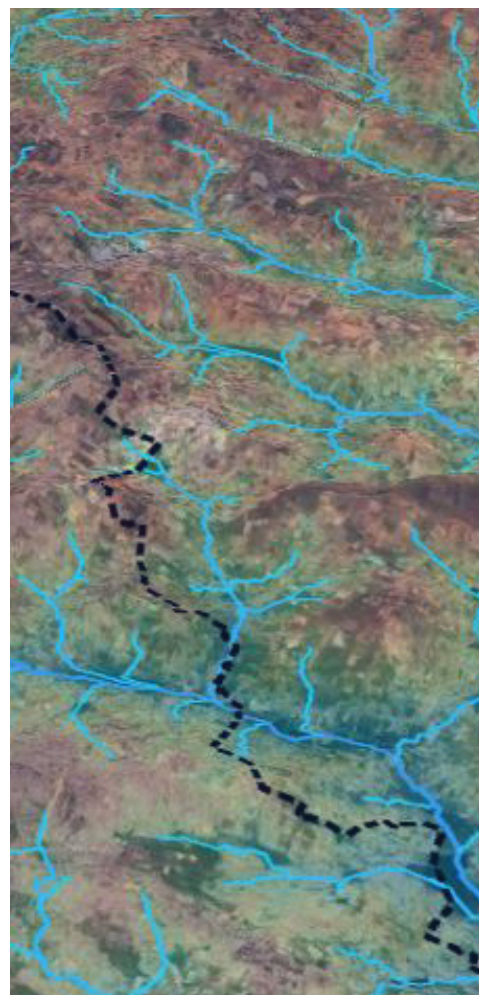
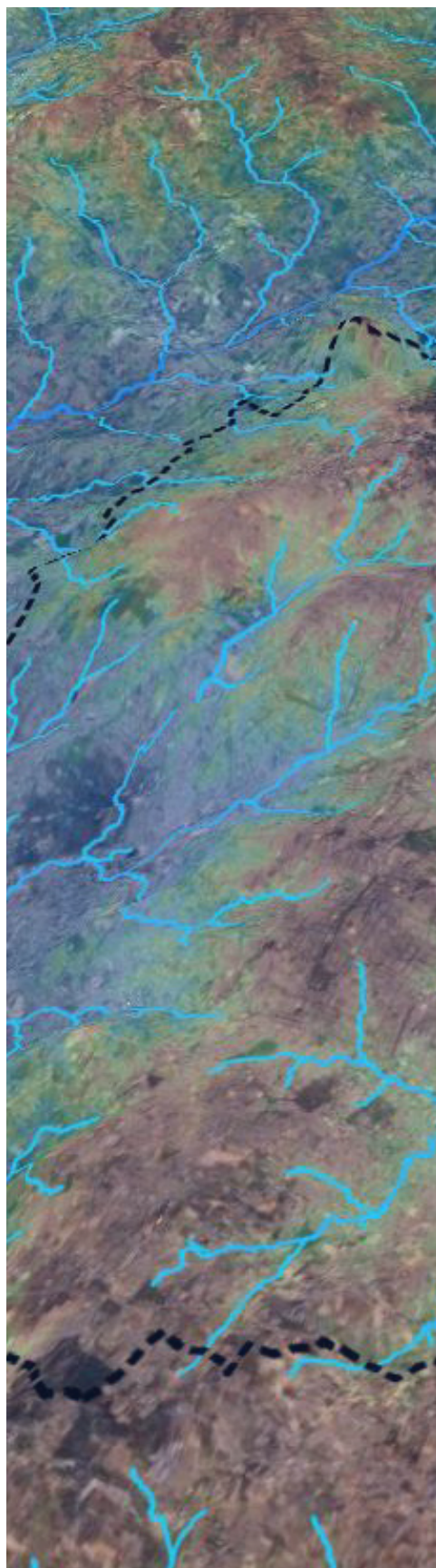




**BUILDING  
A RESILIENT  
BENGALURU**

# READING THE CITY'S DRAINS

UNDERSTANDING AND MAPPING  
STORMWATER TYPOLOGIES

**TYPOLGY WORKSHOP**

October 2025 | Summary Report



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### **Organising Partners**

Mod Foundation & Oorvani Foundation

### **Supported by**

Bengaluru Sustainability Forum Small Grants Program

### **Academic Partners**

MS Ramaiah School of Architecture

RV College of Architecture (RVCA)

BMS School of Architecture, Yelahanka

Faculty of Architecture, PESU

### **Professional Partners**

Well Labs

Paani Foundation

Sponge Collaborative

Cohort X

### **Citizen Partners**

Friends of Lakes

### **Development & Visualisation of Summary Report**

Mod Foundation

### **Citations**

The findings, interpretations, and conclusions presented in this work are based on surveys and information collated from primary fieldwork, workshop activities, published reports, and other publicly available sources. This summary report is part of the ongoing Building a Resilient Bengaluru campaign

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### **Disclaimer**

This report is a summary of discussions held during the Typology Workshop, hosted at the BLR Design Centre by Mod Foundation in collaboration with Oorvani Foundation. It reflects the perspectives shared by participants and facilitators and does not represent the official position of any single organisation or government body. The content is intended for knowledge-sharing and furthering dialogue.



# BUILDING A RESILIENT BENGALURU



RESILIENCE STARTS NOW  
EVERY DROP, EVERY STREET

#NAMMA NEERU NAMMA OORU



When we see how water flows in our cities, we understand where our city breathes — resilience begins with awareness.



# PREFACE

Bengaluru's relationship with water is one of ingenuity disrupted by urban expansion. Once sustained by a network of lakes, tanks, and *rajakaluves* (stormwater channels), the city enjoyed a decentralized system that conserved water and mitigated floods. These interconnected waterways balanced ecology and community life.

The late 19th century shifted this balance. Piped water from distant reservoirs reduced reliance on local sources, while rapid expansion led to lakes being filled for development. Colonial and post-colonial governance reframed lakes from community commons - supporting fishing, agriculture, and grazing - into landscaped amenities for the elite. Sampangi Lake's transformation into a regulated park exemplified this exclusion.

The consequences are stark. Encroachments, poor planning, and unchecked infrastructure have disrupted lake connectivity, turning *rajakaluves* into sewage channels. Once-seasonal water bodies now stagnate under effluents and waste. Frequent flooding and water shortages expose decades of neglect and fragmented governance. The Building a Resilient Bengaluru campaign responds by treating water

systems as essential infrastructure and shared public spaces.

The K100 project, as a proof of concept, demonstrates that stormwater drains can be reimaged as active corridors - linking bus stops and metro stations, enabling community gardens, and providing walkable routes to schools. By aligning infrastructure with everyday urban life, K100 has fostered community ownership and reduced solid waste accumulation.

Collaboration has been key - government departments, NGOs, and communities working together to restore not just drains, but trust and accountability.

The larger challenge lies ahead. Bengaluru's ~842 kms of stormwater drains form the city's hydrological spine, yet remain poorly maintained and encroached. With climate change bringing erratic rainfall and frequent floods, the city must shift from piecemeal projects to a city-wide strategy that restores waterways as urban commons.

Waterways are not problems to engineer away, but living systems to protect and reimagine for resilience, equity, and public life.

# THE CAMPAIGN

## BUILDING A RESILIENT BENGALURU

Bengaluru stands at a critical crossroads. Once sustained by a man-made ecological network of tanks, lakes, and *rajakaluves*, the city nurtured thriving water ecologies, economies, and productive landscapes. Over time, however, rapid urbanisation has severed this relationship. Lakes were filled, stormwater canals narrowed, and the systems that once safeguarded the city against floods steadily dismantled. Each monsoon now exposes the cost of this neglect: inundated neighbourhoods, disrupted livelihoods, and a growing vulnerability across the urban fabric.

The Building a Resilient Bengaluru campaign, initiated by the Mod Foundation, responds to this urgency. Rooted in our ethos of making cities observable, the campaign seeks to bring visibility to the often-overlooked systems that keep Bengaluru alive - its waterways. It is the culmination of years of work on the K100 Citizens' Waterway Project, which reimagined a neglected stormwater canal as a public, ecological, and cultural asset.

By combining institutional reform with placemaking, the K100 project became a proof of concept that influenced the World Bank's INR 3000 crore investment in Bengaluru's flood resilience. By combining institutional reform with placemaking, the K100

project became a proof of concept that influenced the World Bank's INR 3000 crore investment in Bengaluru's flood resilience (August 2024).

Our campaign extends these learnings citywide. By creating a shared knowledge base of strategies, technical insights, and citizen-led practices, we aim to empower people to see waterways not as backdrops or drains, but as vital infrastructures for health, ecology, and culture. We believe that resilience cannot be engineered by mega projects alone. It must be co-created through collective action, informed citizens, and transparent governance.

At the BLR Design Centre, our community space on Church Street, the campaign will host exhibitions, dialogues, and workshops that make these issues visible and accessible. Here, data will meet storytelling, and policy will meet everyday urban experience. Citizens, policymakers, and experts alike will be invited to observe, question, and act.

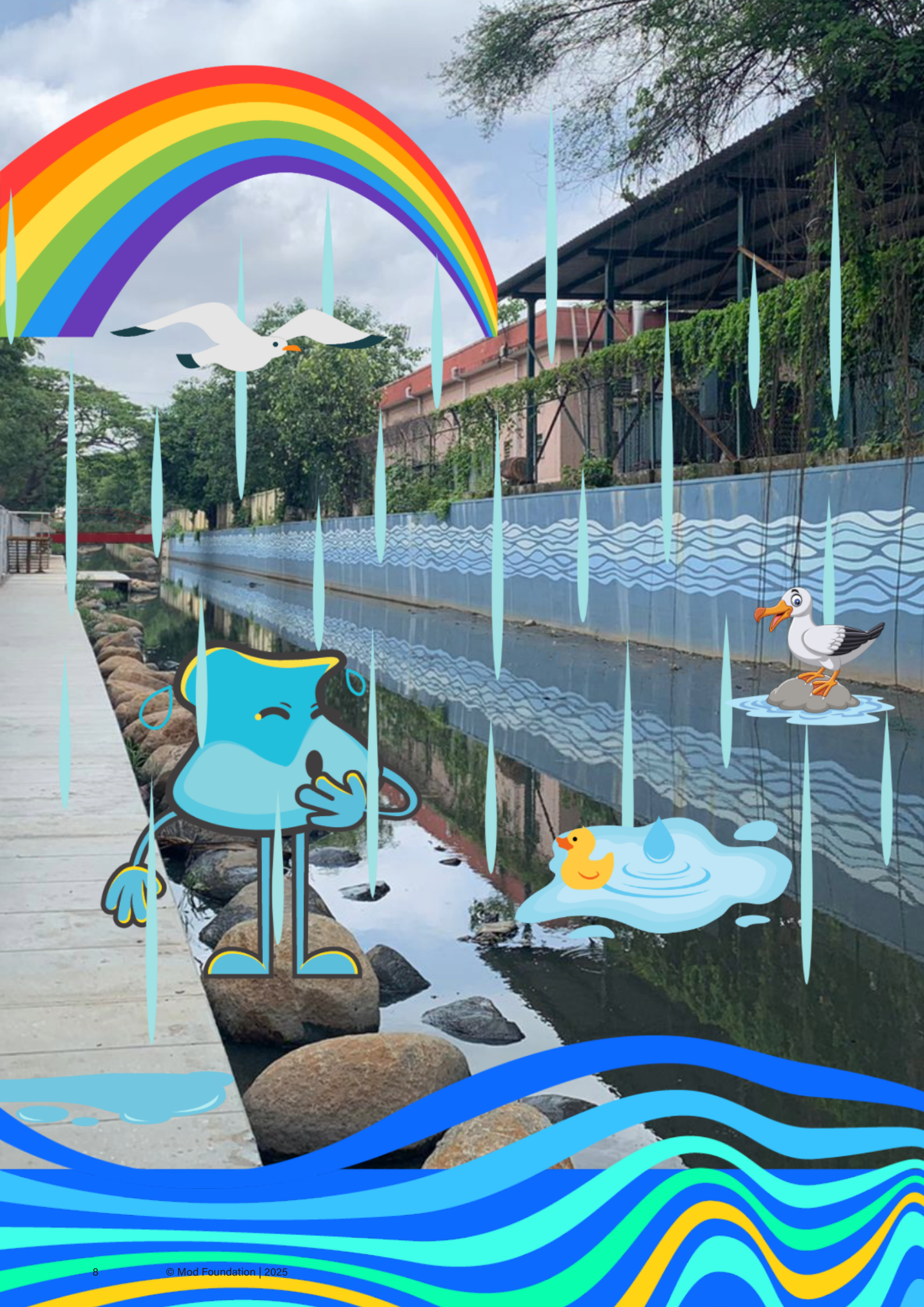
Building a Resilient Bengaluru is more than a campaign, it is a call to reclaim the city's relationship with water. By observing and reimagining the systems beneath our feet, we can shape a Bengaluru that is not only flood-resilient but also equitable, ecological, and future-ready.



- 
1. Can drains become resilient public spaces?
  2. Whose priorities shape our city's waters?
  3. How do we build shared ownership?







# EXECUTIVE SUMMARY

The Typology Workshop on Stormwater Drains was organised by Mod Foundation in collaboration with Oorvani Foundation as part of the Stormwater & the City initiative—an effort supported by the Bengaluru Sustainability Forum (BSF) to enhance awareness, transparency, and citizen engagement around Bengaluru's stormwater drainage network. Held on 11 October 2025 at the BLR Design Centre, the workshop marked a key step in developing a participatory, data-driven understanding of the city's stormwater infrastructure.

Once sustained by an intricate network of lakes, tanks, and *rajakaluves*, Bengaluru's relationship with water now stands disrupted. The Building a Resilient Bengaluru campaign, under which this workshop was conducted, seeks to restore this relationship by making the city's hidden water systems visible and accessible. The workshop introduced participants to stormwater drain (SWD) typologies, their ecological and infrastructural roles, and the importance of creating reliable, open-source data.

This gathering also marked the beginning of what we hope will become a series of conversations dedicated to transforming the city's stormwater drains (*rajakaluves*) into resilient, inclusive public spaces that not only manage water but also enrich the everyday lives of residents. The urgency of this dialogue is underscored by the recently approved Karnataka Water Resilience Project, which allocates \$426 million toward restoring the city's

stormwater network and improving interconnectivity across its five major valleys. While this scale of investment promises to strengthen Bengaluru's resilience, it also highlights the critical need to ensure that community voices and everyday urban life are placed at the centre of this transformation.

Participants included architecture students, professionals, citizen representatives, and members of the Mod and Oorvani teams. Academic partners such as MS Ramaiah School of Architecture, RV College of Architecture, BMS Yelahanka, and PES University collaborated alongside professional and citizen groups like Well Labs, Paani Foundation, Sponge Collaborative, and Friends of Lakes.

Through a series of mapping exercises using Google Earth Pro, participants verified and corrected stormwater drain alignments and classified them into twelve typologies based on their urban adjacencies. The activity not only helped familiarise participants with the city's watershed system but also generated vital spatial data for the development of the Stormwater and the City Dashboard—a digital platform that will make stormwater networks more transparent and participatory.

The workshop demonstrated how collaborative learning, civic participation, and open-source tools can come together to build resilience. It reaffirmed resilience emerges from shared knowledge, collective action, and citizen-led observation.





# STORMWATER & THE CITY

## A DASHBOARD FOR STORM WATER DRAIN AWARENESS AND ACTION

A part of Building a Resilient Bengaluru Campaign, *Stormwater & the City* is a 12-month initiative to develop an interactive digital dashboard that maps Bengaluru's stormwater drainage network (Rajakaluves) across physical, urban, and governance dimensions. Storm Water Drains (SWDs) are critical for flood mitigation, public health, and water quality, yet remain invisible in planning and public discourse, often reduced to mere open drains.

*Stormwater & the City* positions information as the first, crucial step toward action. One that aligns Bengaluru's resilience ambitions with inclusive, participatory community engagement. This project aims to make Storm water networks visible and legible through a user-friendly, participatory dashboard that enhances transparency, encourages civic engagement, and fosters collective stewardship. Drawing inspiration from the citizen-led revival of Bengaluru's lakes, this initiative envisions a similar transformation in the perception and management of stormwater infrastructure.

In July 2025, Mod Foundation in collaboration with Oorvani Foundation won a grant for this project. This project is funded by Bengaluru Sustainability Forum (BSF). The first step towards making stormwater network visible was to map and understand the typologies along SWDs. This workshop was conducted on 11th October, 2025 at BLR Design Centre. Students, professionals and RWA members came together to map and understand SWDs and their typologies.







A resilient city begins with remembering what flows beneath it.



# ABOUT THE WORKSHOP

## UNDERSTANDING AND MAPPING STORM WATER TYPOLOGIES

The Typology Workshop on Stormwater Drains held at the BLR Design Centre in collaboration with Oorvani Foundation, set out to introduce participants to different typologies of SWDs, their ecological and infrastructural functions, and their role in urban resilience. It involved hands-on mapping, case-based discussions, and system-level learning. The workshop offered a unique platform for architecture students to interact with professionals and citizen groups that have been involved in stormwater drains systems.

The participants were divided into groups. Each group consisted of students, professionals, RWA member and a member of MOD team. By bringing together students and professionals the workshop created a platform for students to learn from practitioners, learn tools and reflect on the state of stormwater drains in the city.





1810 SETTING UP OF CANTONMENT



# WORKSHOP STRUCTURE

The intent of the typology workshop is to understand Bengaluru's stormwater system and to contribute in creating reliable and accessible information for the city. Using Google Earth Pro, the participants will map and verify the drain paths and classify the drains into distinct typologies. The objective of this workshop is to create a database of the stormwater system which will hold accurate alignment of the drains as well as information on their urban adjacencies.

The workshop started with members of Mod Foundation and Oorvani team introducing the organisation and the Project. This was followed by an introduction to the city's stormwater systems and drain typologies.

## Understand Bengaluru's stormwater infrastructure

An overview to build knowledge and capacity to map stormwater drains (SWDs)

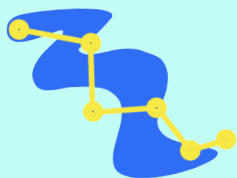
- Introduction to the city's stormwater system
- Stormwater drain typologies
- Why map a drain?
- Assign groups and tasks
- Activity to understand the topography and flow of water

## Map the stormwater drains

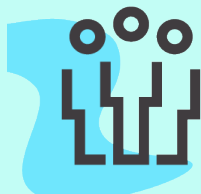
Hands-on GIS mapping to verify alignments and determine typologies of SWDs

- Set up the software and standard operating procedure
- Task 1 - Find correct alignments of SWDs
- Task 2 - Find SWD typologies based on urban adjacencies

## Expected Outcomes



Making sense of  
Spatial Data



Community & Expert  
Collaboration

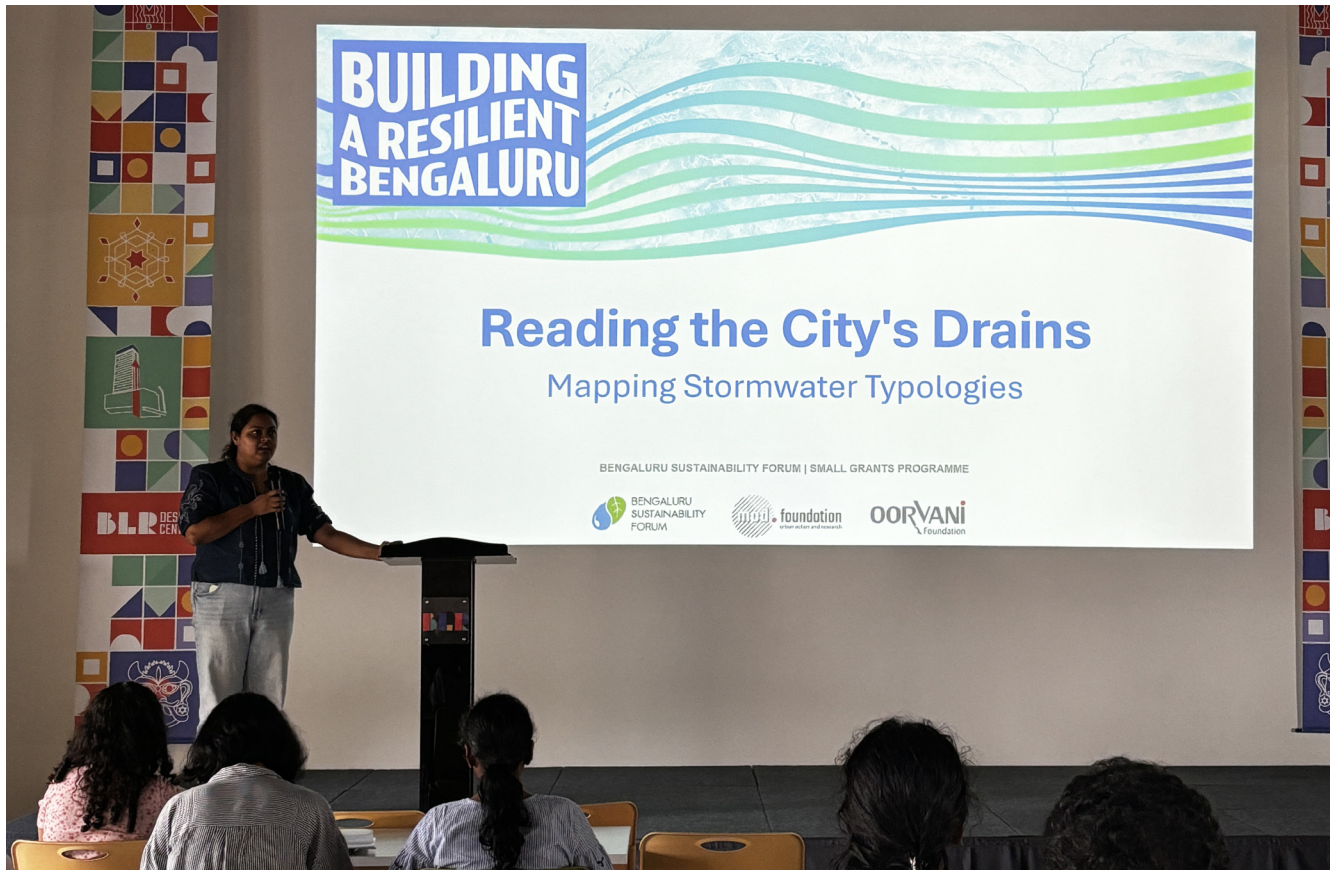


Building Visibility  
with Open-source Data



A Repository for Future  
Informed Action





Introduction to the Building a Resilient Bengaluru campaign the workshop and the workshop by Mod Foundation.



Bottom Left: Presentation by Mod Foundation highlighting objectives & approach of the Stormwater and the City project.  
Bottom Right: Participants actively engaged in mapping and discussion during the workshop.



# MAPPING THE FLOW

## ACTIVITY

Understanding the city's stormwater system began with tracing the natural flow of water through Bangalore's natural terrain. Each group was given zoomed-in valley maps showing contours, lake chains, and connecting drains, allowing them to visually follow the direction of flow from ridge to valley. Using pens and markers, participants traced the direction of water flow across these maps, identifying ridges, depressions, lake chains, and the points where natural contours guide water toward the storm water drains. The exercise also helped participants familiarise themselves with the watershed map and understand how elevation shapes drainage patterns across the city's terrain.

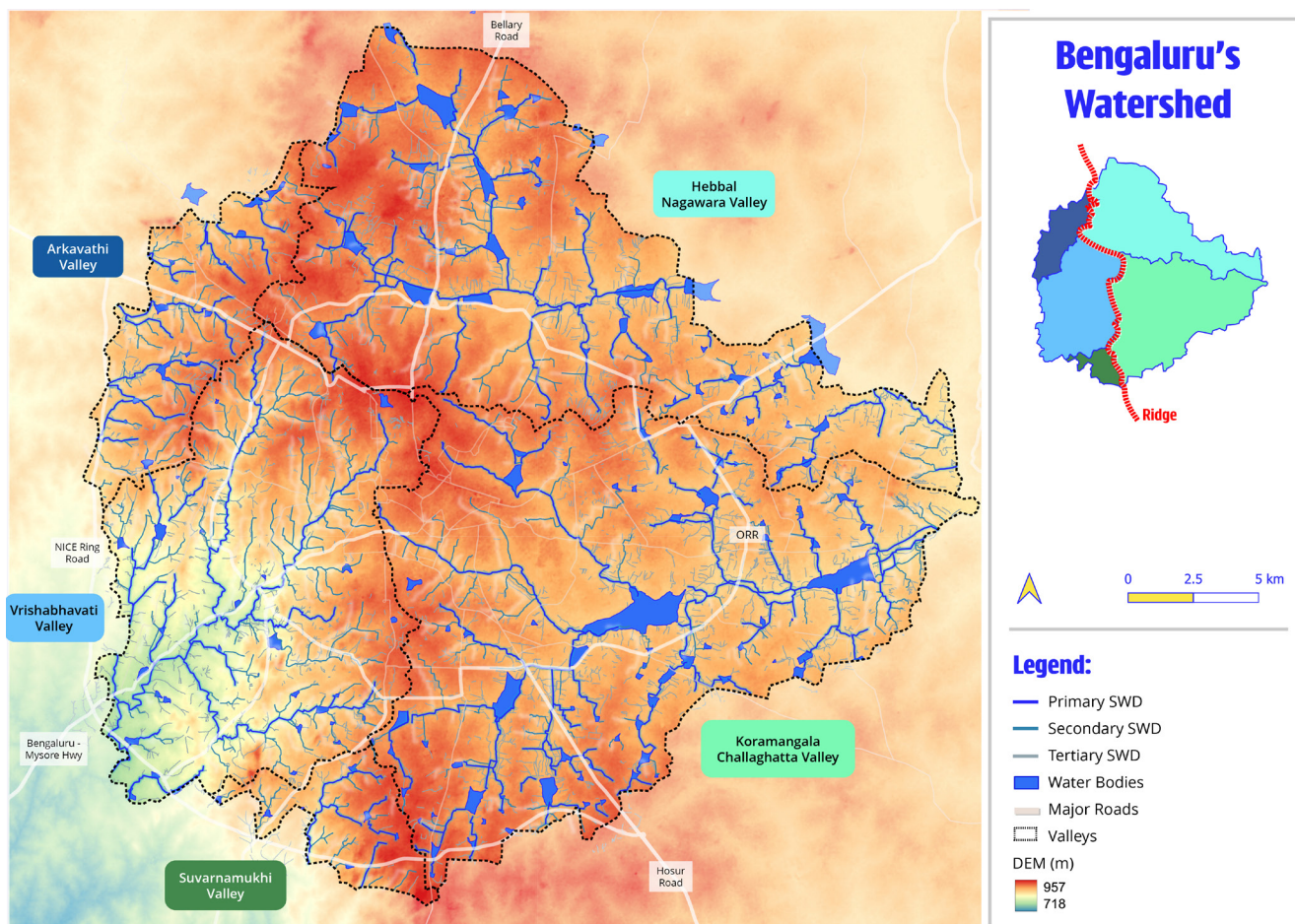
By physically mapping the flow of water, participants could better grasp the interconnected nature of Bengaluru's valleys. This was crucial for accurately classifying stormwater drain typologies later during the course of the workshop.

The exercise revealed how each valley functions as part of a larger interconnected watershed system, where tanks and drains once formed a continuous network of storage and flow. By mapping the city on paper first, participants could clearly see how these systems are now fragmented, setting the stage for discussions on resilience.

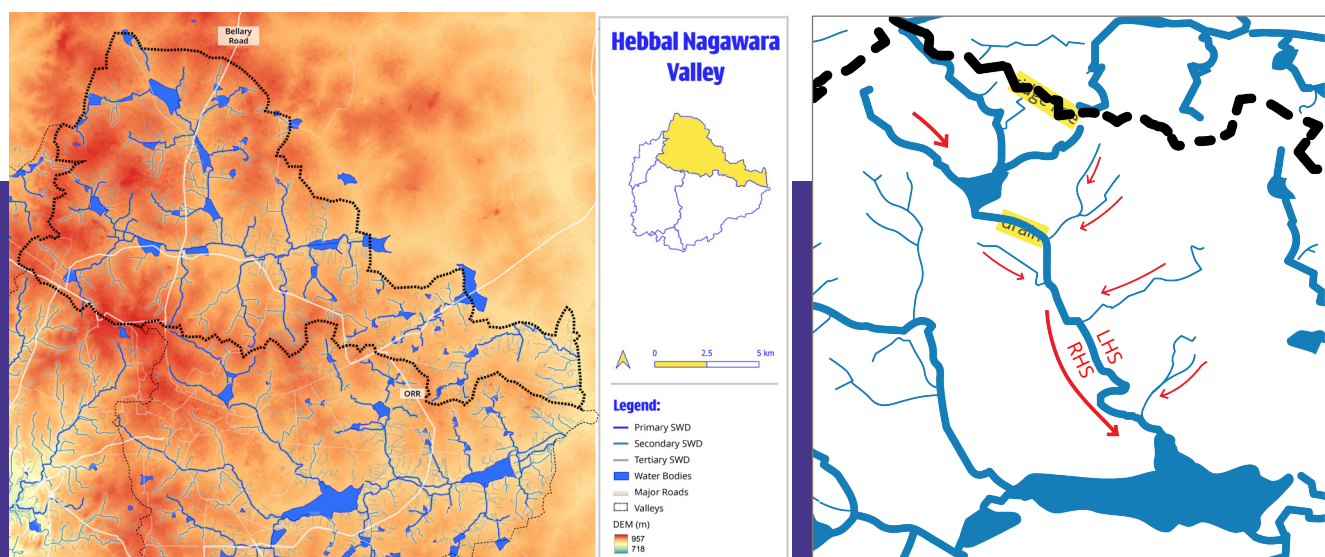


Participants actively engaged in mapping and discussion during the workshop.





Map of the Digital Elevation Model (DEM) of Bengaluru developed by Mod Foundation and provided to participants as a reference for understanding the city's topography.



Bottom Left: Zoomed in map of the Hebbal-Nagawara Valley, created to help participants trace the flow of water. Similar maps were prepared for the Koramangala-Challaghatta, Arkavati, Suvarnamukhi, and Vrishabhavati valleys.

Bottom Right: Flow of Water Mapping Guide provided to participants to assist in identifying contours, catchments, and drainage directions.



# SWD ALIGNMENT

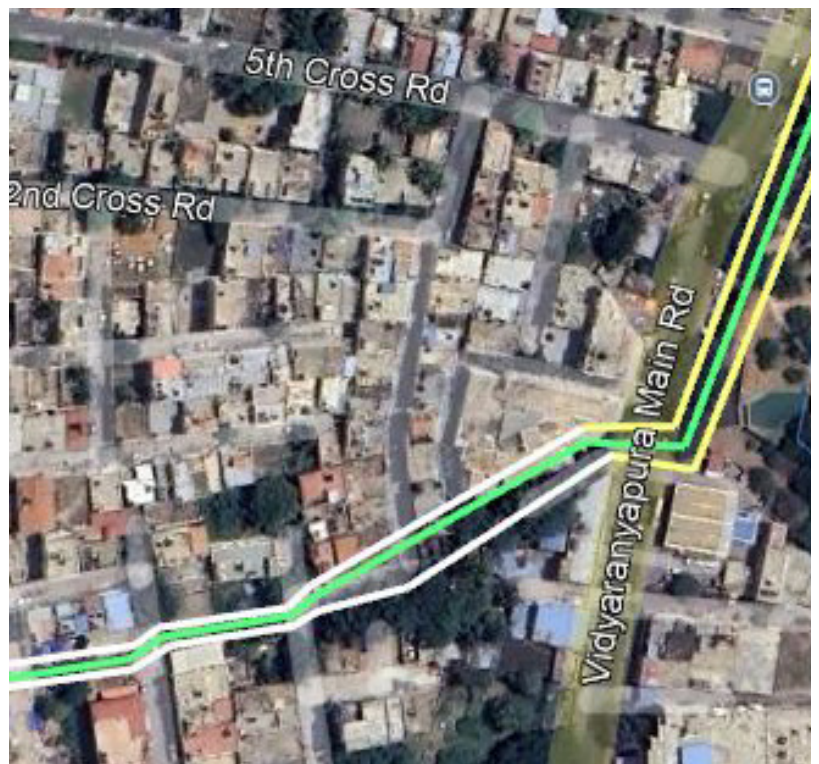
## TASK I

The first task focused on verifying and correcting the alignment of stormwater drains (SWDs) using Google Earth Pro. Participants worked in groups, each assigned to one of Bengaluru's five valleys, to trace and validate the actual paths of drains visible on satellite imagery.

Existing datasets, sourced from OpenStreetMap and STUP Consultants, served as the base layer, but these often did not match real-world conditions. Using visual cues such as terrain contours, street layouts, and building edges, participants adjusted these alignments to reflect on-ground realities more accurately.

To ensure precision, they cross-referenced imagery with the GBA GIS Viewer, which provided high-resolution drone visuals.

This exercise helped participants understand both the technical challenges and interpretive judgment involved in digital mapping. Through this task, they realised that many SWDs are discontinuous or obscured by urban development, highlighting the gaps in publicly available stormwater data. The alignment exercise thus became a crucial step toward building a reliable, open-source spatial database of Bengaluru's stormwater network—one grounded in collective observation and collaborative verification.



Top: Participants mapped a secondary in the Koramangala–Challaghatta Valley, tracing its corrected alignment highlighted in green.

Bottom: Participants mapped a primary drain in the Hebbal–Nagawara Valley, tracing its corrected alignment highlighted in green.





Participants interacting and exchanging observations as part of the workshop session.





Participants interacting and exchanging observations as part of the workshop.



# DETERMINE STORMWATER DRAIN TYPOLOGY

## TASK II



Building on the alignment work, the second task involved identifying and classifying stormwater drains into typologies based on their surrounding urban contexts.

Participants referred to the Typology Code Sheet provided in the workshop guide, which outlined twelve distinct typologies:

- » *road-adjacent drains (t1-t3)*
- » *property-edge drains (t4-t5) to*
- » *lakeside, open space, and vacant land adjacencies (t6-t12).*

Using corrected alignments in Google Earth Pro, participants carefully examined both the left and right banks of each drain segment, noting variations in built form, land use, and accessibility. In some instances, a single drain exhibited multiple typologies along its length, revealing the complex and fragmented nature of Bengaluru's urban fabric.



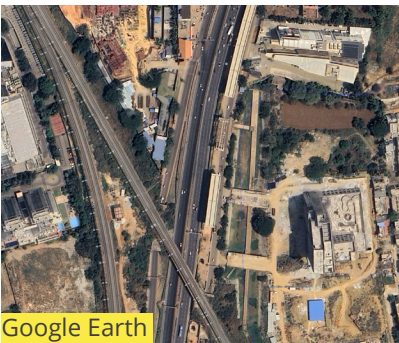
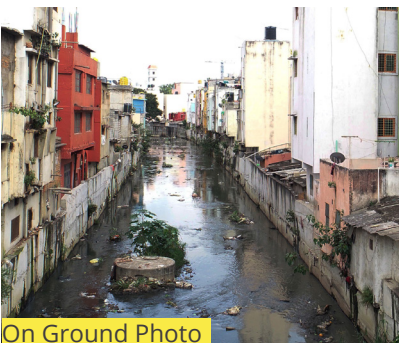
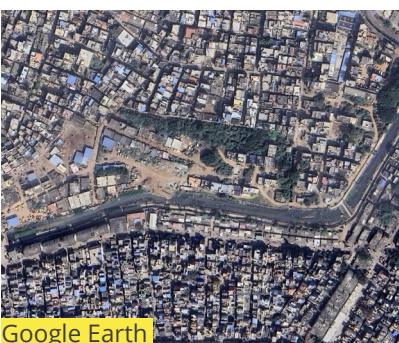
Top: Participants identified the typology on both LHS and RHS of the secondary drain (Task I) in the Koramangala–Challaghatta Valley.

Bottom: Participants identified the typology on both LHS and RHS of the primary drain (Task I) in the Hebbal–Nagawara Valley.

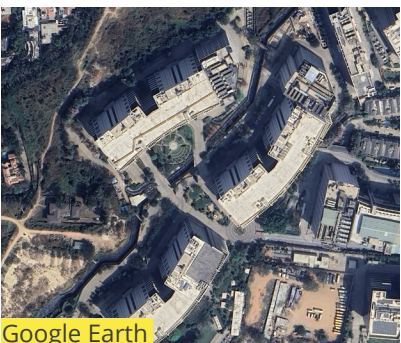
This classification process not only deepened understanding of how stormwater systems interact with their urban surroundings but also generated crucial spatial and contextual data for the development of the Stormwater and the City Dashboard. By documenting typologies systematically, participants contributed to building a citywide database that will make Bengaluru's stormwater network more visible, transparent, and accessible to all.



# SWD DRAIN TYPOLOGY CODE SHEET

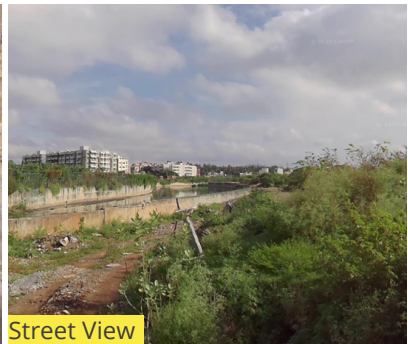
| Code | Typology                                                                                                                                                                                                                                                       | Description                                                               |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------|
| t1   | Road Adjacent (With Footpath)                                                                                                                                                                                                                                  | Drains run alongside a public road with a defined footpath or pavement.   |
|      |          |                                                                           |
| t2   | Road Adjacent (Without Footpath)                                                                                                                                                                                                                               | Drains run along roads but lack proper pedestrian edge or are unwalkable. |
|      |       |                                                                           |
| t3   | Ring Road Adjacent                                                                                                                                                                                                                                             | Drains run along large roads with medians or service roads; often wider.  |
|      |    |                                                                           |
| t4   | Property Adjacent (Abutting Buildings)                                                                                                                                                                                                                         | Buildings or homes directly abut the drain wall; no setback or walkway.   |
|      |    |                                                                           |



| Code | Typology                                                                                                                                                                                                                                                       | Description                                                                        |
|------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------|
| t5   | Property-Adjacent (With Setback)                                                                                                                                                                                                                               | Small setback between buildings and drain; may serve as informal pathway/driveway. |
|      |          |                                                                                    |
| t6   | Lake Adjacent (With Pathway)                                                                                                                                                                                                                                   | Drain connects to a lake edge that has formal greenways or walkways.               |
|      |       |                                                                                    |
| t7   | Lake Adjacent (Without Pathway)                                                                                                                                                                                                                                | Drains terminate at lakes.                                                         |
|      |    |                                                                                    |
| t8   | Inside Private Property / Campus                                                                                                                                                                                                                               | Drains are part of a gated or managed institutional campus or tech park.           |
|      |                                                                                         |                                                                                    |



# SWD DRAIN TYPOLOGY CODE SHEET

| Code | Typology                           | Description                                                                                                                                                                                                                                                                                                                                                       |
|------|------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| t9   | Railway Adjacent                   | Drains running parallel to railway lines.<br><br>Google Earth                                                                                                                                                                                                                   |
| t10  | Openspace(playgroundsetc.)Adjacent | Drains passing beside large grounds.<br>May be fenced.<br> Aerial Photo<br> Google Earth<br> Street View |
| t11  | Agricultural Land Adjacent         | Peri-urban or low-density areas where drains flow past fields.<br> Google Earth                                                                                                                                                                                               |
| t12  | Vacant Land Adjacent               | Drains that flow through vacant parcels of land.<br> Google Earth<br> Street View                                                                                                        |





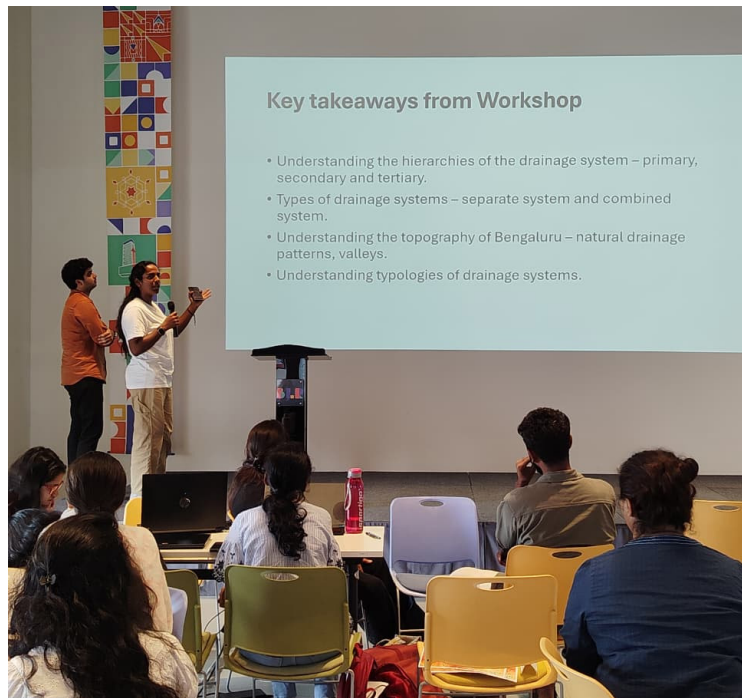
Top: Presentation by Mod Foundation highlighting objectives & approach of the Stormwater and the City project.  
Bottom: Participants actively engaged in mapping and discussion during the workshop.



# PRESENTATIONS BY PARTICIPANTS

The workshop culminated in presentations by each participant group, where students showcased their mapping exercises, observations, and typology classifications. Using Google Earth Pro and the data provided, they demonstrated how they identified and corrected drain alignments.

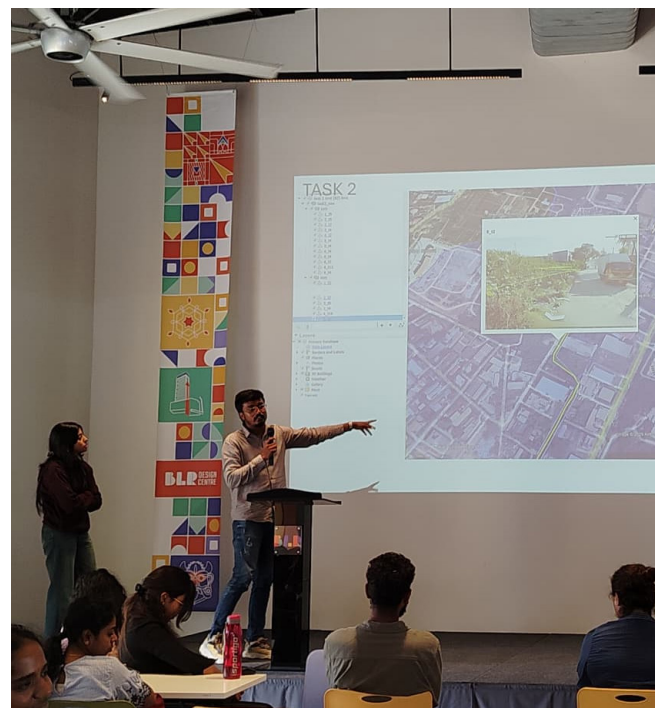
Each group presented their analysis of a specific valley sharing before-and-after comparisons of drain alignments and discussing the challenges faced during verification. They reflected on variations in typologies, from drains along road with adjacent footpath to and covered drains. They observed that these typologies are not just theoretical categories but tangible realities across the city.



A student group presents their mapping outcomes and collective learnings from the workshop.



Participants presenting their results from verifying and correcting stormwater drain alignments.



Participants sharing their findings from classifying stormwater drains into distinct typologies.





Participants presenting their results from verifying and correcting stormwater drain alignments along 5 different stretches.

The session encouraged critical thinking and collaborative dialogue. Professionals and citizen representatives responded to student presentations with valuable feedback ranging from technical validation of the mapping process to broader reflections on the importance of transparency in urban data and participatory mapping. This exchange allowed participants to understand the multidisciplinary nature of urban water systems, where engineering, design, and community perspectives intersect.

The presentations not only validated the workshop's mapping objectives but also fostered a sense of ownership and curiosity among young practitioners. It marked the beginning of a shared effort to build a reliable and accessible stormwater database for Bengaluru.



Participants share that they identified two typologies within the valley they studied.



# THE WAY FORWARD

The Understanding and Mapping Stormwater Typologies workshop marks an important step in reimagining how Bengaluru can respond to the challenges of flooding and water insecurity. We have seen that resilience cannot be engineered through infrastructure alone. It must be built collectively, with citizens at the heart of the process. When communities are included, solutions become more grounded in lived realities, more adaptable to change, and more deeply connected to the city's ecological and cultural fabric.

The workshop concluded with reflections from the organising teams and participants. Members of Mod

Foundation and Oorvani Foundation emphasised that this was not an isolated exercise but part of a larger vision to make Bengaluru's hidden stormwater systems visible, understood, and valued.

The facilitators reiterated that this collective effort is a crucial step towards "Building a Resilient Bengaluru", where informed citizens, students, and professionals together contribute to a transparent and data-driven approach to flood resilience. We invite you to continue engaging, with your ideas, your networks, and your lived experiences, to help shape a future where Bengaluru's waterways are reclaimed, its communities empowered, and its resilience secured.



Group Photo: Participants, organisers, and partners | Typology Workshop | BLR Design Centre.







# ABOUT US

## Mod Foundation

Mod Foundation, established in 2010, is an interdisciplinary urban action and research institute based in Bengaluru. By leveraging interdisciplinary research and creative practices, we aim to reimagine urban environments that are deeply rooted in cultural context, responsive to contemporary challenges, and adaptable to future needs.

The work we do is design-driven, with an emphasis on exploring the underlying dimensions in the urban fabric, focussing on everyday spaces and objects. We are fascinated with cities, and interpreting them by visualising their information and analyses, hands-on design and mapping techniques.

Mod Foundation is the urban design and research team at Venkataramanan Associates (VA), an architecture, interiors and urban design practice headquartered in Bangalore.

## Oorvani Foundation

Oorvani Foundation is a non-profit committed to civic engagement, citizenship and communities. The Foundation's mission is to connect people who want better cities with civic information, tools, networks and resources they need to make it happen.

Urban challenges in our cities need collective action to fix them, action that is based on a deep understanding of issues and root causes, and changemaking. Oorvani Foundation is rooted in the belief that informed, engaged citizens are key to transforming our cities. The team enables individuals and communities to navigate the journey from awareness to action through a structured, three-step changemaking process.

## BLR Design Centre

BLR Design Centre, established in December 2024, is the public engagement platform of Mod Foundation. It is a collaborative workspace focused on transforming urban living environments through architectural partnerships, cultural dialogue and design-led solutions. Recognizing urban change as a cultural challenge, not merely a technical issue, the Centre promotes architectural innovation across disciplines.

Through exhibitions, talks and projects, it builds collaborations to address pressing societal issues. By studying built environments, cultural histories and societal structures, the Centre aims to develop implementable models that shape Bengaluru's future, positioning the city as a living laboratory for architectural and urban research, intervention & design.

## Bengaluru Sustainability Forum

The Bengaluru Sustainability Forum is an inter-institutional collaborative initiative that aims to address issues relating to long-term sustainability of urban and peri-urban landscapes. Bengaluru Sustainability Forum focuses on public goods and urban commons - including water, air and soil - amongst others.

The main objective of the Bengaluru Sustainability Forum is to convene and disseminate knowledge on various aspects of sustainability in the urban landscape, with a focus on Bengaluru. The Forum aims to achieve this by encouraging conversation and collaboration across a broad range of stakeholders.





## WE WORK BETTER TOGETHER

Our partnerships drive meaningful conversations and on-ground action. From design studios and research institutes to citizen groups and government bodies, we're proud to collaborate with organisations that share our commitment to shaping better urban futures.



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