NFSSM ALLIANCE

WRI INDIA

WASH Institute
Water Sanitation and Hygiene Institute

Conference on Building

# Climate Resilient WASH Systems in India

## Adapting to Climate Change

**27th & 28th November 2024, Thiruvananthapuram**

# Acknowledgement

The Conference on Building Climate-Resilient WASH Systems in India was driven by the urgent need to confront the growing threats climate change poses to Water, Sanitation, and Hygiene (WASH) infrastructure and behaviors. From floods that damage vital systems, to droughts that deplete water sources and rising temperatures that reshape water use and public health risks, the challenges are immense. At the same time, the WASH and health sectors play a role in greenhouse gas emissions, making it essential to rethink how these systems function in a changing climate. Climate-resilient WASH is not just about protection—it's about ensuring continuity, adaptability, and sustainability despite climate-induced hazards. The Conference came at a critical juncture to address these challenges while also advancing equity, inclusion, and sustainable resource management in a changing climate.

We extend our deepest gratitude to USAID, the NFSSM Alliance, and the World Resources Institute - India (WRI India) for their unwavering support in fostering critical discussions and driving meaningful action toward climate-resilient WASH systems.

We also sincerely appreciate the contributions of all participants, including sector practitioners, government representatives, researchers, and academia, who enriched the Conference with their expertise and insights. Their active engagement in thematic discussions and collaborative efforts helped shape a roadmap for integrating climate resilience into WASH policies, governance, and financing mechanisms.

A special note of appreciation goes out to the dedicated teams from WASH Institute, WRI India and Dasra (on behalf of the NFSSM Alliance), who worked tirelessly to organize and facilitate meaningful conversations. We hope that the knowledge shared, and partnerships formed during the Conference will drive lasting progress in ensuring inclusive, sustainable, and climate-resilient WASH systems in India.

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# EXECUTIVE SUMMARY:

The Conference on Building Climate-Resilient WASH Systems in India, held on 27th and 28th November 2024 in Thiruvananthapuram, brought together over 200 stakeholders from government, academia, civil society, and the private sector to address the urgent need for climate-resilient Water, Sanitation, and Hygiene (WASH) systems. The Conference explored the intersection of climate change and WASH, emphasizing the disproportionate impact on marginalized communities and the need for inclusive, sustainable solutions. Over two days, participants engaged in thematic discussions, case studies, and workshops to identify actionable strategies for building resilience in WASH systems. Below is a detailed summary of the key insights and outcomes from the Conference.


# Day 1: Building Climate-Resilient WASH Systems in India

Day 1 of the Conference delved into the intersectionality of climate change and WASH, with particular emphasis on how marginalized communities are disproportionately affected.

## Theme 1: Understanding the Intersectionality of Climate Change and WASH Climate-Sanitation Linkages:

Climate change exacerbates vulnerabilities in WASH systems, particularly in sanitation, where floods and droughts disrupt infrastructure. For example, the 2013 Uttarakhand floods severely damaged sanitation systems, highlighting the need for climate-resilient infrastructure.

**Community Perspectives:** Vulnerable communities, especially in informal settlements, face significant challenges during climate events, such as reduced access to water and sanitation. Community-driven monitoring and local governance are critical for resilience.

**Small Towns:** Small towns like Chintamani (Karnataka) face unique challenges, including water scarcity and poor infrastructure. Bottom-up approaches that integrate local knowledge are essential for climate adaptation.

**GHG Emissions from WASH:** The WASH sector contributes to greenhouse gas (GHG) emissions, particularly through wastewater treatment. Methane capture and renewable energy integration (e.g., solar-powered STPs) can mitigate emissions.

## Key Recommendations:

- Integrate climate resilience into national programs like Jal Jeevan Mission (JJM) and Swachh Bharat Mission (SBM).
- Promote energy-efficient technologies and circular economy models in sanitation.
- Strengthen community-led monitoring and governance structures.

## Theme 2: Frameworks for Climate-Resilient WASH

**Strategic Frameworks:** Tools like the Climate Hazard and Vulnerability Assessment (CHVA) framework help cities assess risks and design resilient WASH systems. For example, WRI India's toolkit was successfully applied in Chunar (Uttar Pradesh) to address heat and water scarcity.

**Integrated Water Resource Management (IWRM):** Frameworks like IWRM and nature-based solutions (NBS) are critical for sustainable water management. For instance, decentralized wastewater treatment in Bangalore has proven effective.

**Energy Transitions:** Solar energy integration in WASH infrastructure (e.g., STPs) can reduce operational costs and emissions. Pilot projects in Maharashtra demonstrated energy neutrality in water treatment plants.

### Key Recommendations:

Develop simplified frameworks for small towns to assess climate risks.

Scale up decentralized wastewater treatment and renewable energy solutions.

Align WASH frameworks with SDG indicators and climate resilience metrics.

## Theme 3: Lighthouse Stories in Climate Resilience

**Geo-Spatial Analysis:** Tools like HEC-HMS and HEC-RAS were used in Aurangabad to model flood risks and inform urban planning.

**Nature-Based Solutions (NBS):** Constructed wetlands and decentralized wastewater treatment systems (e.g., Lemnion Green Solutions) offer scalable, low-cost solutions for water management.

**Community-Led Solutions:** Projects in the Western Ghats (e.g., Pandrimalai) and Devanahalli demonstrated the effectiveness of community involvement in water recharge and sanitation systems.

## Key Recommendations:

- Promote NBS forwastewater treatment and water recharge.
- Strengthen community ownership and local governance in WASH projects.
- Use geospatial tools for disaster preparedness and urban planning.

## Theme 4: Financing for Climate-Resilient WASH

**Blended Finance:** Combining public and private funding can scale up WASH services. For example, Maharashtra's Performance-linked Annuity Model reduced public capital investment while improving sanitation services.

**Green Bonds:** Municipalities like Ghaziabad and Vadodara successfully raised Green Bonds for wastewater treatment plants. However, the market remains underdeveloped due to lack of standardization.

**Carbon Financing:** While promising, carbon financing in WASH faces challenges in accurately measuring emissions reductions.

### Key Recommendations:

Explore innovative financing models like Green Bonds and blended finance.

Build capacity among municipalities to access climate finance.

Advocate for policy incentives to attract private investment in WASH.

## Theme 5: Data for Climate Change Action

**Localized Climate Data:** Strengthening climate modelling efforts through high-resolution, downscaled data is critical for urban and regional planning. Tools like GIS and predictive analytics were highlighted for disaster preparedness and infrastructure planning.

**Real-Time Monitoring:** Integrating AI-driven tools and real-time data collection can enhance adaptive learning and timely interventions in WASH systems.

**Standardized Data Formats:** Creating data-sharing platforms with standardized formats and auditing systems is essential for comprehensive monitoring and decision-making.

### Key Recommendations:

Enhance localized climate data collection and integrate it into WASH planning.

Leverage GIS and predictive analytics for disaster preparedness and resource allocation.

Develop standardized data-sharing platforms to combine climate and WASH data for holistic monitoring.

## Theme 6: Building a Climate-Resilient Workforce

**Skill Gaps:** There is a lack of climate-resilience training in government and academic programs, leaving professionals ill-equipped to address climate challenges in WASH systems.

**Interdisciplinary Learning:** Academic institutions to integrate climate resilience into curricula, combining fields like civil engineering, social sciences, and economics.

**Community Empowerment:** Localized, context-specific training programs are needed to empower communities, particularly women and marginalized groups, to lead climate-resilient WASH initiatives.

### Key Recommendations:

Integrate climate resilience into induction and in-service training programs for WASH professionals.

Foster interdisciplinary learning and hands-on, studio-based education in academic institutions.

Strengthen community-led solutions and ensure gender-inclusive planning in WASH projects.

# Day 2: Shaping Climate-Resilient WASH Systems

Day 2 began with a **field visit to Anchuthengu Gram Panchayat,** a coastal community in Thiruvananthapuram severely impacted by erosion. Participants observed rising sea levels, unpredictable waves, and inadequate early warning systems. Despite government schemes like **Punargeham,** many residents resist relocation due to emotional and economic ties, highlighting the need for **nature-based solutions** like mangrove restoration and stronger community-centric policies.

The visit was followed by a **workshop** to identify gaps and opportunities in building climate-resilient WASH systems, to strengthen governance, financing, infrastructure, and community engagement.

## Workshop: Pathways for Present & Future

- **Horizon 1 (Current State of WASH Systems):**

- Legacy WASH systems are ill-equipped to handle climate risks, with outdated infrastructure and inadequate data.

- Poor interdepartmental coordination and lack of climate-resilient policies hinder progress.

- **Horizon 2 (Emerging Future):**

- **Bold Goals:** Integrate climate resilience into WASH policies, scale NBS, and empower communities through decentralized decision-making.

- **Actionable Solutions:**

1. Establish a Climate Convergence Cell for cross-sector coordination.
2. Create standardized data management across departments through centralized platforms for real-time monitoring and predictive analytics.
3. Strengthen community engagement and gender-inclusive planning.

## Key Recommendations:

**Governance, Policy, and Finance:**
Update national and state policies to include climate resilience in WASH frameworks.

Explore innovative financing mechanisms like Green Bonds and public-private partnerships.

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**Data and Monitoring:**
Develop standardized data-sharing platforms with auditing systems across departments to integrate climate and WASH data.

Use AI-driven tools for predictive analytics and real-time monitoring.

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**Infrastructure and Technology:**
Scale up NBS and renewable energy solutions in WASH systems.

Incorporate climate resilience into Detailed Project Reports (DPRs).

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**Community Engagement:**
Foster decentralized decision-making and community ownership.

Ensure gender inclusivity and representation in WASH planning.

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**Capacity Building:**
Provide context-specific training for local authorities and communities.

Empower women Self-Help Groups (SHGs) to lead climate-resilient WASH initiatives.

## Conclusion

The Conference highlighted the pressing need to integrate climate resilience into WASH systems to tackle the escalating challenges posed by climate change.

Key insights emerged, emphasising the importance of embedding climate resilience into national and state WASH policies, leveraging innovative financing mechanisms like blended finance and green bonds to fund resilient infrastructure, and adopting inclusive, decentralised approaches to empower communities and ensure sustainable solutions. Additionally, the role of data-driven decision-making was underscored, with standardised management of data across all data platforms and integration of AI tools identified as critical for enhancing monitoring and adaptive learning.

By aligning governance, finance, technology, and community engagement, India can develop WASH systems that are not only climate-resilient but also inclusive and sustainable. The Conference marked a significant step forward in fostering collaboration and driving actionable solutions for building climate-resilient sanitation systems across the country.

## Day 1:
# Building Climate-Resilient WASH Systems in India

The Conference on Building Climate-Resilient WASH Systems in India, held on 27th and 28th November 2024, explored the urgent need to adapt Water, Sanitation, and Hygiene (WASH) systems to the ever-increasing impacts of climate change. The two-day event brought together sector practitioners, government representatives, researchers, and academia to understand vulnerabilities of current WASH infrastructure and identify actionable solutions to safeguard these systems from climate-related challenges like flooding, droughts, and rising temperatures.

Day 1 of the Conference delved into the intersectionality of climate change and WASH, with particular emphasis on how marginalized communities are disproportionately affected. Through thematic discussions, participants co-created a roadmap for integrating climate resilience into WASH policies through governance mechanisms, financing, and community-driven solutions. The event helped close knowledge gaps and encouraged collaboration among different groups to support climate-resilient WASH systems, stronger policies, and better financing.

This Proceedings Report highlights the insights, outcomes, and recommendations of the Conference, all aimed at ensuring that India's WASH systems can withstand future climate shocks while also remaining inclusive, sustainable, and responsive to the needs of vulnerable populations.

The Conference on Building Climate-Resilient WASH Systems in India opened with a guiding note and welcome address by Ms Kaveri Dhawan (Manager, Dasra), Ms. Sahana Goswami (Senior Program Manager, WRI India) and Dr Arumugam Kalimuthu (Executive Director, WASH Institute).

# SUMMARY OF OPENING REMARKS

## KAVERI DHAWAN, NFSSM ALLIANCE

Kaveri Dhawan opened the Conference by acknowledging the crowded landscape of climate and WASH-related Conferences but highlighted why this event in Thiruvananthapuram was especially significant. She explained, despite progress in the climate-WASH field, there is still a lack of shared understanding among experts about how climate change affects WASH systems. Ms. Dhawan emphasized that the Conference's goal was to foster clear, actionable dialogue on this front.

Going on to describe the structure of the two-day event, Ms. Dhawan highlighted key topics like using frameworaks for adaptation and focusing on sectors such as data and finance. She also emphasized the need to involve emerging professionals in the climate-resilient WASH workforce through better education.

She then introduced a field visit to Kerala's coastal areas, where participants could see firsthand how climate change affects water resources and vulnerable communities, connecting theory with real-world experience.

She concluded by urging participants to engage fully with the various activities, including poster presentations, and expressed hope that the Conference would create practical recommendations in infusing WASH systems with climate resilience.

## SAHANA GOSWAMI, WRI INDIA

Sahana Goswami began by discussing global climate change, noting that the world has already surpassed the 1.5°C temperature rise limit. She explained that while these numbers may seem small, their impact is already being felt, especially in water resources. Climate change is altering the water cycle, affecting rainfall, water availability, and increasing water stress in many regions. She emphasized that India, with its large population and limited freshwater resources, is particularly vulnerable. Water availability is becoming more uncertain, especially during monsoons, and extreme weather events like floods and droughts are increasing in frequency and severity.

Ms. Goswami also touched on the importance of addressing climate change through three main approaches – mitigation, adaptation, and resilience – and how the water sector is critical in all three approaches. Of these, she noted that adaptation and resilience are essential, because even if mitigation efforts could curb emissions today, the climate would continue to change. Highlighting the urgency of building systems that can withstand the climate extremes that lie ahead, she hoped that the Conference would provide insights into tools and strategies for more resilient WASH systems.


## DR ARUMUGAM KALIMUTHU, WASH INSTITUTE

Dr Arumugam Kalimuthu welcomed attendees and emphasized the Conference's importance given the growing challenge that climate change poses to WASH systems. He noted that water, once overlooked in climate discussions, has now gained attention due to its crucial link to climate change. Dr Kalimuthu shared concerning statistics, including the rapid depletion of water sources and the harmful effects of climate-related disasters on agriculture, infrastructure, and public health. He stressed the need to focus on vulnerable communities, particularly those in rural areas and urban slums, who are already facing the brunt of climate change.

Dr Kalimuthu also highlighted the pressing need for state-specific and region-specific fact sheets to assess climate-related vulnerabilities; these local-level assessments would be instrumental in guiding policies and local intervention. He also called for clear, simple climate messaging, and resources and mechanisms to help vulnerable communities adapt to climate challenges.

In his closing remarks, Dr Kalimuthu urged all participants to utilise the Conference to deep dive into technical challenges facing the sector and focus on creating concrete roadmaps and recommendations to direct climate mitigation efforts for WASH services.

# Theme 1: Understanding the Intersections of Climate Change and WASH

**Moderator: Ms. Kaveri Dhawan | NFSSM Alliance**

## Government of India's Climate Change Plans and Initiatives in WASH

### Nikita Madan | National Institute of Urban Affairs

Nikita Madan, Senior Environment Specialist at the National Institute of Urban Affairs (NIUA), discussed the climate challenges faced by cities, especially in relation to WASH systems. She highlighted that 66% of India's population is at risk of extreme flooding, but only 33% is covered by early warning systems, showing a gap in disaster preparedness. She also pointed out that India faces significant water stress, with only 4% of global freshwater resources supporting 18% of the world's population. In 2024, 93% of days in urban areas experienced climate impacts like heatwaves and floods. Given these challenges, Ms. Madan substantiated that urban WASH systems require resilience-building to climate risk.

She then introduced India's National Action Plan on Climate Change (NAPCC), with several missions focused on water conservation, sustainable water management, and climate-resilient urban planning. The National Water Mission and the Mission on Sustainable Habitat - both part of the NAPCC - aim to improve water use efficiency, reduce waste, and ensure sustainable water systems across the country. These frameworks align with India's commitments under the Paris Agreement to cut carbon emissions and improve energy efficiency in water treatment.

The presentation also covered various government programs like Jal Jeevan Mission (JJM), which seeks to provide safe and adequate drinking water to every rural household, and Swachh Bharat Mission (SBM), which focuses on used water and solid waste management. Ms. Madan also introduced the Urban River Management Plan (URMP), launched to manage urban rivers sustainably and incorporate used water reuse and flood management into urban river planning. She concluded by calling for better integration of these programs with climate resilience efforts and stressed the need for robust climate finance to support their successful implementation.

## Climate and Sanitation Interlinkages

## Aasim Mansuri | CWAS - CRDF, CEPT University

Aasim Mansuri, representing the Center for Water and Sanitation (CWAS), addressed interconnections between climate change and sanitation. He emphasized that while the sanitation sector may not be a major emitter of greenhouse gas (GHG) emissions, when compared to sectors like transportation, it can significantly contribute by reducing methane and nitrous oxides from untreated wastewater.

Mr. Mansuri used the 2013 Uttarakhand floods as an example to show how climate impacts, like floods and heatwaves, make sanitation systems vulnerable. In Uttarakhand, sanitation infrastructure, including water and sewage treatment plants, was severely affected in the 2013 floods, disrupting essential service. He also noted that India, ranked as the seventh most vulnerable country to climate hazards, faces significant challenges in maintaining functional WASH infrastructure amidst these changing climate patterns.

Given these challenges, Mr. Mansuri argued for energy-efficient technologies and improving the sustainability of existing water and wastewater systems. He presented the example of an elevated Sewage Treatment Plant (STP) in Maharashtra, which was designed to be flood resilient, and emphasized that investing in climate-resilient infrastructure, although slightly more expensive, is critical to ensure long-term functionality of WASH systems in a changing climate.

Mr. Mansuri also discussed the potential to reduce emissions through energy transitions in sanitation, such as by integrating solar energy in STP operations and capturing methane from wastewater treatment plants for energy generation. By adopting circular economy models, where wastewater is recycled or reused, the sector can reduce emissions and mitigate its contribution to climate impact. He concluded by stressing on the need for WASH policies that support both climate adaptation and mitigation, such as promoting low-carbon technologies and encouraging investment in climate-resilient infrastructure.


## GHG Emissions and Potential for Reduction from WASH

## Neeraj Ramchandran | EY

Neeraj Ramchandran, Senior Manager at EY, focused on the intersection of climate change and GHG emissions in the WASH sector. He explained how emissions from water extraction, transportation, treatment, and wastewater management—especially methane and nitrous oxide—significantly contribute to global warming.

Mr. Ramchandran pointed out that the wastewater sector is a major emitter of methane, a potent GHG; capturing methane and converting it into energy can mitigate the sector's contribution to climate change. He also discussed emissions resulting from energy-intensive processes in water treatment and distribution, where renewable energy integration and energy-efficient technology can help decarbonize the sector. His presentation called for comprehensive urban GHG emissions inventories, specifically for wastewater and water supply systems, as current data often relies on default values and underestimates true emissions. Mr. Ramchandran argued that accurate emissions inventories are essential for developing effective decarbonization strategies for cities. Mr. Ramchandran emphasized the need for equitable climate adaptation in the WASH sector, noting that vulnerable populations, especially in rural and informal urban areas, are most affected by climate impacts. He advocated for more inclusive approaches to ensure marginalized groups have better access to WASH services.

Finally, he stressed the importance of policy frameworks to support decarbonization in the WASH sector, suggesting that existing policies, like the National Mission on Clean Ganga (NMCG) and AMRUT, should also focus on climate adaptation and reducing GHG emissions. He concluded by advocating for stronger regulatory frameworks that prioritize emissions reduction in WASH systems and support the adoption of low-carbon technologies.

## Climate Change: What Do Communities Want?

## Juhi Jain | CFAR

Juhi Jain presented findings from CFAR's work in Bhubaneswar and Jaipur, where they assessed the impact of climate change on WASH services in informal settlements. Her presentation shared data that calculated Safety Scores for wards in these cities, using indicators such as access to water, sanitation, and socio-economic factors. Her presentation showed how many households in flood-prone areas of informal settlements are unable to use WASH services during climate events; for example, access to piped water in some areas dropped from 81% to 50% during floods, and open defecation increased significantly.

Ms. Jain emphasized that building resilience in WASH systems requires not just infrastructure improvement but also strengthening local governance structures to address the needs of vulnerable groups. To this end, CFAR works with Slum Development Committees and other community-based structures to ensure that marginalized groups, including women, persons with disabilities, and the elderly, are included in decision-making processes related to WASH services. This approach strengthens local governance and empowers communities to take ownership of climate-resilient WASH solutions. She also highlighted the role of community-driven monitoring and data collection. CFAR conducts household surveys, Focus Group Discussions (FGDs), and Key Informant Interviews (KIIs) to assess WASH access and climate vulnerability; this data is used to create Local Climate Adaptation Plans tailored to community needs.

Ms. Jain concluded by calling for more inclusive, community-based approaches to building climate-resilient WASH systems, especially in informal settlements where climate change impacts are likely to be most severe.

## Changing Climate Impacts on Small Towns: A Local Perspective of Chintamani

## Anju Varghese | BORDA LO

Anju Varghese used BORDA's study on Chintamani Town (Karnataka) to demonstrate the challenges small towns face in adapting to climate change. Chintamani, where many borewells are non-functional during drought, struggles with poor water quality due to a mixing of stormwater with wastewater. This problem especially affects vulnerable populations, particularly in slums, where people rely on expensive tanker water.

Small towns are often overlooked in climate resilience discussions, despite facing significant climate impact (drought, water scarcity, and shifting precipitation patterns), and lacking resources and political will to prioritize climate adaptation for WASH systems. While national programs like JJM and SBM are helping larger cities, small towns remain underfunded and underserved.

Thus, Ms. Varghese highlighted the need for small towns to adopt climate-sensitive WASH frameworks developed through a bottom-up approach, where local knowledge is integrated into the framework. She stressed the importance of involving local communities, municipal officials, and other stakeholders to ensure climate resilience is prioritized in town planning. This would help these towns better prepare for the increasing climate risks they face.

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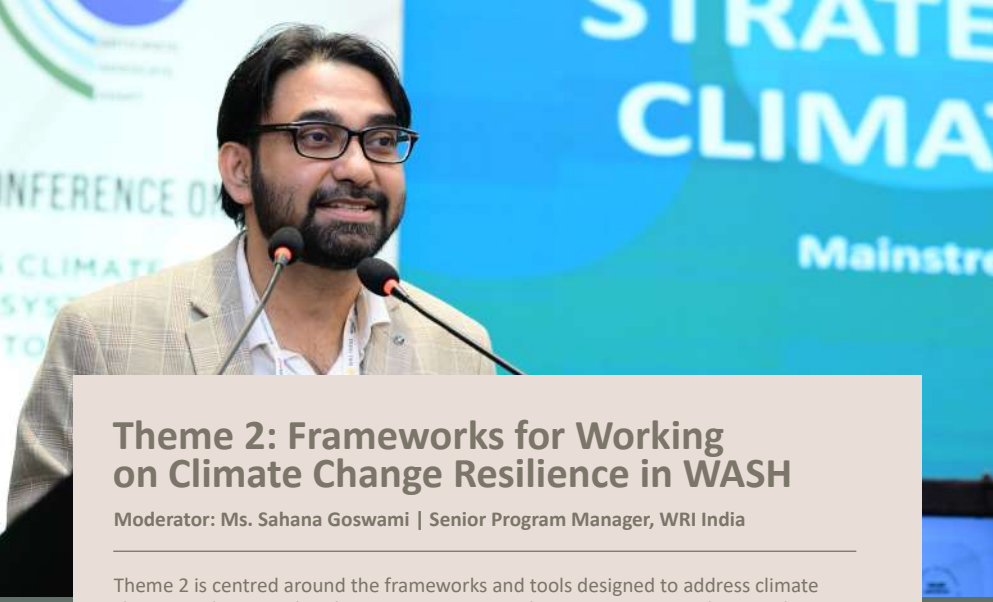
## Key Takeaways:

**Citizen Engagement in River Management:** The Urban River Management Plan (URMP) framework aims to achieve a 'desirable state' that balances human needs and ecological health. It focuses on citizen involvement in monitoring and caring for river ecosystems, as demonstrated in Aurangabad, where community cleaning drives and participatory river management successfully reconnected communities with polluted rivers, highlighting the importance of public stewardship and citizen engagement in building sustainable and climate-resilient river systems.

**Incorporating Indigenous Climate Responses:** Indigenous and ground-up practices from small towns must be integrated into municipal planning to ensure that local knowledge and traditional adaptation measures inform climate-resilient WASH solutions. Raising awareness and mobilizing governments to address climate change in WASH services can be achieved through dialogue, as demonstrated by Chintamani's approach, which ensures that solutions are context-specific, sustainable, and inclusive.



# Theme 2: Frameworks for Working on Climate Change Resilience in WASH

**Moderator: Ms. Sahana Goswami | Senior Program Manager, WRI India**

Theme 2 is centred around the frameworks and tools designed to address climate change resilience within the WASH sector. It explores innovative mechanisms being developed at the intersection of climate change and WASH, and highlights how these frameworks can help climate-related challenges emerging within urban systems. We focus on understanding the diverse breadth of frameworks and tools in development, and how cities are engaging with these evolving tools to build more resilient infrastructures and systems in the face of climate challenges.

## Strategic Framework for WASH Climate Resilient Development

## Yusuf Kabir | UNICEF

Yusuf Kabir discussed the global view on climate-resilient WASH frameworks, highlighting connections between climate change, environmental degradation, and biodiversity loss. He defined climate-resilient WASH as ensuring continuous access to water, sanitation, and hygiene services during extreme climate events. Mr. Kabir's presentation highlighted the Integrated Water Resource Management (IWRM) framework, which is central to achieving climate-resilient WASH and aligns with Sustainable Development Goal (SDG) 6. He emphasized that the Green Climate Fund (GCF), which finances climate adaptation projects, supports climate-resilient WASH initiatives in water supply, governance, disaster response, and integrated management strategies, including drought and flood management.

Mr. Kabir pointed out that there is a critical lack of climate-resilient WASH indicators within SDG 6; this gap is a crucial deterrent to the inclusion of climate resilience metrics and monitoring. He also noted India's Atal Bhujal Yojana, a government program aimed at improving groundwater management, provides a framework for resilience-building in water-stressed regions; significantly, most climate-resilient WASH financing in India continues to be from public sources, with limited corporate or philanthropic investment.

Given this, Mr. Kabir suggested that the government should adopt a clearer language for climate resilience that can be easily added to existing programs. He concluded by stressing the need to align climate resilience strategies with government programs like SBM and AMRUT, and encourage more private sector involvement in climate finance.

## Climate Adaptation in the Water Sector in India

## Shreya Nath | WELL Labs

Shreya Nath highlighted how Indian cities are already facing challenges of sewage management, high water usage, and energy consumption. These urban issues worsen vulnerabilities to climate change on the one hand, while also exacerbating climate change through emissions from infrastructure.

Using Bangalore as a case study, she discussed how many cities are struggling with both floods and droughts in the same year. Studies by WELL Labs modelling Bangalore's water flow reveal that 50% of the city's water supply depends on groundwater, which is unsustainable given slow recharge rates. She noted that while rainwater harvesting can help, it only meets a small portion of the city's water needs, and treated wastewater could potentially supply a larger share.

Ms. Nath advocated for integrated use of blue, green, and grey infrastructure solutions; blue infrastructure focuses on water management systems like lakes and aquifers, green infrastructure includes nature-based solutions like urban forests, and grey infrastructure covers traditional built systems. In Bangalore, for example, decentralized wastewater treatment and its use for non-potable purposes, such as irrigation and construction, have proven to be an effective model for other cities.
She concluded by highlighting the importance of robust development frameworks in supporting infrastructure solutions, stressing that addressing climate change impacts requires strong social, governmental, and business frameworks for long-term resilience.

## Using the Climate Hazard and Vulnerability Assessment (CHVA) Framework for Transitioning to Climate Resilient WASH in Small Towns

### Ashwathy Anand & Linda Regi | WRI India

Ashwathy Anand and Linda Regi presented WRI's Climate Hazard and Vulnerability Assessment (CHVA) framework, which helps cities assess their vulnerability to climate change and build climate-resilient WASH infrastructure. They stressed the importance of data-driven decisions to address climate risks, like droughts, floods, and heatwaves, which impact vulnerable populations.

The CHVA framework involves three key components: hazard identification, exposure analysis, and vulnerability assessment. Hazard identification pinpoints climate hazards that affect a city, such as flooding or drought. Exposure analysis assesses the risk to critical WASH infrastructure, like water treatment plants and sanitation facilities, while vulnerability assessment examines how these hazards affect both infrastructure and communities, especially marginalized groups.

The presentation introduced a Toolkit based on the CHVA framework to help small and medium towns develop climate-resilient strategies. The toolkit contains self-reflection exercises for local authorities to identify climate hazards specific to their town, and a consultative process with stakeholders to deepen the understanding of climate risk. It will help towns design climate-resilient WASH interventions that also improve community resilience.

The team also showed how the Toolkit was applied in Chunar (Uttar Pradesh), where heat and water scarcity were identified as major climate hazards. They concluded that small towns, with limited resources and data, need simplified versions of the CHVA framework, supported by satellite data and surveys, to ensure accurate risk assessments and planning.

## Evidence-based Decision Support Tool for IWRM in Government Schools

### Priyanka Jamwal | ATREE

Dr Jamwal presented ATREE's research aimed at improving water management in Government Schools in Karnataka. The project outcome – AquaWISE – is a decision support tool to help design resilient sanitation systems by addressing water quality and scarcity issues. In Karnataka's semi-arid areas, many schools lack clean water and rely on tanker supplies, which complicates water management. These schools also often discharge untreated wastewater into open drains, causing health risks for students and the surrounding environment. AquaWISE was created to provide location-specific solutions for wastewater treatment, considering factors like water source, school location, and available space. It suggests nature-based treatment options and provides cost estimates for installation and operation.
Dr. Jamwal's team tested AquaWISE in 23 schools in semi-arid Karnataka, where it successfully identified optimal solutions for used water treatment. The tool fills gaps in baseline data for government and CSR-funded school sanitation projects, and aims to improve school health, attendance, and the environmental sustainability of water systems through Integrated Water Resource Management (IWRM) principles.

## Models for Energy Transition in WASH Services – Emission Reduction Strategies

### Aasim Mansuri | CWAS-CRDF, CEPT University

CWAS-CRDF's Aasim Mansuri presented a pilot project on energy transitions in WASH services across six cities in Maharashtra. The project aimed to reduce energy consumption and GHG emissions from water and sanitation infrastructure, particularly in energy-intensive facilities like water treatment plants (WTPs), STPs and FSTPs.

Mr. Mansuri explained that WASH services, particularly in municipal utilities, are major consumers of energy, often accounting for the highest electricity usage in local government budgets. The pilot project integrated solar energy into existing infrastructure utilities, achieving energy neutrality in places like Sinnar and Wai. Energy audits were conducted to estimate energy savings before transitioning to renewable energy.

The project showed that energy transitions can lower operational costs and carbon emissions, helping India meet its climate goals. Mr. Mansuri stressed the need for such measures in small towns, where local governments often face high energy costs. The project's success has encouraged local governments to invest in renewable energy for WASH infrastructure.

## Integrated Climate Resilient Assessment Framework in Sanitation

## Suraj Kumar | INNPACT Solutions

Suraj Kumar presented INNPACT's framework for assessing climate risks in sanitation systems. He called for granular assessments at the building level to identify specific climate risks and plan appropriate sanitation solutions.

Using satellite data and deep learning models, INNPACT mapped climate risks such as flooding, heat stress, and proximity to water bodies. They assessed vulnerable settlements in cities like Dhanbad (Jharkhand) to pinpoint areas requiring customized resilience solutions, identify specific climate risks and develop tailored responses for sanitation infrastructure.

Suraj highlighted the importance of combining socio-economic vulnerability with climate risk assessments to prioritize marginalized communities. INNPACT's tool, used in over forty cities, has helped local governments design resilient sanitation systems and manage climate risks effectively.

# KEY TAKEAWAYS

**Leverage Primary Data and Open-Source Tools:**
Use primary data collection and open-source geospatial platforms to independently verify and validate government data.

Conduct ground-truthing exercises to address discrepancies and improve data accuracy.

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**Enhance Water Quality Monitoring:**
Integrate Earth observation tools with government monitoring systems to fill gaps in pollution data and provide a more comprehensive understanding of water quality.

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**Develop a Unified WASH Framework:**
Align existing government reports (e.g., Panchayati Raj indices) with SDG indicators to create a simplified, standardized framework for climate-resilient WASH systems.

Enable the adoption of this framework to ensure consistency and clarity in data-driven decision-making.

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**Simplify Frameworks for Smaller Towns:**
Adapt complex frameworks (e.g., CHVA) to suit smaller towns by addressing data gaps and simplifying processes focusing on localized solutions that are easier to implement and understand.

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**Integrate with Existing Frameworks:**
Align data-driven solutions with established government frameworks to ensure smoother adoption and institutionalization of climate resilience practices.

Collaborate with academic and research institutions (e.g., CEPT University) to integrate data-driven approaches into existing policies and systems.

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**Support Tool Selection and Capacity Building:**
Provide training to help government agencies identify and adopt the most effective tools for climate-resilient WASH.

Create guidelines or decision-making frameworks to assist agencies in selecting the right tools for their specific needs.


# Theme 3: Lighthouse stories in climate change

**Moderator: Mr Sasanka Velidandla | Director (Government Advisory), WASH Institute**

Theme 3 moves the discussion from theoretical frameworks to real-world application. Participants were presented with a combination of proactive strategies designed with climate change in mind, as well as responses developed to address local challenges. The recurrent idea here is the clear emphasis on building climate resilience in local communities and promoting adaptation to climate impacts.

## Geo-spatial Analysis of Flood Risk for Urban Local Planning in Aurangabad

### Parth Gohel | Alluvium Consulting India

Parth Gohel discussed Alluvium's geo-spatial analysis and hydrodynamic modelling for flood risk management in Aurangabad (Maharashtra). The project assessed flood vulnerability along the Kham River which flows through the city; it focused on identifying critical infrastructure and vulnerable locations, while also suggesting mitigation strategies for flood risk. A key aspect of the project involved analysing land use and growth patterns, as the city had experienced significant expansion towards the east.

Mr. Gohel's team conducted detailed rainfall and hydrological analysis using software like HEC-HMS and HEC-RAS; while, traditionally, the heaviest rainfall occurred between June and August, data analysis showed a shift towards September as the key month for intense rainfall. The project also simulated peak flows and water surface elevation for different return periods to create flood frequency maps; these were overlaid on the city's infrastructure to identify high-risk areas. The study found discrepancies in 1-in-25-year and 1-in-100-year flood maps; they did not align with real-time flood events, especially in newly developed areas.

The project recommended mitigation strategies including the creation of natural detention basins upstream and better flood risk management practices. It also facilitated capacity-building workshops for Aurangabad's Municipal Authorities, focusing on the importance of flood resilience in urban planning. Mr. Gohel emphasized the role of geospatial analysis in urban resilience and concluded by urging continuous monitoring and adjustment of flood management strategies as urban development continues.

## Water Resilience in Villages of the Western Ghats: Case of Pandrimalai

## Sampath Gopalan | WASH Institute

Sampath Gopalan shared WASH Institute's experience implementing drinking water projects in the Kodaikanal hills of Tamil Nadu, where climate change has exacerbated existing water challenges. The region, comprising 194 villages, relies heavily on borewells, springs, and rivers, with many villages facing water scarcity due to groundwater depletion. The project, supported by local governments and international partners like charity: water, aimed to increase access to safe drinking water by upgrading existing water facilities.

The key challenge in the region is groundwater depletion; wild animals also pose a threat as they destroy exposed pipelines and water storage tanks.

The project team addressed these issues by drilling additional borewells, building concrete mini-water tanks, and installing in-line chlorinators to prevent bacterial contamination. They also trained local communities to monitor water quality and maintain the systems for long-term sustainability. The project included rainwater harvesting in schools and encouraged the use of solar-powered pumps to reduce the impact of power outages.

Mr. Gopalan highlighted the importance of community involvement for the project's success. Local Water User Committees (WUCs) were created to maintain water systems. He also discussed how water scarcity has caused resurgence in open defecation in some areas, as new toilets built under SBM remain unused due to water unavailability. WASH Institute is working on furthering water source sustainability by converting defunct borewells into recharge structures and encouraging large-scale rainwater harvesting.


## Water Scarcity Due to Climate Change and Community Mitigation in Devanahalli

## Avinash Krishnamurthy | Biome Environmental Trust

Avinash Krishnamurthy shared Biome Environmental Trust's work in Devanahalli (Bangalore), which faces severe water scarcity due to climate change and over-reliance on deep borewells. Historically, the town relied on open wells and tanks for water recharge, but urbanization and road construction have disrupted these systems. As a result, the town has become dependent on increasingly deep borewells that are no longer sufficient.

Mr. Krishnamurthy's team worked with the town to revive traditional water systems, focusing on the restoration of open wells and lakes. Through a Managed Aquifer Recharge (MAR) approach, they used treated wastewater from Bangalore's sewage treatment plants to refill lakes and wells; this water is then filtered through shallow aquifers to ensure sustainable water supply for the community. The project involved the local community, political representatives, and other stakeholders, such as the Environmental Foundation of India, which helped clean and restore the local lakes. The town now benefits from 240 KL of water per day from these rejuvenated wells, with plans to increase this supply to 650 KL of water per day.

In concluding, Mr. Krishnamurthy emphasized the importance of monitoring water quality, particularly for issues like heavy metal contamination in the aquifer. The project serves as a living lab, integrating data from various sources to monitor the sustainability of water systems and promote decentralized, climate-resilient water solutions.

## Nature-Based Solutions for Climate Resilience in Wastewater Management

## Pooja Tendulkar | Lemnion Green Solutions Pvt. Ltd.

Nature-Based Solutions (NBS) are eco-friendly, low-cost natural methods that treat water without relying on chemicals or heavy infrastructure. Pooja Tendulkar's team at Lemnion Green Solutions designs decentralized wastewater treatment systems that combine blue (water) and green (ecosystem) infrastructure; they are chemical-free, solar-powered and effectively treat wastewater for reuse with minimal operational costs. She discussed various examples of NBS, including constructed wetlands which mimic natural wetland systems to treat wastewater effectively.

One key benefit of NBS is scalability; Ms. Tendulkar explained how her team has expanded NBS from small systems treating 1 KLD of wastewater to larger systems handling 2-3 MLD. These solutions can be implemented at the household level, or for entire communities; it is also customizable, and adaptable to different spaces and types of wastewater, such as blackwater and greywater.

Ms. Tendulkar's team has successfully implemented NBS for residential spaces and waterbody rejuvenation; their design process emphasizes community involvement, ensuring that residents take pride in the system and contribute to their long-term sustainability. She concluded by defining NBS as a key tool in climate resilience, offering both ecological and social benefits while addressing wastewater management challenges.

## NBS for Climate Resilience in Water Recharge

## Keyur Kumar Namdev & Nand Nitin Kamat | BacTreat Environmental Solutions

Keyur Namdev and Nand Nitin Kamat, of BacTreat Environmental Solutions, discussed their use of constructed wetlands to address water recharge issues exacerbated by climate change. BacTreat's wetland systems provide an eco-friendly way to treat wastewater by breaking down organic waste and reducing salinity. They operate on a gravity-based system, reducing operational costs and maintenance.

The presentation delved into a case in Nalgonda (Telangana), where BacTreat implemented a 20 KLD Wetland Treatment System on 900 sq. m of land. It also highlighted the scalability of their systems; from larger wetland treatment plants, such as their 1 MLD plant built on 1600 sq. m of land, to different contexts like public toilets or community projects.

BacTreat's NBS are low in maintenance and operational costs and can be monitored remotely using sensors to provide real-time data; such systems have been implemented in Goa, for public toilets in Madgaon, to treat wastewater from fish markets, and in housing societies near open nalas. Their decentralized approach ensures that wastewater is treated efficiently and reused for non-potable purposes like irrigation and flushing.

They also shared their success with a decentralized faecal sludge treatment system, which processes waste from tankers and creates compost for sale. Equally scalable in application, the system successfully expanded from handling 1 tanker to 15 tankers per day. BacTreat's systems not only tackle water and waste issues but also help with climate resilience using affordable, nature-based solutions that require minimal mechanical infrastructure.

## Responsive Waste Management in Disaster Situations

## Anoop K | Suchitwa Mission

Suchitwa Mission is the Technical Support Group (TSG) for waste management under the Local Self Government Department, Government of Kerala; in 2024, the organization was challenged in this function by the Wayanad landslides, which displaced thousands due to heavy rainfall. Significant amount of waste, including biodegradable waste, medical waste, and faecal sludge, was generated. This was a key challenge, especially given the remote region's limited infrastructure.

Anoop K, Programme Officer for District Suchitwa Mission – Wayanad, coordinated waste management in 17 relief camps, ensuring displaced people and relief workers had sanitary facilities. With the help of local volunteers and organizations like the Haritha Karma Sena (HKS), bio-toilets were installed, and biodegradable waste composted.

The team also managed 175 KL of faecal sludge using Mobile Treatment Units (MTUs) and successfully handled sanitary waste through a special-created system of zip-lock bags. Non-biodegradable waste was sorted and processed with the help of local partners.

Mr. Anoop highlighted the importance of community involvement and local governance in disaster waste management; he also emphasized that such systems need to be flexible and responsive. The experience in Wayanad demonstrates the importance of disaster preparedness, waste segregation, and the need for mobile treatment solutions in emergency situations.

### KEY TAKEAWAYS

**Adapt and Scale Resilient Solutions:** Leverage time-tested solutions like DEWATS and NBS to address modern climate and WASH challenges. Focus on adapting these approaches to current needs through innovation, collaboration, and urgency. Use these proven frameworks as a foundation to develop resilient systems that can withstand evolving environmental and societal pressures.

**Foster Collective Commitment:** Build awareness and partnerships among stakeholders to ensure these solutions are implemented thoughtfully and scaled effectively.

# Theme 4: Financing for Climate Change

**Moderator: Mr Krishna Chaitanya Rao | Director (WASH Advisory), WASH Institute**

Mr. Krishna Chaitanya Rao opened the discussion by stressing on the significance of finance in addressing climate change, particularly in the WASH sector. He highlighted the $300 billion annual target set at COP29, which falls short of the required $1.3 trillion in reaching WASH targets.

Mr. Rao introduced the idea that climate finance exists in various forms: international climate funds, development banks, green bonds, and carbon financing, and emphasized that understanding these financing options is crucial for implementing climate-resilient WASH infrastructure. His first question touched upon blended finance, what it means, how it has been used in sanitation and water value chains, and how else it applies to the WASH sector.

## Upasana Yadav on Blended Finance:

Ms. Yadav explained blended finance as a model that combines public funding with private investment to scale up WASH services. She concurred that achieving the SDG goals by 2030 required a significantly higher investment, far beyond current funding levels. Thus, while public funds will remain the cornerstone, blending in private capital is key to unlocking the necessary resources.

Ms. Yadav shared success stories from Maharashtra where CWAS and CEPT University mobilized household loans for sanitation and water connections, benefiting thousands of households. She also highlighted the Performance-linked Annuity Model used in small cities for non-networked sanitation, where private sector players invest in de-sludging equipment and the ULB pays based on performance; this arrangement minimizes public capital investment while improving service delivery.

Further, Ms. Yadav touched on how ULBs can cut operational costs and reduce greenhouse gas emissions by transitioning to solar energy. She explained how the Renewable Energy Service Company (RECSO) model, often used for large solar projects, is being adapted for smaller ULBs; private operators install solar infrastructure at public utilities while ULBs only pay for the energy they use – making the transition to clean energy more affordable and efficient.


## Follow-up Question:

Mr. Rao enquired how CWAS's team has engaged private finance for treatment infrastructure, specifically models like Welspun, in small ULBs and the involvement of the private sector in financing treatment infrastructure.

## Ms. Upasana Yadav:

The Welspun model in Gandhidham offers a brilliant example of innovation in water management. The textile industry collaborated with local municipalities to bring in untreated water, managed treatment via a Design, Build, Finance and Operate (DBFO), and recirculated treated water to industries. This clever approach not only saved the city significant capital investment but also created a win-win scenario. The company purchased untreated water, which helped generate income for the municipality, supporting the ongoing operation of the city's sewerage system. In turn, the textile plant received a reliable water supply, and the community benefitted financially.

Mr. Rao enquired about what Development Financial Institutions (DFIs) look for when deciding to invest in a project, and what key criteria are evaluated when considering projects for financing.

## Mr. Parthiv Soni on Development Financial Institutions:

Development Finance Institutions (DFIs) assess projects for project clarity, land availability for infrastructure, and the creditworthiness of the implementing entity. Before investing, DFIs also look at the institutional commitment of the executing body to ensure they have the capacity to deliver the project successfully.

Mr. Soni highlighted a cautionary tale from Indonesia, where a DFI invested in a Sewage Treatment Plant (STP), but the project faced major setbacks when the city couldn't connect households to the sewer network; misalignment between the sewerage system and septic tanks killed the investment. This experience has taught DFIs to take a more thorough approach to feasibility, ensuring that the entire value chain is carefully evaluated for smooth execution and lasting success.

### Follow-up Question:

Mr. Rao followed up by asking how DFIs incorporate climate considerations into their evaluation process for WASH infrastructure projects.

### Mr. Parthiv Soni:

Over the past ten years, climate finance inflows from Development Finance Institutions (DFIs) and Multilateral Development Banks (MDBs) have skyrocketed by a staggering 450%. The bulk of this funding has traditionally gone towards mitigation efforts; but DFIs are increasingly recognizing the need for climate adaptation projects that show clear, measurable climate impacts and align with sustainable practices. DFIs now strongly emphasize on bankable projects that can deliver quantifiable results and drive long-term change and resilience.

Mr. Rao requested Mr. Mahesh Harhare to elaborate on financing mechanisms for wastewater reuse, and the role of the private sector in financing such projects. He sought insights into what has worked, and what hasn’t, in financing reuse aspects of sanitation.

## Mr. Mahesh Harhare on Financing Wastewater Reuse:

Mr. Harhare shared valuable insights from his extensive experience in wastewater recycling projects, noting that only a small percentage have achieved true success. The biggest hurdles, he explained, often stem from convincing municipalities and industries to embrace water reuse practices.

He pointed to Surat as a prime example: initially, industries were reluctant to use recycled water, especially when it was priced the same as potable water. However, as the value of treated wastewater became clear, industries began to see the benefits, and demand for recycled water grew. Today, Surat is recycling an impressive 330 MLD of water, with a significant portion going to industries.

Mr. Harhare emphasized that successful projects require a strong market and business model to be financially viable. For successful financing in the agriculture sector, particularly in wastewater reuse, cross-subsidization and the involvement of multilateral banks or concessional finance models are crucial.


### Follow-up Question:

Mr. Rao enquired about financing for agricultural wastewater reuse, particularly in cities with limited industrial demand for recycled water.

### Mr. Mahesh Harhare:

In cities without strong industrial demand, using wastewater for agriculture can be a tough sell, often due to pricing issues and political interference. To make it work, the tariff model for agriculture must reflect local realities, and sometimes municipalities need to step in with policies that actively encourage the use of treated water. In Surat, for example, the initially hesitant agricultural sectors now use treated water for horticulture.

Mr. Harhare concluded that blended finance or concessional funding models can play a vital role in supporting agricultural reuse projects, particularly when cross-subsidization and demand creation are factored into the equation.

## Question:

Mr. Rao requested Dr Negi to clarify what Green Bonds are and how municipalities can raise these funds, particularly when many ULBs in India are financially constrained.


## Dr Anjula Negi on Municipal Green Bond Financing:

Green Bonds are a form of financing specifically used for projects that have positive environmental impacts, such as renewable energy, water security, and waste management. While the Green Bond market in India is still growing, it faces a few hurdles, especially with no clear standard on what qualifies as "green." To date, only six municipalities in India have raised funds through Green Bonds.

Dr Negi highlighted that municipalities like Ghaziabad and Vadodara have successfully raised Green Bonds for wastewater treatment plants; Ghaziabad Municipal Corporation raised ₹100 crore in 2021, for example. India's attractive coupon rates make Green Bonds appealing to investors, but the market is still maturing, and this challenges municipalities from tapping into this funding source easily.

## Follow-up Question:

Mr. Rao followed up by asking whether the Ministry of Housing and Urban Affairs (MoHUA) incentivizes municipalities issuing Green Bonds.

## Dr Anjula Negi:

The Ministry of Housing and Urban Affairs (MoHUA) is offering exciting incentives for municipalities that issue Green Bonds, including concessional loans from global institutions like the World Bank and the Asian Development Bank (ADB). For every ₹100 crore raised, municipalities can receive up to ₹26 crore in incentives, depending on the size of the bond. The AMRUT 2.0 scheme, which focuses on water security, also offers funding for green projects.

Dr Negi emphasized that municipalities could access additional funding if they focused on water reuse and industrial wastewater reduction, providing further incentives for green financing.

## Carbon Financing in the WASH Sector:

Mr. Rao then opened the floor to all the panellists to discuss the potential for carbon financing in sanitation, a topic often associated with energy, but still relevant to the WASH sector.

## Mr. Parthiv Soni:

Carbon financing is growing but remains more accessible to sectors like energy and transport, where emissions reductions are easier to monitor and verify. Wastewater and waste management sectors face challenges in accurately estimating emissions reductions; this has limited the application of carbon financing in WASH.

## Ms. Upasana Yadav:

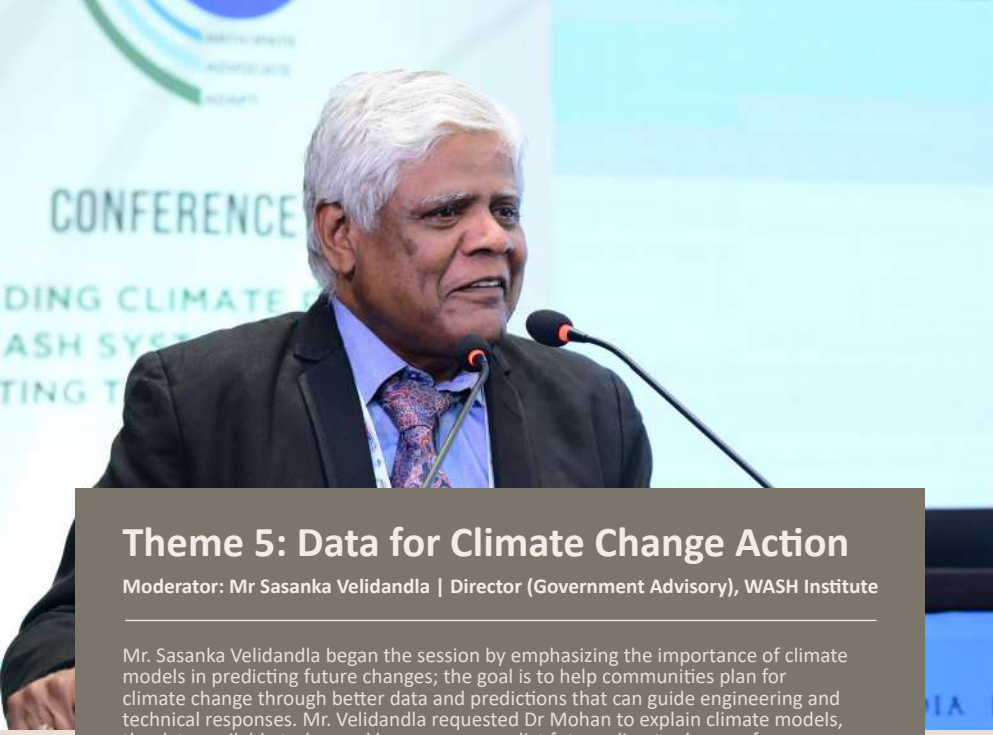
The carbon credit market is still in its early stages, operating on a voluntary basis without clear regulations, which can make it tricky for municipalities to navigate. On top of that, the high costs of project development, registration, and ongoing monitoring—plus the need to hire consultants—can be a huge barrier for Urban Local Bodies (ULBs) to get involved.

## KEY TAKEAWAYS

**Blended Finance and Private Sector Involvement in WASH:**
Expand blended finance models to strengthen climate-resilient WASH services by integrating Performance-linked Annuities in sanitation and Renewable Energy Service Companies (RESCO) frameworks for solar energy. Amplify successful approaches like Maharashtra's sanitation loans and Welspun's DBFO water reuse model into municipal financing. Encourage knowledge sharing to enhance private sector participation in sustainable WASH infrastructure.

**Strengthening Institutional Capacity to Unlock Climate Finance:**
Conduct targeted capacity-building programs for municipal officials on credit ratings, financial structuring, and investor engagement. Establish technical assistance mechanisms to help cities improve creditworthiness and navigate regulatory approvals for market-based financing. Promote sustainable revenue models to enhance the success of Public-Private Partnerships (PPPs).

**Scaling Municipal Green Bonds & Carbon Financing:**
Strengthen municipal adoption of Green Bonds for wastewater treatment, water reuse, and energy-efficient sanitation by enhancing national standards and leveraging MoHUA incentives (e.g., concessional loans, AMRUT 2.0 funds). Expand carbon financing in WASH by investing in data systems, cost-effective verification, and municipal capacity-building to unlock emissions reduction opportunities.




# Theme 5: Data for Climate Change Action

**Moderator: Mr Sasanka Velidandla | Director (Government Advisory), WASH Institute**

Mr. Sasanka Velidandla began the session by emphasizing the importance of climate models in predicting future changes; the goal is to help communities plan for climate change through better data and predictions that can guide engineering and technical responses. Mr. Velidandla requested Dr Mohan to explain climate models, the data available today, and how we can predict future climate changes for more effective response.

## Where are we on Climate Change Models?

## Dr S Mohan | Puducherry Technological University

Dr S Mohan highlighted the importance of climate data and how predictive models help us understand long-term weather and climate changes. Temperature, humidity, precipitation, and other meteorological parameters are essential in predicting climate changes, with a strong link to GHG emissions. There has been a dramatic increase in carbon dioxide levels, from pre-industrial levels of 100 ppm to more than 400 ppm today. Dr Mohan stressed that controlling emissions would significantly impact these variables and mitigate some of the negative effects of climate change.

Using IPCC reports, he explained how greenhouse gases influence climate and how different Representative Concentration Pathways (RCPs) lead to different climate futures. Dr Mohan emphasized the need for accurate climate data at a local scale to better inform climate action plans and decisions. To this end, his team used 45 meteorological stations across India to create localized climate predictions, especially for states like Kerala and Tamil Nadu. By downscaling global models, these localized predictions help in formulating more region-specific climate policies. Data localization is crucial because India's long coastline makes it especially susceptible to rising sea levels and extreme weather events like storms and cyclones.

## Question:

Mr. Velidandla asked Dr Mohan about the change factors used for precipitation in climate models and whether they are applicable to other climate parameters such as temperature and cloud cover.

## Dr Mohan:

Change factors are indeed applicable to other parameters like temperature and evapotranspiration, although their impact varies across regions. For example, temperature change factors are straightforward, but factors for precipitation or cloud cover can vary significantly across different areas.

## Follow-up Question:

Mr. Velidandla enquired about the resolution of climate models and how localized predictions could be scaled to smaller geographic areas.

## Dr Mohan:

While global models have broad resolutions, efforts are underway to improve these models using downscaled data; this allows predictions to become more localized, especially for urban areas or specific regions. What is even more promising is the push to enhance data accuracy by integrating more detailed and granular sources, paving the way for more precise climate models and, more effective climate action.

## Assessing Climate Change Impacts on WASH Infrastructure in Kerala through Rainfall Pattern Analysis

## Vinod P G | Cochin University of Science and Technology (CUSAT)

Vinod P G, from the School of Environment Studies at CUSAT, discussed the impact of climate change on Kerala, focusing on rainfall and temperature trends and their implications for WASH infrastructure. Kerala has seen extreme rainfall fluctuations, with major floods in 1991, 1998, and 2018, and droughts in 2002 and 2016. This variability has stressed local water resources and communities.

Meteorological data for Kerala from 1986 to 2022 shows a marked increase in both rainfall variability and temperature. While rainfall has increased, it is unpredictable, causing both water shortages and floods. Southern districts like Thiruvananthapuram and Kollam have warmed faster than the north.

Mr. Vinod also highlighted the use of GIS technology for disaster management. He explained how data from satellite images and various environmental parameters were used to create flood maps for Kerala, helping identify flood-prone areas. These maps have since been used to improve disaster preparedness and response, especially during floods and landslides. For example, GIS models were key in assessing the 2024 Wayanad landslides and helping local governments respond more effectively. These data-driven insights have been instrumental in improving decision-making for disaster management, resource allocation, and recovery efforts.
He concluded by stressing the importance of combining GIS data with real-time tools and continuous data collection to improve disaster management and build long-term climate resilience.

## KEY TAKEAWAYS:

**Enhance Localized Climate Data for Targeted Action:** Strengthen climate modelling efforts by integrating high-resolution, downscaled data for urban and regional planning. Expand meteorological monitoring networks and improve data accuracy to support climate-resilient infrastructure and early warning systems.

**Leverage GIS and Predictive Analytics for Climate-Resilient WASH Systems:** Utilize GIS-based flood mapping, real-time data collection, and climate projections to inform disaster preparedness and infrastructure planning. Institutionalize these tools in local governance for proactive risk mitigation and resource allocation.

# Theme 6: A Discussion on creating a climate change ready workforce

**Moderator: Mr Rajesh Pai | Senior Technical Advisor, WASH Institute**

Mr. Rajesh Pai introduced Theme 5 by highlighting the need of a climate-resilient workforce to address challenges posed by climate change, particularly in the WASH sector. He emphasized how significant discussions on climate change, its impacts, solutions, and policies, would be remiss without a skilled workforce for successful implementation on the ground. As climate impacts intensify, the WASH sector faces unprecedented challenges, and the development of a trained, capable workforce is essential to building resilient and sustainable systems.

The Panel explored key gaps in workforce development for climate resilience; the role of academic institutions; and the contributions of government, private sector, and civil society in addressing these gaps. The panel also discussed strategies to foster effective collaboration among stakeholders to advance climate-resilient WASH systems.

Mr. Rajesh Pai began by enquiring about knowledge or skill gaps that exist in communities, governments, and professionals when it comes to building a climate-resilient workforce.

## Mr. Yusuf Kabir on Skill Gaps in the Climate-Resilient Workforce:

There are currently no flagship programs for building a climate-resilient WASH workforce, unlike in other sectors like education and health. While government training institutes offer Induction and In-Service Training, they often overlook climate resilience. Many Public Health and Engineering officials are not equipped with the knowledge of how climate change impacts their work.

Mr. Kabir suggested that the climate change component should be integrated into Induction and In-Service Training programs of government bodies. He also highlighted the need to sensitize the public health and sanitation sector to understand climate science and its implications for WASH. Communities, especially in rural areas, are already aware of climate change – its shifting seasons and decreasing water levels – but they lack the technical knowledge to adapt. Therefore, there is a critical need to train for technology transfer to empower communities to cope with climate impacts effectively.

Mr. Rajesh Pai raised that key topics, skills, and approaches should be included in academic curricula to prepare professionals for building climate-resilient WASH systems.

## Dr Mona Iyer on Climate Resilience in Academic Curricula

Dr Iyer highlighted the importance of interdisciplinary learning, merging fields like civil engineering, social sciences, economics, and law to tackle the multifaceted challenges of climate change and WASH. CEPT University, for example, has transformed its approach over time to integrate climate resilience into urban planning education. While the focus initially centred on traditional urban planning, the curriculum now includes specialized programs in urban infrastructure and, more recently, WASH.

Dr Iyer emphasized the growing need for academic institutions to collaborate with government bodies, practitioners, and local communities. She also championed hands-on, studio-based learning, where students address real-world problems from cities and gain valuable insights into governance, finance, and institutional issues.

Mr. Pai enquired on what should ideally be included in education programs aimed at climate-resilient WASH professionals.


## Dr. Pranjal Deekshit on Curriculum Development for Water Policy and Governance:

Dr. Deekshit highlighted the challenges of teaching interdisciplinary subjects. Early on, TISS faced difficulty in integrating climate change into their curriculum, as professors were trained in traditional disciplines. However, over time, they've successfully embraced a more interdisciplinary approach; for example, their Postgraduate Diploma Programme in WASH, supported by UNICEF, includes a hands-on three-month practical engagement with sector partners. This allows students to work directly with practitioners and gain valuable real-world experience.

Dr. Deekshit echoed Dr Iyer's sentiment that climate change is highly localized and requires robust data systems, something that is often lacking. He also stressed the need for flexible, modular designs that are adaptable to local contexts, and the importance of focusing on technical and modular approaches for practical solutions.

## Follow-up Question

Mr. Pai asked Dr Mohan how academic and training institutions are preparing professionals to address climate resilience in WASH.

## Dr S Mohan on Institutional Support for Climate Resilient WASH Workforce:

Climate change should not be treated as a standalone course but integrated with topics like technology, sustainable development, and water management. By integrating simple, practical solutions like nature-based solutions and decentralized water treatment systems into the curriculum, we can foster greater acceptance and implementation of these ideas. Focusing on both the science behind climate change and its practical applications, institutions must make climate resilience understandable even for those without a technical background. To this end, Dr Mohan proposed a 3-month module that combines these elements to make the content more accessible to a wider audience.

## Follow-up Question

Mr. Rajesh Pai enquired about strategies that can foster effective collaboration among different stakeholders like academia, policymakers, implementers, and beneficiaries to advance climate-resilient WASH systems.

## Ms. Paridhi Mishra on Nurturing Ecosystems for Climate Resilient Workforces:

Ms. Mishra began by reflecting on her own school experience, where environmental science was taught but failed to spark action. She emphasized that education alone is not enough; motivation and engagement are key. When discussing the workforce, it should not only refer to professionals already working in climate and WASH but also include a broader range of roles such as Operations Managers, CFOs, and policymakers.

Climate action needs to be mainstreamed across sectors, and collaboration should extend beyond academia and government. Reaching out to the public, using simple language and engaging platforms like social media, documentaries, and public discussions, is imperative to spur action. Ms. Mishra shared her experience with the Environmental Defense Fund (EDF), which brings together scientists, lawyers, and activists to address environmental issues. She emphasized the power of thinking beyond traditional sectors and forming unexpected partnerships to amplify the impact of climate action.

## Key Takeaway:

**Localizing Climate Action through Simplified Approaches:** Develop practical, easy-to-implement climate action frameworks tailored to localized Indian conditions by fostering collaboration between academic institutions, research bodies, and sector practitioners. Simplifying climate language and raising awareness can drive greater public engagement, while capacity-building efforts will strengthen a climate-resilient workforce.

## Day 2:
# Anchuthengu Site Visit: Impact of Coastal Erosion

Day 2 of the Conference began with a thought-provoking site visit to areas in Anchuthengu Gram Panchayat (Thiruvananthapuram District) that have been severely affected by coastal erosion. The visit aimed to provide participants with a firsthand understanding of challenges faced by coastal communities, reinforced by conversations with residents and insights from an Environmental Engineering student with first-hand experience of these issues. Ward representatives guided participants through affected areas, highlighting steadily worsening impacts of coastal erosion.

Mr. Stephen N. Luvees, Ward Councillor and Chairman of the Health and Education Standing Committee, provided an overview of Anchuthengu Gram Panchayat, a 3.36 sq. km region where all 2,300 residents (primarily fishermen) live within the CRZ III area. The Punargeham scheme, a Kerala State Government initiative designed to rehabilitate fishermen families living within 50 meters of the high tide line, is active in the area.

The site visit revealed pressing issues affecting coastal communities. Inconsistent early warning systems leave residents unprepared for sudden sea changes, while the government's honorarium for affected families remains inadequate. Concrete groynes have been installed to mitigate wave impacts, but the local community believes that mangrove structures could provide a more sustainable, nature-based alternative. The Punargeham Scheme provides safe housing and financial assistance for land purchase and construction, offering a vital safety net for those most at risk; however, such schemes and rehabilitation camps have limited headway with the populace. Many residents choose to remain in their homes despite worsening conditions, fearing the loss of their property and belongings. The unpredictability of the sea has increased, with sudden retreats and surges of waves making it difficult to anticipate danger. A particularly alarming reality is that homes originally built according to Coastal Regulation Zone (CRZ) guidelines are now at risk due to the shifting coastline - turning housing security into a constantly moving target.

With these realities in mind, Day 2 continued with a Workshop on Shaping Climate-Resilient WASH Systems, where participants explored practical strategies for adapting to climate challenges. The discussions underscored the urgent need for stronger policies, sustainable infrastructure, and better support systems to protect vulnerable communities and ensure long-term resilience.

## Workshop:
# Shaping Climate-Resilient WASH Systems: Pathways for Present & Future

The Workshop on Shaping Climate-Resilient WASH Systems on Day 2 of the Conference on Building Climate Resilient WASH Systems in India and explored intersections between climate change and WASH systems. The Workshop assessed the current state of WASH services, weighed the potential future impacts of climate change on these services, and identified actionable solutions towards climate-resilient systems across thematic areas of policy; governance and finance; data; monitoring and evaluation; infrastructure and technology; community engagement, and capacity building.

**The Workshop employed the Horizon Framework to examine two critical perspectives:**

**Horizon 1:** The current state of WASH services, and their climate change implications if no significant changes are made by 2030

**Horizon 2:** The emerging future of WASH, bold goals required to tackle challenges of climate change and WASH, and the solutions required to achieve these goals

The Horizon Framework allowed participants to focus on understanding vulnerabilities and gaps in current WASH systems, while crafting actionable and sustainable recommendations towards long-term resilience across thematic areas. The following were discussed in-depth during the workshop:

## Critical Gaps in Current WASH Systems

Legacy WASH systems, inadequately prepared for climate resilience and lacking key data, make it hard to manage future climate challenges.

Incoherent governance mechanisms, poor policy coordination, lack of funding for climate-resilient WASH solutions, and limited capacity for data-driven decision-making challenge climate-resilience in the WASH sector.

## Opportunities for Improvement

**Governance and Policy:** There is an opportunity to update and align national and local policies with global and local climate change priorities, and to streamline financial tools like Green Bonds to drive real change.

**Data and Monitoring:** We have the chance to integrate data-sharing platforms that aggregate national and local climate and WASH data to improve decision-making. To this end, using Artificial Intelligence (AI) in predictive analytics and real-time monitoring is key to adapting and learning quickly.

**Infrastructure and Technology:** There is great potential to expand Nature-Based Solutions (NBS), like rainwater harvesting and wastewater reuse, while also integrating renewable energy to enhance sustainability.

**Community Engagement:** Decentralizing decision-making, involving communities in planning, and empowering marginalized groups are essential to gain local support and ensure sustained ownership climate-resilient WASH systems.

**Capacity Building:** Building the skills of local authorities and communities, especially in gender inclusion, representation and data use, through trainings and peer learning is crucial for long-term WASH policies that are climate resilient.

## Bold Goals

Boost cross-sector collaboration to drive impactful climate-related WASH action
Scale innovative financing and local capacity-building to sustain climate-related WASH intervention

Embed climate resilience in every step of WASH planning, service delivery, and infrastructure development

## Actionable Solutions

**Governance and Policy:** Establishing a Climate Convergence Cell to coordinate efforts across sectors and explore financing mechanisms like Green Bonds
Infrastructure: Strengthening the NBS ecosystem and integrating renewable energy in existing and proposed WASH systems

**Data and Monitoring:** Creating a platform for data aggregation, sharing and dissemination, and utilizing predictive analytics to track resilience

**Community Engagement:** Empowering communities through participatory planning and ensuring gender inclusivity and representation in all processes

**Capacity Building:** Incorporating gender-responsive training and strengthening the abilities of local bodies to make data-informed decisions

# Detailed Insights across Thematic Areas

## Governance, Policy, and Finance Current State of WASH Systems (Horizon 1)

In 2030, if we continue with the current approach, WASH services (especially in states like Odisha and Kerala) will face growing challenges. A lack of climate-resilience policies and the absence of climate change language in existing WASH frameworks will leave systems vulnerable. Limited financial tools, like Green Bonds and climate funds, will struggle to secure funding for climate-resilient infrastructure. Meanwhile, uncoordinated governance mechanisms will fragment effective climate action into piecemeal measures that will be unable to tackle multi-dimensional challenges to climate-resilient WASH systems.

**Critical Gaps**
Lack of climate resilience integration in existing WASH policies and frameworks.

Non-comprehensive financial mechanisms and climate funds.

Weak interdepartmental coordination, particularly between urban planning, water management, energy, transport and climate action sectors.

**Optimizing Effective Aspects**
Strengthen interdepartmental coordination to ensure climate resilience is embedded across urban planning, sanitation, and water sectors.

Establish financial mechanisms like Green Bonds, innovative public-private financing, and leverage public financing institutions such as NABARD to support climate-resilient WASH projects.

**Emerging Future (Horizon2)**
Bold goals that emerged during the discussion include: Policies updated to explicitly integrate climate change and resilience into WASH frameworks at both state and national levels.

Legal mandates that make climate action in local and state planning processes compulsory.

More comprehensive innovative financing mechanisms such as municipal taxes, Green Bonds, and private-sector engagement to secure funding for resilient infrastructure.

**Recommendations**
Update national and state policies to include climate resilience in WASH systems planning.

Establish a Climate Convergence Cell within the Ministry of Housing and Urban Affairs (MoHUA) for coordinated action and policy alignment.

Explore public financing options, including NABARD, and incentivize green financing for climate-resilient WASH projects.

## Data and Monitoring & Evaluation
## Current State of WASH Systems (Horizon 1)

Outdated monitoring tools and inchoate data management will hold us back from fully understanding climate impacts on WASH systems. We will also lack crucial baseline data on vulnerable communities, systems, and economies, along with clear climate resilience indicators in existing WASH frameworks like Swachh Survekshan. These gaps will prevent us from strengthening the sector's ability to adapt and respond to future climate risks.

**Critical Gaps**
Inadequate baseline data and ineffective monitoring systems that fail to capture climate resilience factors.

No climate-resilience indicators within current monitoring frameworks and tools.

**Optimizing Effective Aspects**
Strengthen integration of climate resilience indicators into monitoring tools like Swachh Survekshan, to better track climate adaptation progress.

Improve data collection and analysis through consistent standardized data across departments, through consistent data formats, and auditing systems for better policy and operational decision-making.

**Emerging Future (Horizon 2)**
In the future, the WASH sector will require:Standardized data formats across departments, through data-sharing platforms that integrate both climate-related and WASH data to provide a holistic view of systems resilience.

AI-driven tools and predictive analytics to facilitate real-time monitoring and ensure adaptive learning and timely intervention when WASH systems are at risk.

**Recommendations**
Creation of standardized data formats centrally and auditing systems for ensuring reliable data management system to combine climate and WASH data for comprehensive monitoring.

Incorporate AI-driven analytics for forecasting, adaptation and response to climatic challenges for improved WASH system resilience.

## Infrastructure and Technology
## Current State of WASH Systems (Horizon 1)

By 2030, WASH infrastructure will be outdated and ill-equipped to handle the growing impacts of climate change—floods, droughts, and rising temperatures. Existing centralized systems will be unable to meet increasing urban demands; lacking resilience, they will struggle to adapt to future climate scenarios. As we continue to overlook climate-resilient planning, we will be left with outdated data that fails to address systemic vulnerability in the WASH sector.

**Critical Gaps**
Outdated infrastructure ill-equipped to handle increasing climate risks.

Inadequate investment in Nature-Based Solutions (NBS) and renewable energy for WASH systems.

Absence of climate-resilient designs and long-term Operation and Maintenance (O&M) planning for infrastructure.

**Optimizing Effective Aspects**
Scale up NBS-based pilot projects, such as wastewater reuse, which can alleviate pressure on existing infrastructure.

Integrate renewable energy into WASH systems to reduce dependence on unreliable traditional energy sources and systemically enhance sustainability.

**Emerging Future (Horizon 2)**
Bold goals that emerged during the discussion include: Integrated climate-resilient planning in all WASH Detailed Project Reports (DPRs) throughout their lifecycle.

Adoption of NBS and solar energy to reduce reliance on centralized and fossil fuel-based systems.

Business models that can sustainably generate revenue to finance and maintain resilient infrastructure.

**Recommendations**
Advocate for public-private partnerships (PPPs) to scale up green energy solutions and NBS in WASH solutions.

Incorporate climate resilience concerns when planning for any WASH infrastructure.

## Community Engagement
## Current State of WASH Systems (Horizon 1)

In 2030, if current trends continue, community ownership and participation in WASH systems will remain low, particularly among marginalized groups like women, who are often left out of decision-making. Disconnects between scientific models and local knowledge will alienate community engagement and result in a lack of locally contextualized solutions. As a result, so-called 'climate-resilient' systems will overlook community needs, leading to unsustainable projects that fail to make a lasting impact.

**Critical Gaps**
Marginalized groups are underrepresented in decision-making, leading to WASH solutions that do not reflect their needs.

Disconnect between scientific climate models and traditional knowledge about vulnerabilities and local adaptation measures.

**Optimizing Effective Aspects**
Adapt existing Participatory Rural Appraisal (PRA) mechanisms to introduce climate resilience into local planning processes.

Strengthen community-led solutions while ensuring that marginalized groups, especially women, are included in decision-making.

**Emerging Future (Horizon 2)**
The emerging future should focus on:
Decentralized decision-making processes that empower local communities to take ownership of climate-resilient WASH solutions.

Gender-inclusive planning that considers the specific needs of women and other marginalized communities.

**Recommendations**
Foster decentralized decision-making to increase community ownership of WASH systems.

Reinforce gender-inclusive planning and participatory processes to ensure local knowledge and the voices of marginalized groups are reflected in climate-resilient WASH solutions.

## Capacity Building
## Current State of WASH Systems (Horizon 1)

By 2030, the WASH sector will lack the capacity to effectively plan, implement, and manage climate-resilient systems at the local level. Poorly integrated training efforts will fail to address specific climate risks communities face. Moreover, political will for climate action in WASH will remain weak, and there will be a lack of localized, context-specific training for community leaders and decision-makers.

**Critical Gaps**
Localized training programs that address specific climate risks and vulnerabilities are insufficient in number.

Limited political will for, and alignment between, national and local policies on climate-resilient WASH.

**Optimizing Effective Aspects**
Enhance contextualized action-oriented training for local authorities and community leaders.

Engage women Self Help Groups (SHGs) and community-based models for capacity building.

**Emerging Future (Horizon 2)**
The future vision for capacity building includes:
Implementation of decentralized decision-making in letter and spirit, as envisioned in the 74th Constitutional Amendment.

Gender-inclusive context-specific training programmes that can capacitate communities and local governments to design and implement climate-resilient WASH solutions.

**Recommendations**
Create easy-to-adapt, open-source training materials for local authorities and communities.

Encourage peer learning and empower local champions to advocate for climate-resilient WASH solutions in their communities.

## Opportunities for Action to build climate resilient WASH Systems:

The Workshop on Shaping Climate-Resilient WASH Systems explored the challenges and opportunities of integrating climate resilience into WASH services. While WASH systems as they currently exist have major vulnerabilities, there is plenty of potential to create adaptive, sustainable solutions.

**Policy & Finance Integration:**
Integrate climate-resilience indicators to be embedded in WASH policies by engaging with city, state and national government, and financial institutions to design and implement climate-smart funding models, such as blended finance and resilience bonds.

**Community-Centered Resilience:**
Establish inclusive governance models that empower local communities, particularly women and marginalized groups, by enhancing their decision-making roles, providing climate-resilient WASH training, and ensuring equitable access to resources.

**Scaling Nature-Based Solutions (NBS):**
Promote the adoption of wetlands, bio-remediation, and green infrastructure while integrating renewable energy into water and sanitation systems to reduce carbon footprints and enhance sustainability.

**Data-Driven Decision-Making:** Strengthen climate monitoring systems by investing in real-time data collection, predictive analytics, and digital platforms to track climate impacts on WASH services and inform adaptive strategies.

By implementing these opportunities, WASH systems can transition toward being more climate-adaptive, resource-efficient, and socially inclusive.

# ANNEXURE I: PROGRAMME AGENDA

| DAY ONE: 27th November 2024, Wednesday | | | |
|---|---|---|---|
| **DURATION** | **SESSION** | **SPEAKER** | **DESIGNATION** |
| 10:00 AM - 10.30 AM | Conference Welcome Opening Remarks | Ms. Kaveri Dhawan | NFSSM Alliance |
| | | Ms. Sahana Goswami | Senior Program Manager \| WRI India |
| | | Dr Arumugam Kalimuthu | Executive Director \| WASH Institute |
| **THEME 1: Understanding the Intersectionality of Climate Change and WASH<br>Moderator: Ms. Kaveri Dhawan (Manager \| Urban WSH Vertical, DASRA** | | | |
| **DURATION** | **SESSION** | **SPEAKER** | **DESIGNATION** |
| 10.30 AM – 10.45 AM | Government of India's Climate Change Plans & Initiatives Frameworks for climate resilience in WASH | Ms. Nikita Madan | Senior Environment Specialist \|Climate Centre for Cities - National Institute of Urban Affairs (NIUA) |
| 10.45 AM – 10.55 AM | Climate - Sanitation Interlinkages | Shri. Aasim Mansuri | Senior Program Lead \| Center for Water and Sanitation (CWAS), CRDF, CEPT Universit |
| 10.55 AM – 11.05 AM | GHG emissions and potential for reduction from WASH | Shri. Neeraj Ramchandran | Senior Manager \| EY |
| 11.05 AM – 11.15 AM | Climate change – what do Communities want? | Ms. Juhi Jain | Deputy Director \| Centre For Advocacy & Research (CFAR) |
| 11.15 AM – 11.25 AM | Changing Climate Impacts on Small Towns – Case of Chintamani | Ms. Anju Varghese | Project Lead \| BORDA LO |

**11.35 AM – 11.45 AM: TEA BREAK**

**Theme 2: Frameworks for Working on Climate Change Resilience in WASH**
**Moderator: Ms. Sahana Goswami (Senior Program Manager | WRI India)**

| DURATION | SESSION | SPEAKER | DESIGNATION |
|---|---|---|---|
| 11.45 AM – 12.00 PM | Strategic framework for WASH climate-resilient development | Shri. Yusuf Kabir | Specialist: WASH-Climate-Environment \| UNICEF |
| 12.00 PM – 12.10 PM | Climate Adaptation in India's Water Sector | Ms. Shreya Nath | Managing Partner \| WELL Labs |
| 12.10 PM – 12.30 PM | Using the Climate Hazard and Vulnerability Assessment Framework to transition to CRA – WASH in small towns in India | Ms. Ashwathy Anand<br>Ms. Linda Regi | Project Manager – Cities Program \| World Resources Institute<br>Program Associate – Cities Program \|WRI India |
| 12.30 PM – 12.40 PM | Evidence-based Decision Support Tool for IWRM in Government Schools | Dr Priyanka Jamwal | Programme Leader & Senior Fellow \| ATREE |
| 12.40 PM – 12.50 PM | Models for Energy Transition in WASH Services | Shri. Aasim Mansuri | Senior Program Lead \| Center for Water and Sanitation (CWAS), CRDF, CEPT University |
| 12.50 PM – 01.00 PM | Integrated Climate Resilient Assessment Framework in Sanitation | Shri. Suraj Kumar | CEO \| INNPACT Solutions |

**01.10 PM – 02.30 PM: LUNCH**

**Theme 3: Lighthouse stories in Climate change**
**Moderator: Shri. Sasanka Velidandla (Director - Government Advisory & Talent Management | WASH Institute)**

| DURATION | SESSION | SPEAKER | DESIGNATION |
|---|---|---|---|
| 02.30 PM – 02.40 PM | Geo-Spatial Analysis of Flood Risk for Urban Local Planning - Aurangabad | Shri. Parth Gohel | Senior Urban Water Specialist \| Alluvium |
| 02.40 PM – 02.50 PM | Water Resilience in Villages of Western Ghats - A Case of Pandrimala | Shri. Sampath Gopalan | WASH Technical Expert \| WASH Institute |
| 02.50 PM – 03.00 PM | Water scarcity due to climate change and how communities can mitigate them | Shri. Avinash Krishnamurthy | Director \| Biome Environmental Trust |
| 03.00 PM – 03.10 PM | NBS for Climate resilience in Wastewater management | Ms. Pooja Tendulkar | Co-founder \| Lemnion Green Solutions Pvt Ltd. |
| 03.10 PM – 03.20 PM | NBS for climate resilience in Water recharge | Shri. Keyur Namdev<br>Shri. Nand Nitin Kamat | Technical Manager \| BacTreat Environmental Solutions LLP<br>Manager \| BacTreat Environmental Solutions LLP |
| 03.20 PM – 03.30 PM | Responsive waste management in Disaster Situations | Shri. Anoop K | Programme Officer (Wayanad) \| Suchitwa Mission |

**Theme 4: Fireside Chat on Financing for Climate Change**
**Moderator: Shri. Krishna Chaitanya Rao (Director - WASH Advisory | WASH Institute)**

| SPEAKER | DESIGNATION |
|---|---|
| Dr Anjula Negi | Advisor, Urban & Infrastructure Finance, PPPs & Spatial Planning |
| Ms. Upasana Yadav | Program Lead \| CWAS |

| | |
|---|---|
| Shri. Mahesh Harhare | Independent Consultant |
| Shri. Parthiv Soni | Independent Urban Sector Consultant |

**Theme 5: Data for Climate Change Action**
**Moderator: Shri. Sasanka Velidandla (Director - Government Advisory | WASH Institute)**

| DURATION | SESSION | SPEAKER | DESIGNATION |
|---|---|---|---|
| 04.30 PM – 04.45 PM | Climate change models | Dr S. Mohan | Vice Chancellor \| Puducherry Technological University |
| 04.45 PM – 04.55 PM | Assessing Climate Change Impacts on WASH Infrastructure in Kerala through Rainfall Pattern Analysis | Shri. Vinod P. G. | Research Scholar \| School of Environmental Studies, CUSAT |

**Theme 6: A Discussion on Creating a Climate Change -ready Workforce**
**Moderator: Shri. Rajesh Pai | Senior Technical Advisor, WASH Institute**

| SPEAKER | DESIGNATION |
|---|---|
| Prof. (Dr) S Mohan | Vice Chancellor \| Puducherry Technological University |
| Prof. (Dr) Mona Iyer | Professor \| Faculty of Planning, CEPT University |
| Prof. (Dr) Pranjal Deekshit | Assistant Professor \| TISS |
| Shri. Yusuf Kabir, Specialis | WASH-Climate-Environment \| UNICEF |
| Ms. Paridhi Mishra | Deputy Director and Program Head \| Climate Corps at Ashoka |

**05.25 PM – 05.30 PM: DAY ONE CONCLUDES**

| DAY TWO: 28th November 2024, Thursday | | |
|---|---|---|
| **DURATION** | **SESSION** | **ACTIVITY** |
| 07.00 AM – 09.00 PM | Field Visit | Visit to places near Thiruvananthapuram city that have been affected by coastal erosion |
| 10.00 AM – 11.00 AM | Breakfast & Gallery Walk | Participants are encouraged to hear from Poster Presenters on numerous themes connected to Climate Change and WASH |
| 11.00 AM – 11.30 AM | Introduction to the Workshop | Briefing on the Workshop Activity |
| 11.30 AM – 01.00 PM | Workshop | Each group works on identifying action points w.r.t policy, technology, financing, monitoring, etc. to propose climate resilience in WASH. This is concluded by a presentation from each group |
| 01.00 PM – 01.45 PM | Presentations and discussions | |
| **01:45 PM – 02:45 PM: LUNCH** | | |
| **Conference CONCLUDES** | | |

## ANNEXURE II: PARTICIPANTS

| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| MEENAL BIAS | CDD INDIA | PARTICIPANT |
| ELISA PATNAIK | EY | PARTICIPANT |
| JEKCY C JOY | GREEN WORMS | PARTICIPANT |
| DHWANI | CWAS | PARTICIPANT |
| ASEEM ACHARYA | BORDA | PARTICIPANT |
| XERXES RAO | UMC | PARTICIPANT |
| BHARATH BABU M | KSWMP | PARTICIPANT |
| MINTU PRADEEP | SUCHITWA MISSION | PARTICIPANT |
| ARUN KUMAR G P | ATREE | PARTICIPANT |
| SOURABH S UNNITHAN | CDD INDIA | PARTICIPANT |
| ASWATHY S | SAMHITA SOCIAL VENTURES | PARTICIPANT |
| DR. PRADHEEPS MUTHULINGAM | UMC | PARTICIPANT |
| SIDDH DOSHI | CEPT UNIVERSITY | PARTICIPANT |
| ARJUN K | WATERAID INDIA | PARTICIPANT |
| DR. SHIBU KRISHNAN | COLLEGE OF ENGINEERING TRIVANDRUM | PARTICIPANT |
| SMITHA WAINGANKAR | TISS | PARTICIPANT |

| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| DR. SUNNY GEORGE | AIILSG | PARTICIPANT |
| RAVI KUMAR | HASHTAG PER CAPITA PVT. LTD | PARTICIPANT |
| LAL S S | TRIVANDRUM MUNICIPAL CORPORATION | PARTICIPANT |
| SUNEESH S U | TRIVANDRUM MUNICIPAL CORPORATION | PARTICIPANT |
| VANDANA RAJAN R K | SUCHITWA MISSION | PARTICIPANT |
| SUHANA S N | SUCHITWA MISSION | PARTICIPANT |
| ANAINA K A | MUNICIPALITY | PARTICIPANT |
| ANANDHU S KUMAR | TISS | PARTICIPANT |
| ANSU CHERIAN | BORDA SA | PARTICIPANT |
| HRITHIKA DEVU NAIR | TISS | PARTICIPANT |
| SASIPRIYA | TECHNOLOGY INFORMATICS DESIGN ENDEAVOUR | PARTICIPANT |
| ASTHA JAIN | USAID | PARTICIPANT |
| JOHN BOSE | - | PARTICIPANT |
| IYRIN ANNA JOHNSON | SMMU AMRUT | PARTICIPANT |
| GREESHMA P G | SMMU AMRUT | PARTICIPANT |
| BINCY BABY | - | PARTICIPANT |
| SOWRITRA BAJPAYEE | KPMG | PARTICIPANT |
| NAYINI KHURANA | AGA KHAN AGENCY | PARTICIPANT |

| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| SHIJOV THIRUMENI | SUCHITWA MISSION | PARTICIPANT |
| SHAMALA S | SUWASI | PARTICIPANT |
| SRIYA | SCHEDIO | PARTICIPANT |
| TEJAS PAI | WATER.ORG | PARTICIPANT |
| SUHAIB | IHMCF | PARTICIPANT |
| HARITH | IHMCF | PARTICIPANT |
| MILAN | IHMCF | PARTICIPANT |
| JAGAN | IHMCF | PARTICIPANT |
| PAUL VARGHESE | Event Management | PARTICIPANT |
| DR. ARUMUGHAM KALIMUTHU | WASH INSTITUTE | ORGANIZER |
| OMKARA LEKSHMI | IHMCF | PARTICIPANT |
| SANA RAFI | Architect | PARTICIPANT |
| GOWRY MOHANAN | TISS | PARTICIPANT |
| ADIL | TISS | PARTICIPANT |
| APOORVA JAGTAP | CDD INDIA | POSTER PRESENTER |
| SHATABDI DASH | ERNST &YOUNG LLP | POSTER PRESENTER |
| DR. PURNA CHANDRA MOHANTY | WATERAID | POSTER PRESENTER |
| ANKITA TAK | TISS | POSTER PRESENTER |

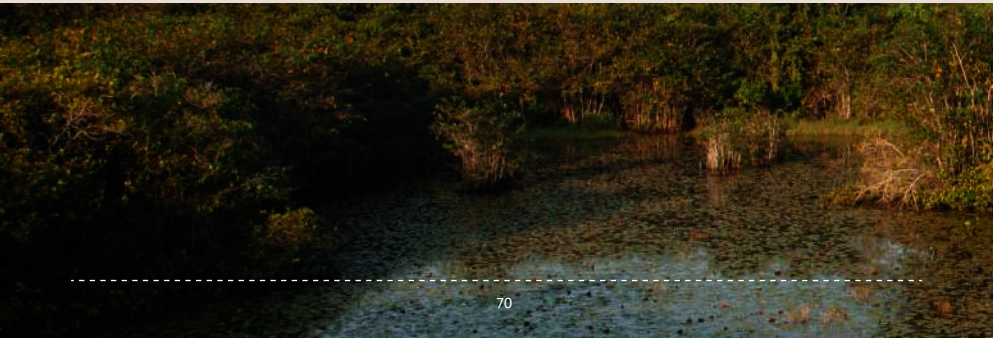
| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| VAISHNAVI SUBRAMANYA | JANA URBANSPACE | POSTER PRESENTER |
| RWITWIK SINHA | BORDA | POSTER PRESENTER |
| ARWA BHARWAL | CWAS | POSTER PRESENTER |
| CHITHRA J | CET | SPEAKER |
| YUSUF KABIR | UNICEF | SPEAKER |
| DR. PRIYANKA JAMWAL | ATREE | SPEAKER |
| ASWATHY ANAND | WRI INDIA | SPEAKER |
| KEYUR KUMAR NAMDEV | WRI INDIA | SPEAKER |
| NAND NITIN KAMAT | BACTREAT | SPEAKER |
| OMKARA LEKSHMI | BACTREAT | SPEAKER |
| DR. MONA IYER | CEPT UNIVERSITY | SPEAKER |
| PARIDHI MISRA | INTERNATIONAL CLIMATE CORPS @ASHOKAX | SPEAKER |
| AVINASH KRISHNAMURTHY | BIOME ENVIRONMENTAL TRUST | SPEAKER |
| ANJU VARGHESE | BORDA LO | SPEAKER |
| AASIM MANSURI | CWAS-CRDF-CEPT | SPEAKER |
| LINDA REGI | WRI INDIA | SPEAKER |
| DR S MOHAN | PUDUCHERRY TECHNOLOGICAL UNIVERSITY | SPEAKER |
| ANOOP K | SUCHITWA MISSION | SPEAKER |

| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| MAHESH HARHARE | INDEPENDENT CONSULTANT | SPEAKER |
| DR. ANJULA NEGI | INDEPENDENT CONSULTANT | SPEAKER |
| DR. PRANJAL DEEKSHIT | TISS | SPEAKER |
| NIKITA MADAN | NIUA | SPEAKER |
| VINOD P G | CUSAT | SPEAKER |
| SURAJ KUMAR | INNPACT | SPEAKER |
| PARTHIV | INNPACT | SPEAKER |
| POOJA EKNATH TENDULKAR | LEMNION SOLUTION PVT. | SPEAKER |
| UPASANA CHITTAL PANDYA | CWAS | SPEAKER |
| NEERAJ RAMCHANDRAN | EY | SPEAKER (ONLINE) |
| JUHI JAIN | CFAR | SPEAKER (ONLINE) |
| SHREYA NATH | WELL LABS | SPEAKER (ONLINE) |
| PARTH GOHEL | ALLUVIUM | SPEAKER (ONLINE) |
| SAMPATH GOPALAN | WASH INSTITUTE | SPEAKER |
| DR. ARUMUGHAM KALIMUTHU | WASH INSTITUTE | ORGANIZER |
| PRAVEEN N | WASH INSTITUTE | ORGANIZER |
| DR. SARANYA | WASH INSTITUTE | ORGANIZER |
| JAMIL AKHTAR | WASH INSTITUTE | ORGANIZER |

| PARTICIPANT NAME | PARTICIPATING ORGANIZATION | DESIGNATION |
|---|---|---|
| MURUGAPANDIAN | WASH INSTITUTE | ORGANIZER |
| AKHILESH RAMESH | WASH INSTITUTE | ORGANIZER |
| DEVIKA HEMALATHA DEV | WASH INSTITUTE | ORGANIZER |
| SHEIK MOHAMMED SHIBL | WASH INSTITUTE | ORGANIZER |
| ASWIN S KUMAR | WASH INSTITUTE | ORGANIZER |
| JACOB ABRAHAM | WASH INSTITUTE | ORGANIZER |
| EIRENE DUROM | WASH INSTITUTE | ORGANIZER |
| PARVATHY RAVIKUMAR | CUSaWASH INSTITUTE AT | ORGANIZER |
| SASANKA VELIDANDLA | WASH INSTITUTE | ORGANIZER |
| RAJESH PAI | WASH INSTITUTE | ORGANIZER |
| KRISHNA CHAITANYA RAO | WASH INSTITUTE | ORGANIZER |
| KARTHIK RAVICHANDRAN | WASH INSTITUTE | ORGANIZER |
| NITIN GUPTA | WASH INSTITUTE | ORGANIZER |
| PRAGYA BOSE | DASRA / NFSSM ALLIANCE | ORGANIZER |
| RISHMA SAHA | DASRA / NFSSM ALLIANCE | ORGANIZER |
| KAVERI DHAWAN | DASRA / NFSSM ALLIANCE | ORGANIZER |
| ARUN MANOHAR | WRI INDIA | ORGANIZER |
| SEETHALAKSHMI | WASH INSTITUTE | ORGANIZER |

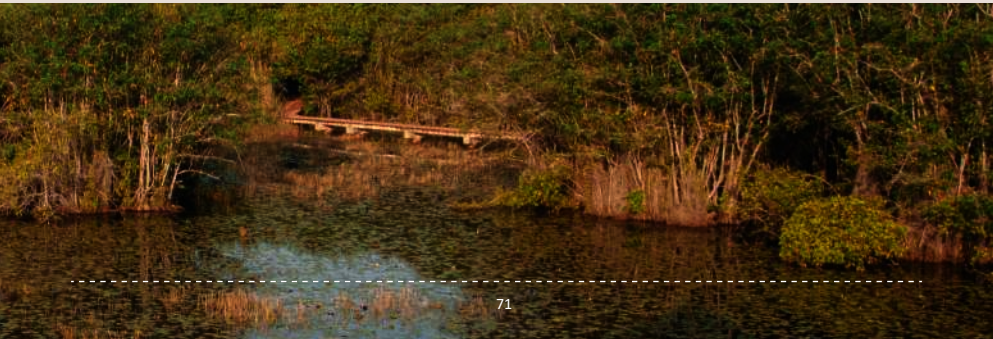
# ANNEXURE III: ABBREVIATIONS

| | |
|---|---|
| ADB | Asian Development Bank |
| AI | Artificial Intelligence |
| AMRUT | Atal Mission for Rejuvenation and Urban Transformation |
| ATREE | Ashoka Trust for Research in Ecology and the Environment |
| BORDA | Bremen Overseas Research and Development Association |
| CFAR | Centre For Advocacy & Research |
| CFO | Chief Financial Officer |
| CHVA | Climate Hazard and Vulnerability Assessment |
| COP29 | 29th United Nations Climate Change Conference |
| CSR | Corporate Social Responsibility |
| CUSAT | Cochin University of Science and Technology |
| CWAS-CRDF | Center for Water and Sanitation - CEPT Research and Development Foundation |
| DEWATS | Decentralized Wastewater Treatment System |
| DFI | Development Financial Institution |
| DPR | Detailed Project Report |
| EDF | Environmental Defense Fund |
| EY | Ernst & Young Global Limited |
| FGD | Focus Group Discussion |
| FSTP | Faecal Sludge Treatment Plant |
| GCF | Green Climate Fund |
| GHG | Greenhouse Gas |
| GIS | Geographic Information System |
| HEC-HMS | Hydrologic Engineering Center - Hydrologic Modeling System |
| HEC-RAS | Hydrologic Engineering Center - River Analysis System |
| HKS | Haritha Karma Sena |
| IISc | Indian Institute of Science |
| IPCC | Intergovernmental Panel on Climate Change |
| IWRM | Integrated Water Resource Management |
| JJM | Jal Jeevan Mission |



# ANNEXURE III: ABBREVIATIONS

| | |
|---|---|
| KII | Key Informant Interview |
| KL | Kilolitres |
| KLD | Kilolitres per day |
| MAR | Managed Aquifer Recharge |
| MDB | Multilateral Development Bank |
| MLD | Million litres per day |
| MoHUA | Ministry of Housing and Urban Affairs |
| MTU | Mobile Treatment Unit |
| NABARD | National Bank For Agriculture And Rural Development |
| NAPCC | National Action Plan on Climate Change |
| NBS | Nature-Based Solutions |
| NFSSM Alliance | National Faecal Sludge and Septage Management Alliance |
| NIUA | National Institute of Urban Affairs |
| NMCG | National Mission on Clean Ganga |
| PPP | Public-Private Participation |
| PRA | Participatory Rural Appraisal |
| RCP | Representative Concentration Pathways |
| RECSO | Renewable Energy Service Company |
| SBM | Swachh Bharat Mission |
| SDG | Sustainable Development Goal |
| SHG | Self Help Group |
| STP | Sewage Treatment Plant |
| TISS | Tata Institute of Social Sciences |
| TSG | Technical Support Group |
| ULB | Urban Local Body |
| UNICEF | United Nations Children's Fund |
| URMP | Urban River Management Plan |
| WASH | Water, Sanitation, and Hygiene |
| WRI | World Resources Institute |
| WTP | Water Treatment Plant |
| WUC | Water User Committee |



# Water, Sanitation and Hygiene Institute (WASH Institute)

**BRIDGING THE KNOWLEDGE GAP FOR SUSTAINABLE COMMUNITY BASED SOLUTION**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