

Integrated Climate Resilience in WASH Services: A Comprehensive Analysis of Mitigation and Adaptation Strategies within Government Flagship Programs-

A Case of Coastal Region of Odisha

Amita Pathria, Purna Chandra Mohanty, Arjun.K

WaterAid India

Global South Academic Conclave on WASH and Climate linkages

2nd - 4th February 2024, Ahmedabad

Contents of the Paper

- Context Setting
- WASH, Climate Change and Disaster Linkage
- Purpose of the study
- Study Area - Odisha Urban and Coastal District (Bhadrak)
- Challenges faced by the community
- Case Studies
- Interventions and Innovations
- Government Flagship Programs- Scope on Disaster Resilience
- Recommendations

Problem Statement:

*The coastal region of Odisha, India, grapples with the urgent challenge of **integrating climate resilience into Water, Sanitation, and Hygiene (WASH) services** within government flagship programs*

*Gaps in understanding the effectiveness of mitigation and adaptation measures persist, necessitating a focused assessment to **identify key strategies and address implementation** challenges for enhanced climate resilience in **vulnerable communities**.*

Objectives:

- **Mapping vulnerabilities** of WASH infrastructures in the context to climate change and disasters in the coastal regions of Odisha
- Comprehensive **analysis of mitigation and adaptation strategies** embedded within the government flagship programs
- **Piloting** climate-resilient WASH service models
- **Policy recommendations** for enhancing sustainability and resilience at both national and local levels.

Scope: Encompassing Disaster and Climate Change prone vulnerable communities in the coastal region of Odisha

Methodology: Documentation, FGD, Survey, IPC, Secondary Data Analysis

- Understanding vulnerabilities of marginalized communities through;
- Understanding the appropriate context specific innovations and interventions; Concluding with specific recommendations

WASH, Climate Change and Disaster Linkage

- Climate-related disasters account for more than 80% of disasters caused by natural hazards (UNDRR 2021).
- Around the world 3.3–3.6 billion people live in areas of high vulnerability to climate change (IPCC 2022).
- Climate change is widening inequalities and creating new vulnerabilities through its impacts on health and WASH, nutrition, livelihoods, air quality, labor productivity and income, and displacement amongst others.

Ref: https://www.climatecentre.org/wp-content/uploads/RCRC_IFRC-Health-and-Water-Sanitation-and-Hygiene-WASH-V1-2021-2.pdf

WASH impacts

(due to natural disasters caused by climate change)

1. Natural Resources

- High risk of water pollution and disease prevalence
- Saline intrusion of coastal water sources due to rise in sea level
- Rising level of groundwater pollution

2. Infrastructure

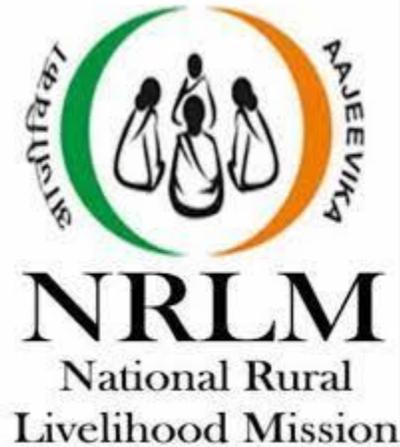
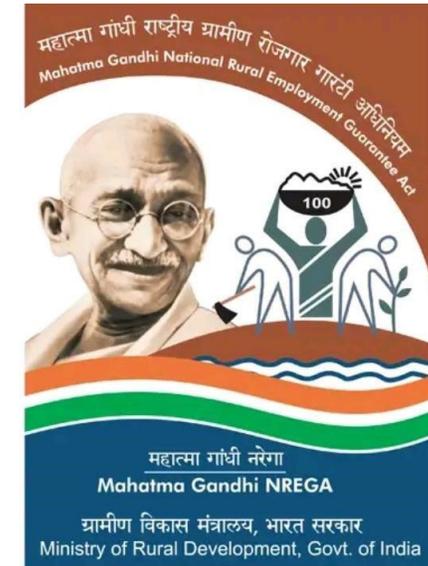
- Water supply system and water source damaged
- Defunct sanitation infrastructure
- HHs, institutions and potential infrastructure damaged

Disaster/ Climate Change factors	Affect on WASH services
Salinity Intrusion	Ground water intrusion, saline water inundation
Floods	Accessibility to services, maroon surface area, surface water / source water body contamination, Infrastructure damage
Cyclones	Infrastructure damage, saline water surge inundation
Cloud burst/ Heavy rainfall	Accessibility to services, maroon surface area, surface water / source water body contamination, Infrastructure damage

Government Flagship Programs



National Urban Livelihoods Mission
Ministry of Housing & Urban Poverty Alleviation



Purpose of the study

- Basic necessities during disasters include WASH services: **safe drinking water, improved sanitation, and good hygiene**
- Health hazards can be minimized with access to safe drinking water, sustainable sanitation, and proper hygiene practices
- The availability of WASH services is influenced by **socio-geological and climatic variations within communities**
- **Disaster-specific infrastructure designs** are crucial, considering the prevalence and nature of each disaster
- A study on **water resources (groundwater and surface water) and sources (tubewell/handpump)** is necessary
- **Government flagship programs for water and sanitation** are impacted by climate change and recurring disasters, affecting infrastructure.
- There is a need for **sustainable infrastructure and a resilient approach** to address the challenges posed by climate change and disasters.
- There is a need for moving **from relief strategy to mitigation strategy.**

Why?

In the World Risk Index (WRI), India stands in 3rd position (out of 193 countries), showing India has the highest overall disaster risk.

The history of disasters substantiates the fact that about 80% of the Odisha State is prone to one or more forms of natural disasters. Odisha over the last 3 decades have faced multiple natural disasters, the major being Cyclones and floods.

Major Cyclones: Super cyclone 1999, Phailin, Hudhud, Titli, Fani, Bulbul, Amphan, Yaas, Gulab, Jawad

Frequency of major natural disasters in Odisha (1996-2022)	
Type of natural calamity	Number of occurrences between 1996 and 2022
Drought	7
Flood	12
Cyclone	10
Heat wave	1
Pest Attack	1

Disaster Scenario (climate sensitivity)

Odisha (Urban)

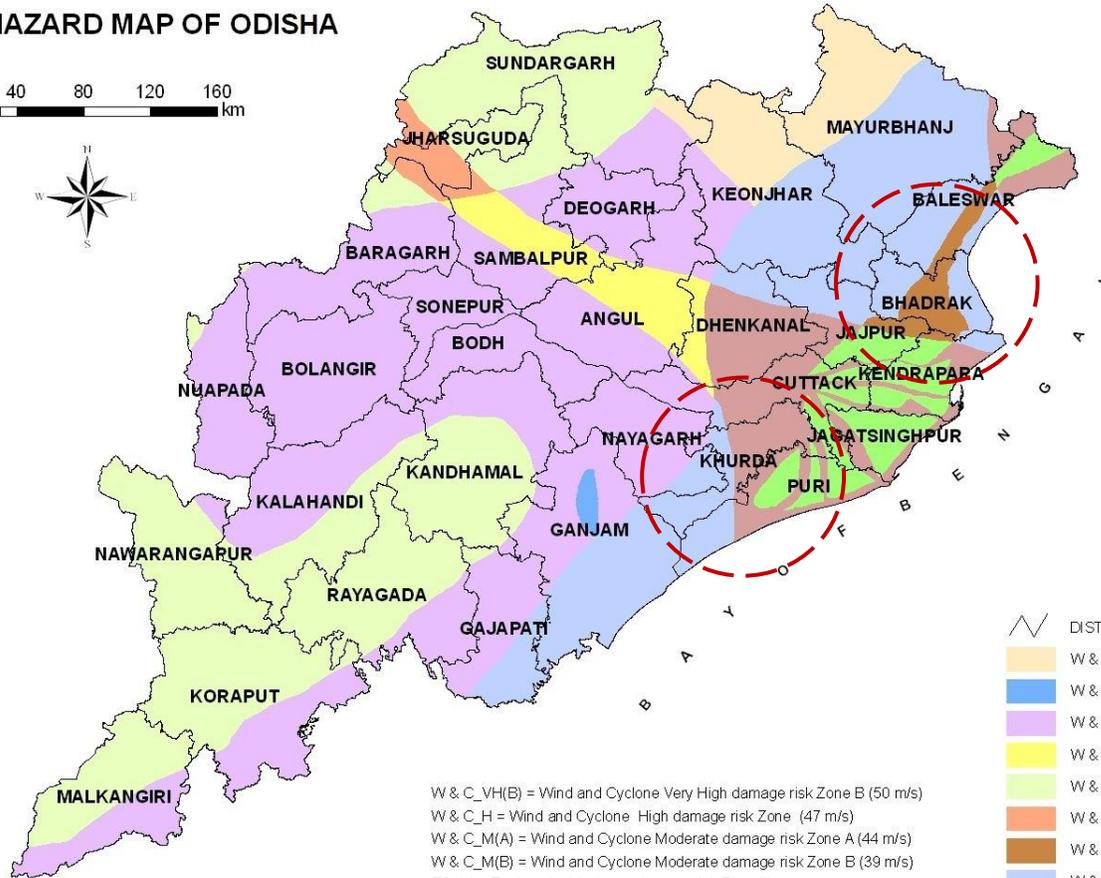
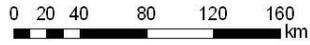
- As many as 26 districts in Odisha, which are home to nearly 36 million people, are exposed to extreme climate events such as cyclones, floods, and droughts
- Extreme flood events have risen nearly seven-fold and affect more than 12.6 million people in Odisha each year, especially in hotspots like Cuttack, Gajapati, Jajpur, Khurda, and Rayagada

Bhadrak District:

- In terms of Disaster activity the district is graded as a very high-risk zone for wind and cyclones, liable to get flooded
- Moderate risk zone for drought, Less damage zone for earthquakes & major accident-prone area for accident

Study Area - Odisha Urban and Coastal District (Bhadrak)

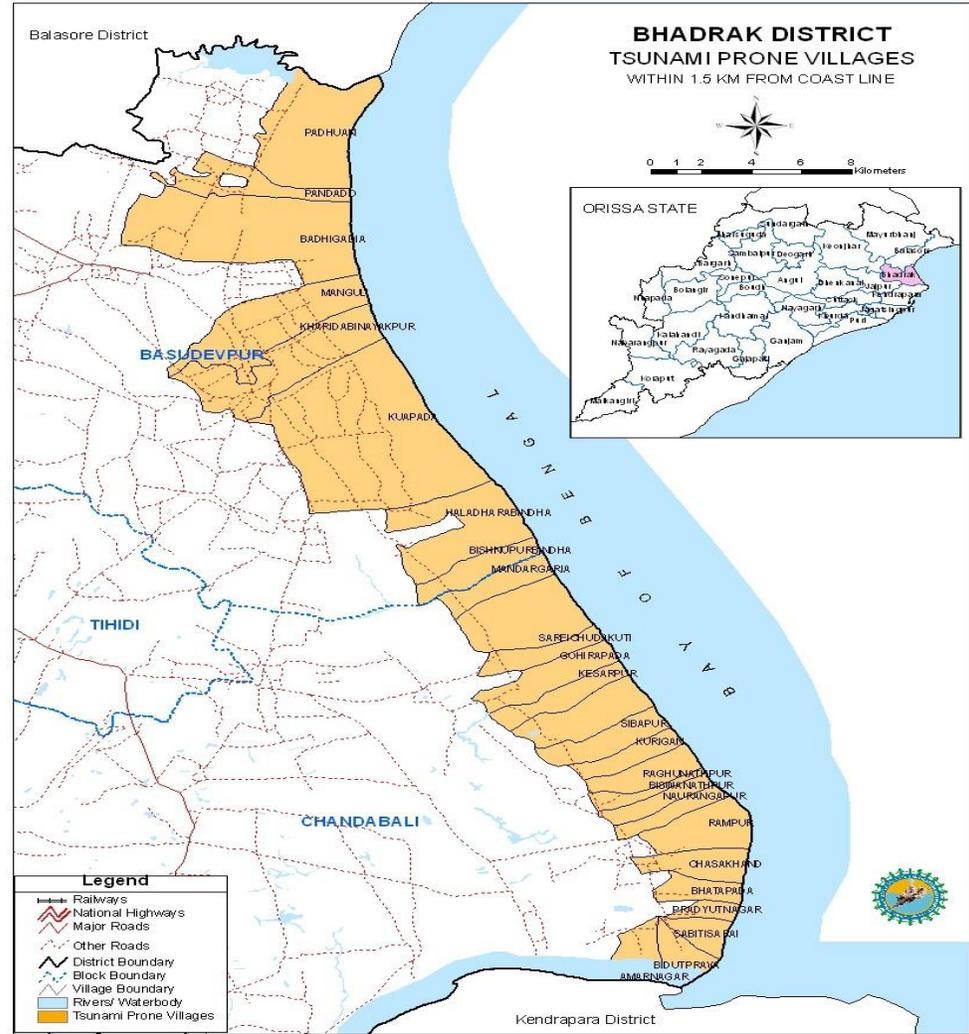
MULTIHAZARD MAP OF ODISHA



W & C_VH(B) = Wind and Cyclone Very High damage risk Zone B (50 m/s)
 W & C_H = Wind and Cyclone High damage risk Zone (47 m/s)
 W & C_M(A) = Wind and Cyclone Moderate damage risk Zone A (44 m/s)
 W & C_M(B) = Wind and Cyclone Moderate damage risk Zone B (39 m/s)
 EQ_M = Earthquake Moderate damage risk Zone III
 EQ_L = Earthquake Low damage risk Zone II
 FLZ = Flood Zone
 NFLZ = No Flood Zone

- DISTRICT BOUNDARY
- W & C_HEQ_LNFZ
- W & C_M(A)EQ_LFLZ
- W & C_M(A)EQ_LNFZ
- W & C_M(A)EQ_MNFZ
- W & C_M(B)EQ_LNFZ
- W & C_M(B)EQ_MNFZ
- W & C_VH(B)EQ_LFLZ
- W & C_VH(B)EQ_LNFZ
- W & C_VH(B)EQ_MFLZ
- W & C_VH(B)EQ_MNFZ

Source: Vulnerability Atlas published by BMTPC Government of India

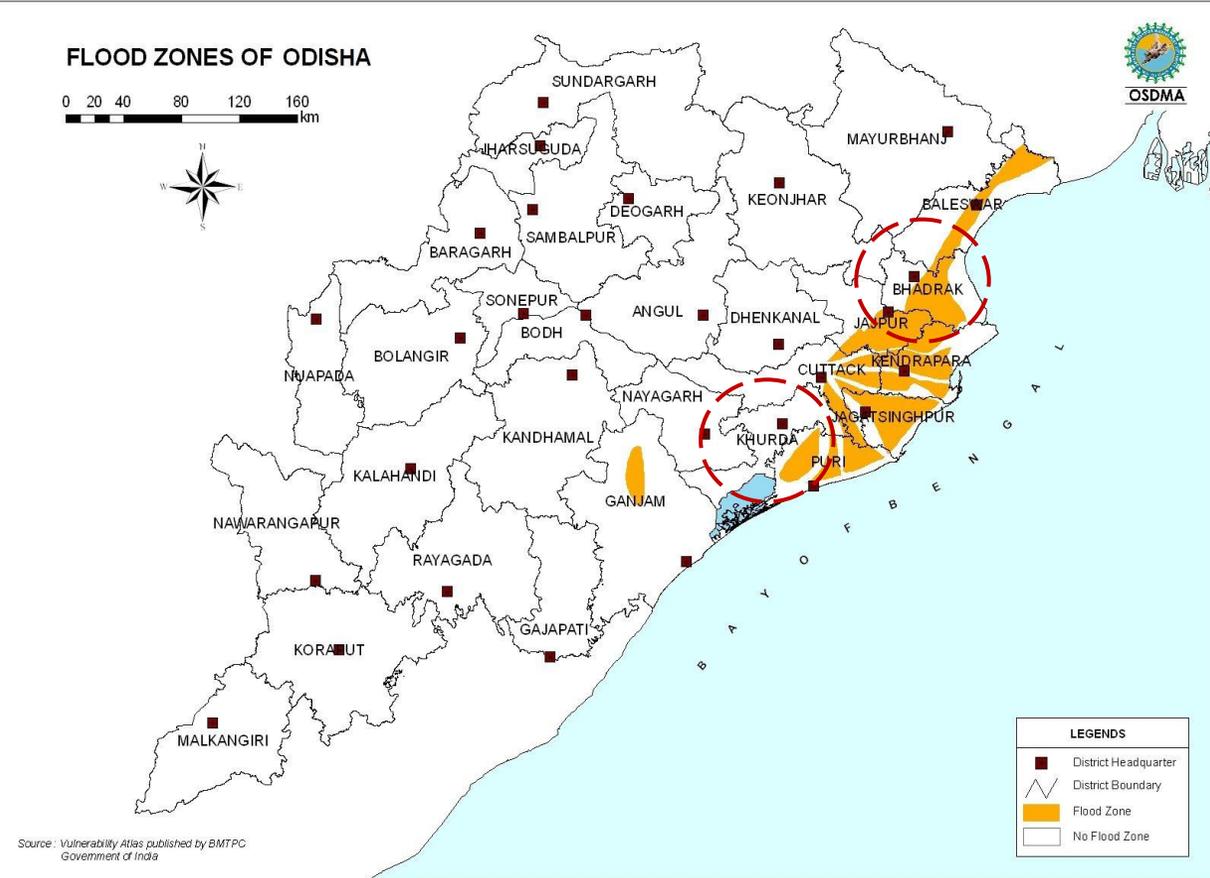


BHADRAK DISTRICT
TSUNAMI PRONE VILLAGES
WITHIN 1.5 KM FROM COAST LINE



- Legend**
- Railways
 - National Highways
 - Major Roads
 - Other Roads
 - District Boundary
 - Block Boundary
 - Village Boundary
 - Rivers/ Waterbody
 - Tsunami Prone Villages

Study Area - Odisha Urban and Coastal District (Bhadrak)



Challenges faced by the community

- Forced **relocation**
- Adverse effects on **livelihoods**
- **Public health** concerns, including waterborne diseases, pandemics, and epidemics
- **Limited access** to fundamental Water, Sanitation, and Hygiene (WASH) services
 - Shortages of safe **drinking water**
 - Limited availability of **secure sanitation** services
 - Challenges related **to hygiene practices**, including menstrual hygiene
 - Issues with **waste management**
 - Escalation **in water contamination**
 - Disruptions **to institutional** services

Case Study 1

- **Domuhi Basti**
- No. of Households: 145
- **Salient features of the site:**
 - The slum is beside the river Kuakhai,
 - **Storm water drainage** passes along the slum draining water into the river
 - The slum is situated at the **confluence of the drain and the river**
 - No. of Handpumps- 1,
 - No of HHs having **toilets- 95**, No of HHs having **piped water supply connection- 75**

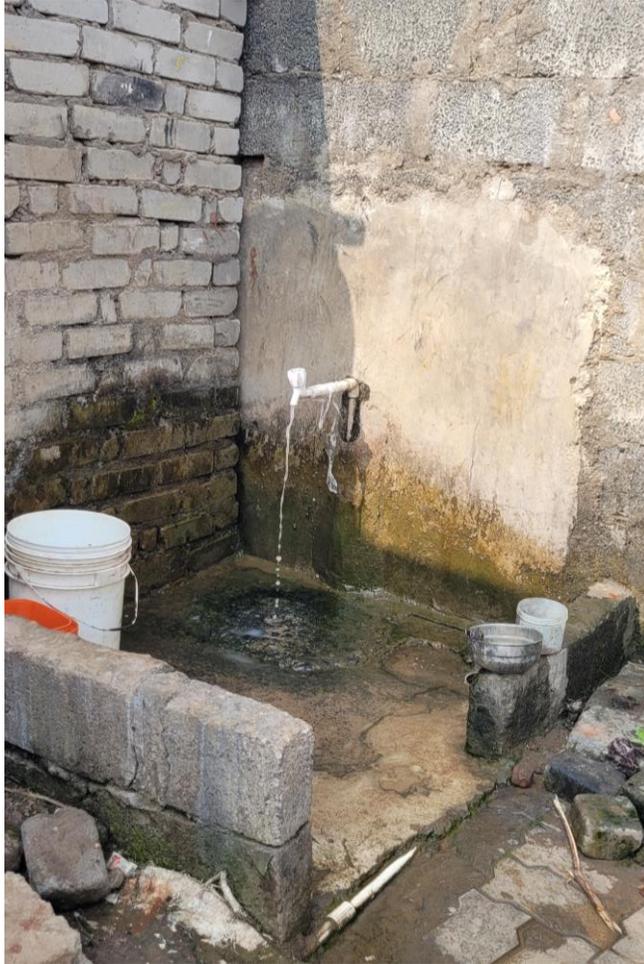
Case Study 2

- **Bhagavati Basti**
- No. of Households: 362
- **Salient features of the site:**
 - Serious contamination **5 open wells**,
 - **low lying area** causing flooding
 - piped water supply in few area but limited time,
 - containment system **(single pit)**,
 - no structured **storm water drainage** system plan

Common Vulnerabilities

- **Narrow** Congested lanes
- Partially the slum area get **submerged** in the rains and flood situation
- **Erosion** in Sloped terrain
- Drinking water **contamination**
- **Disruption** to institutional services
- **Water logging**
- Challenge in **accessing toilets** in low lying area
- **Ground saturation** around leach pits
- Infrastructure **damage**
- **Inaccessibility** to sanitation services
- Prolonged **water quality** issues

Urban Slums, Bhubaneswar



Urban Slums, Bhubaneswar



Case Study 3

- **Sasubhuasuni Village,**
- **Kharang GP, Chandbali**

- Households: 99 HHs,
- Population: 500 people,

- 12 Km from the coast, Occurrence of disaster twice a year (**Flood & Cyclone-Tidal Surge**)

- **4 community handpumps** (800 ft to reach sweet water)- bacteriological contamination, 2 HPs yielding less water during summer, **turbid water during summer**
- Piped water supply yet to be installed and commenced

- HHs in **low lying area,**
- **no access to toilet,**
- few toilets **are damaged due to flood,** damaged and repaired

Case Study 4

- **Amrutapur Village**
- **Nuasahi, Jamjodi**

- HouseHolds: 200,
- Population: 800 people

- Abundance of **surface water,**
- **no piped water supply,**
- direct rivulets draining to the sea during rains and the village **is submerged** in water
- 50 %New **houses built on a height,** 50 % houses still in **low lying area**

- **5 tube wells** out of which 3 saline, 1 handpump total submerged during floods, dried up in summers

- Toilets- **single leach pit** that too gets submerged.
- Disaster twice a year – **flood & cyclone**
- **High tides** cause flooding
- **School is the relief camp** during disaster. School is at a higher ground.

Case Study 5

- KasturiKana Village,**
- Chandbali**

- Households: 82

- The village depends on Prawn cultivation
- 7 Handpumps**
- Baitarni river- **saline water inundation**
- Floods
- Public health risk**
- Stagnated Grey water**
- Impact on **Livelihood**

Bhadrak District



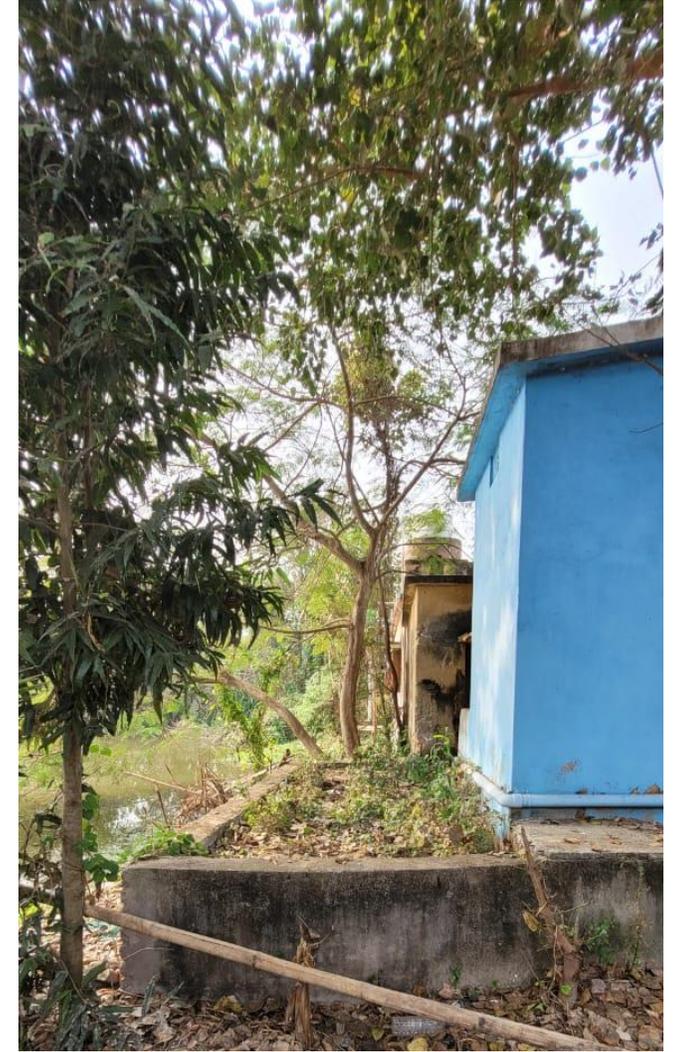
Bhadrak District



Bhadrak District



Bhadrak District- Public Health Facility



Traditional Practice

1. **High plinth** level houses are built
2. Common roads are built **above the flood level**
3. Selection of **shelter places** (schools, cyclone shelters, etc.) situated at high ground level
4. **Drinking Water, Sanitation**
 - Collect from source, screen boil and drink
 - Wait to access toilet after the reduction of inundated water level
 - Cleaning of surroundings post disaster

1. Water Availability

Strategic intervention of Creation of new water bodies and rejuvenation of existing water bodies, for underground recharge of aquifer and reduction in salinity level.

Rainwater harvesting system for water recharge and reducing salinity in ground water

Situation of the waterbodies in a settlement

- Dump yard
- Draining Wastewater into the waterbody
- Waterbodies still in use by the communities



Showing Natural Ponds, Baghanata Village

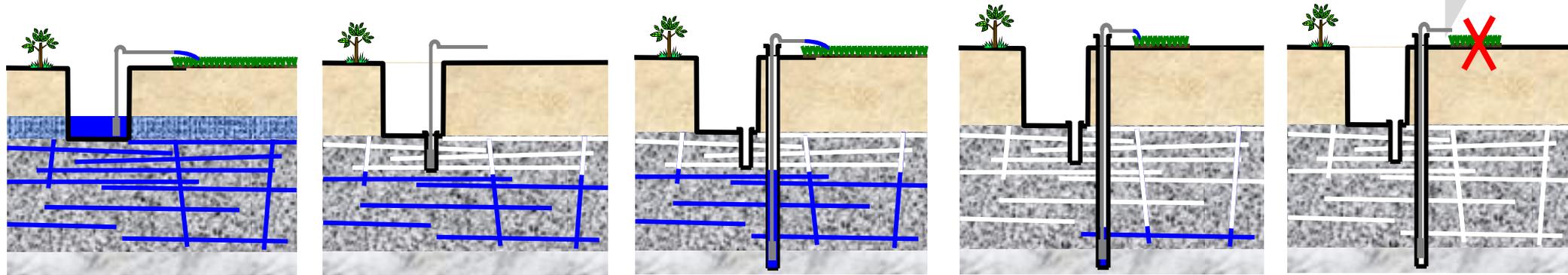
Innovations and Interventions



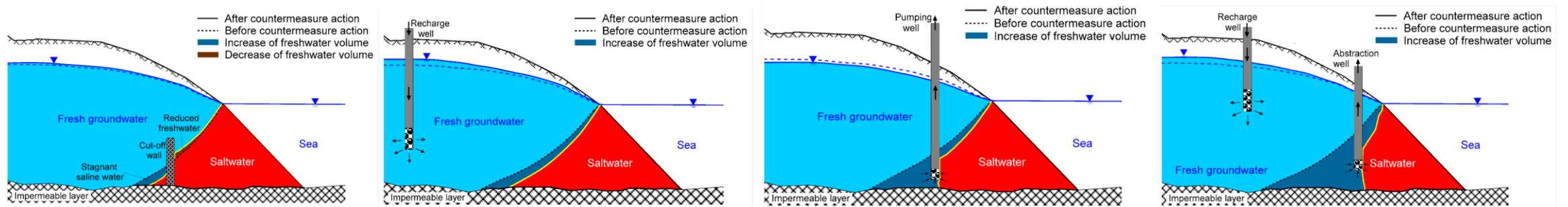
Innovations and Interventions

Ground Water Depletion

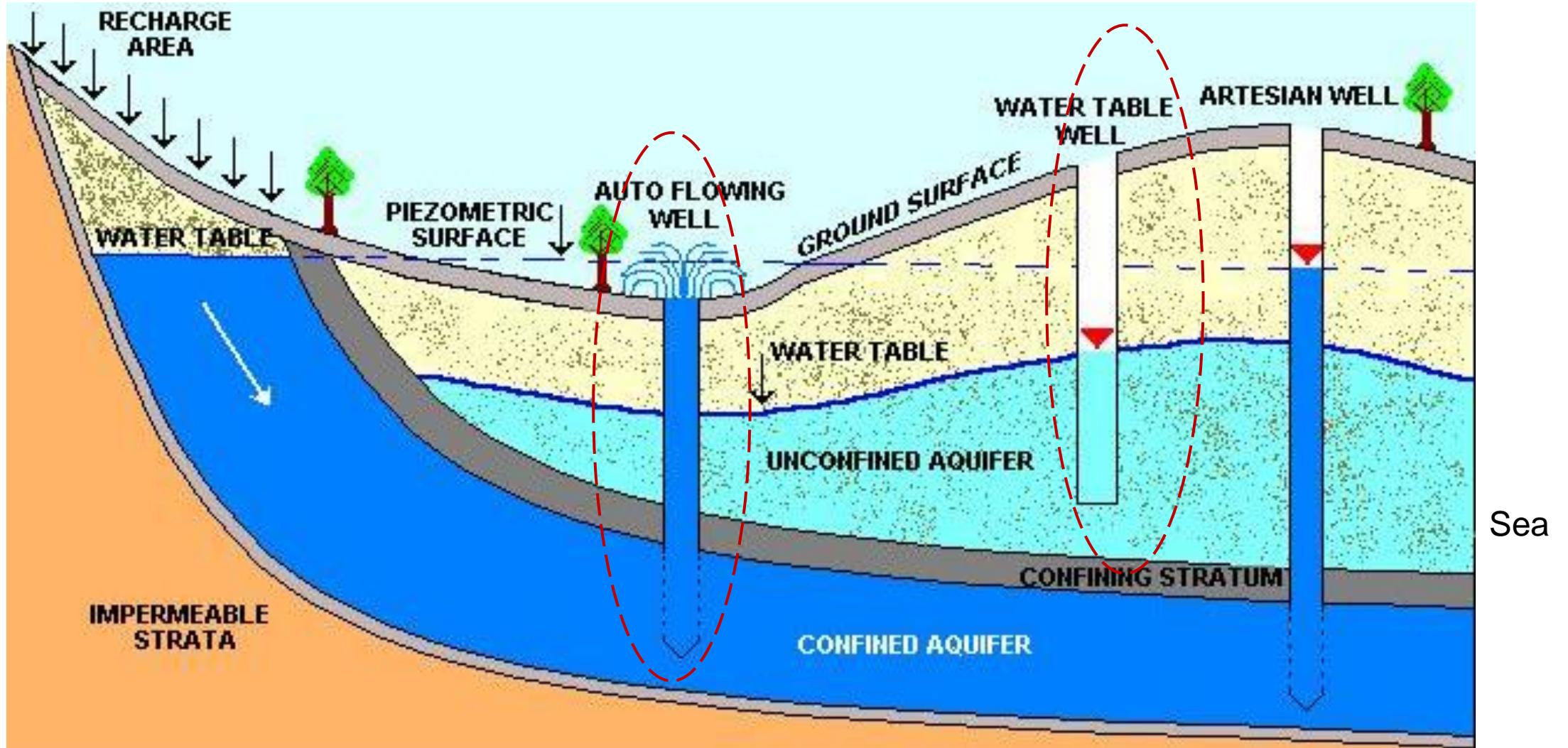
We are busy working on the SOURCE, but the RESOURCE is getting depleted rapidly



Curbing Salinity Intrusion in Coastal Areas

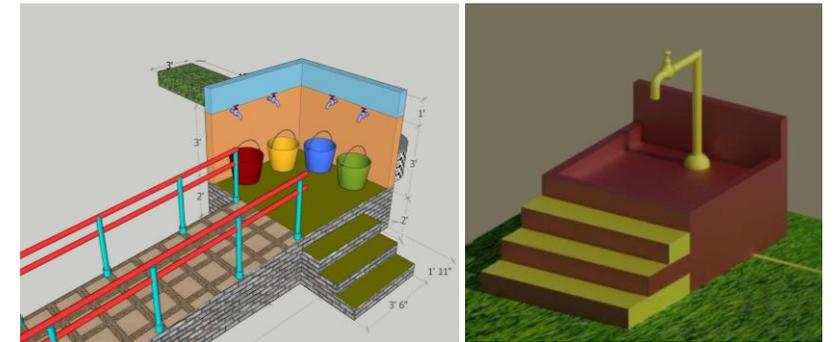
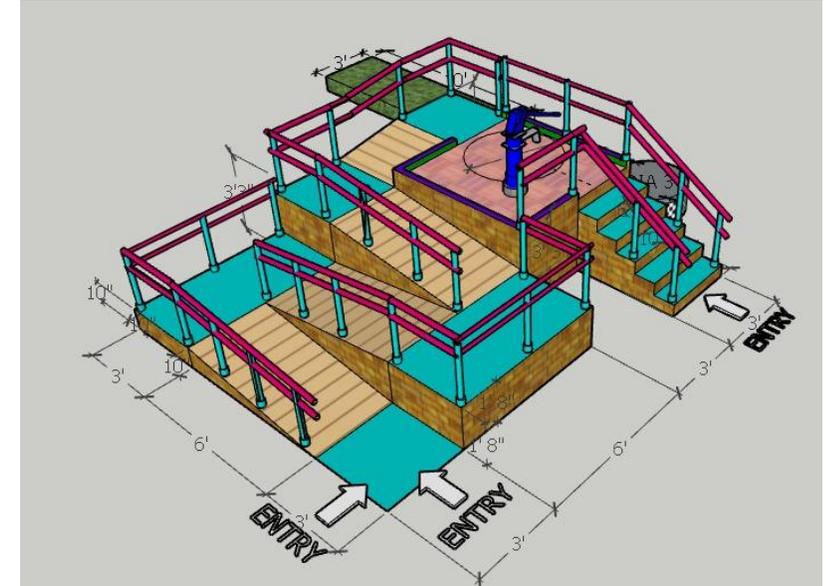


Understanding Ground Water Recharge



2. Access to Water Point

- **High raised water point accessible to all** (resilient handpump/ community water point pictures). Effective grey water management (soak pit with reed bed)
- **PWSS with high raised water point at HH level** (above High Flood Level), overhead tank, distribution system along with greywater management systems
- Provision of **high raised water point at disaster management node** (schools) and disaster management cyclone shelters



3. Water Quality and Treatment technology

Periodic water quality testing from NABL accredited labs and effective treatment technology (slow sand filter)

Desalination plant and RO plant (intrusive salinity)



Sanitation

A. Toilets and FSM

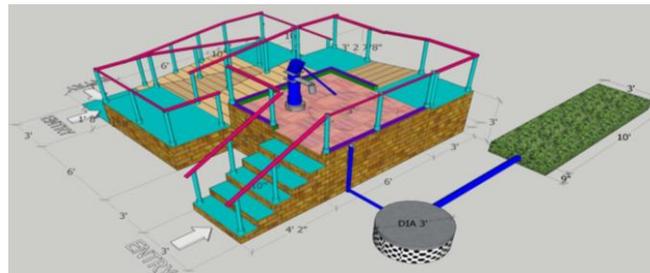
- High raised accessible superstructure(IHHL/CSC etc).
- 2. Effective containment system (onsite/offsite)
- 3. Onsite – selection of innovation models, (high raised twin leach pit with banana plant, bio digester, evapotranspiration



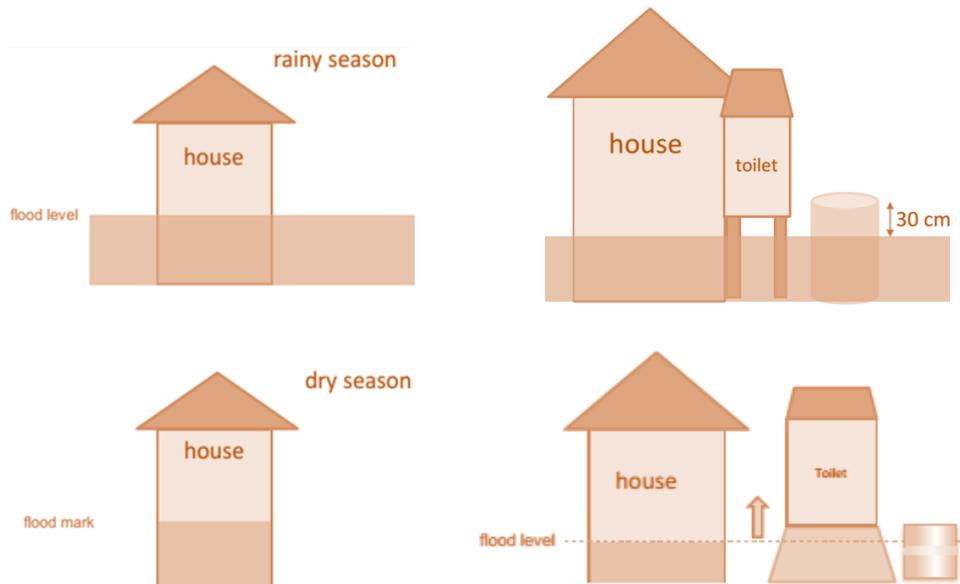
Innovations and Interventions

B. Grey water management

- Johkasu
- Eco stp
- Dewats
- Soak pit with reed bed, soak pit with filtration gallery etc



C. Disaster Resilient Superstructure



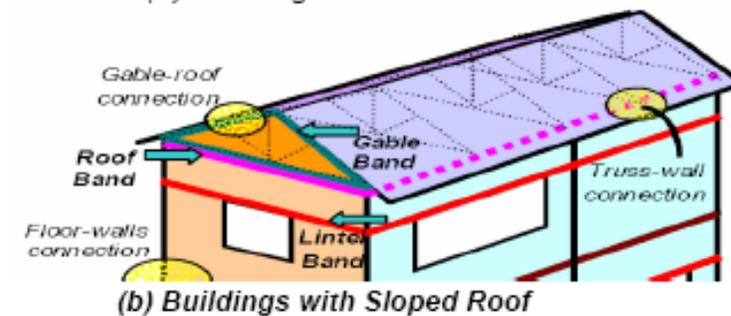
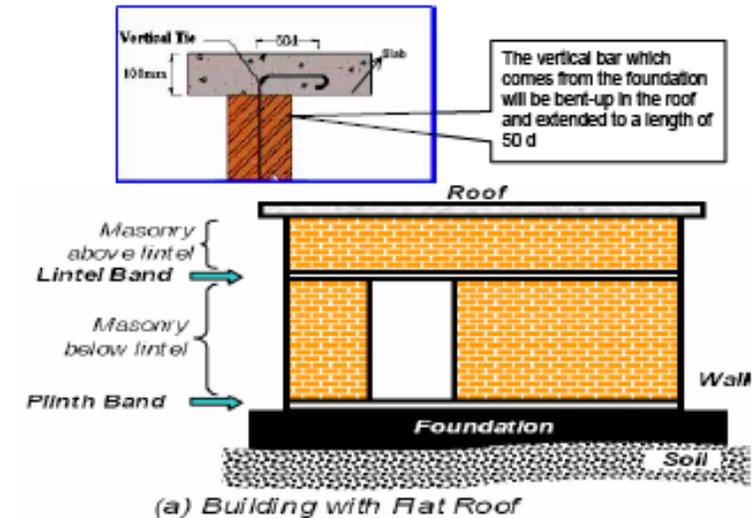
D. Retrofitting

Table-3: Recommended joint details with the vertical reinforcement at corner for masonry walls using different kind of materials

Type of Joint	Corner reinforcement in case of Brick Masonry	Corner reinforcement in case of Solid Concrete Block Masonry	Corner reinforcement in case of Hollow Concrete Block Masonry (see the hole and slit made)
L- Joint			
T- Joint			

Types of reinforcement in a slab

1. Main bars
2. Distribution bars
3. Extra top bars
4. Chair bars





Majority of the relief camps are schools, so disaster resilient wash infrastructures are necessary in disaster prone areas

Major Features

- Accessible gender-segregated climate-resilient toilet structure (PWD access)
- Running water supply with hand wash solution and electricity provided inside the toilet
- High-raised twin pit latrine with Y junction
- Waste bins (MHM waste) provided inside the toilet
- Dedicated pedal operated hand washing station provided in the PHC premise

Government Flagship Programs- Scope on Disaster Resilience

	SBM-U	SBM-G	AMRUT	MNREGA	JJM	NULM & NRLM
Objective	SBM-U aims to achieve universal sanitation and eliminate open defecation in urban areas.	SBM-G focuses on rural sanitation and ending open defecation in rural areas.	AMRUT aims to improve infrastructure in urban areas with a focus on water supply, sewerage, and urban transport.	MNREGA guarantees 100 days of wage employment to rural households for creating sustainable livelihoods.	JJM focuses on providing safe and adequate drinking water to rural communities.	NULM aims to reduce poverty and vulnerability of the urban poor through skill training and livelihood opportunities.
Disaster resilience	Integrating disaster-resilient infrastructure, (constructing flood-resistant toilets , ensuring water supply during disasters, and incorporating climate-resilient designs in wastewater management.)	Incorporating disaster-resistant features in the construction of toilets and sanitation facilities in rural areas. (toilets to withstand floods, earthquakes, or other natural disasters.)	Including disaster-resilient measures in the planning and implementation. (reinforcing infrastructure to withstand natural disasters and ensuring continued access to water during emergencies).	incorporate WASH-DRR elements like building check dams, rainwater harvesting structures , and erosion control measures. This aids in reducing the adverse effects of disasters on water sources and sanitation facilities.	Integrating DRR strategies in water supply projects, including source protection, designing resilient water supply systems , and ensuring emergency response mechanisms to maintain water access during disasters.	Incorporating WASH skill development programs to enhance the capacity of communities in disaster-prone urban areas to manage WASH during emergencies.
<ul style="list-style-type: none"> • Scope of utilization of CFC and SFC in prioritizing Climate resilient WASH infrastructure • Program Convergence 						

Recommendations : Climate-Resilient Infrastructure and Technology

Innovative WASH Infrastructure

- ****Climate-Adaptive Designs****: Infrastructure projects incorporate climate-resilient designs, such as elevated water sources, flood-resistant sanitation facilities, and storm-proof hygiene infrastructure.
- ****Technological Innovations****: The integration of smart technologies and renewable energy solutions enhances the resilience and sustainability of WASH infrastructure in the coastal region.
- ****Nature-Based Solutions****: The use of nature-based approaches, such as mangrove restoration and rainwater harvesting, contributes to climate-resilient WASH infrastructure.

Data-Driven Decision Making

- ****Climate Risk Assessments****: Data-driven assessments are conducted to identify climate risks and vulnerabilities, informing evidence-based decision-making for climate-resilient WASH planning and implementation.
- ****Early Warning Systems****: Integration of early warning systems for extreme weather events enables proactive measures to protect WASH infrastructure and ensure community safety.
- ****GIS and Remote Sensing****: The use of geospatial technologies facilitates accurate mapping of climate risks, aiding in the targeted deployment of climate-resilient WASH interventions.

Technological Interventions

- ****Water Treatment Innovations****: Advanced water treatment technologies are employed to ensure the availability of safe and potable water, even under climate-induced stressors.
- ****Sanitation Solutions****: Innovative sanitation solutions, including eco-friendly toilets and decentralized waste management systems, contribute to climate-resilient WASH services.
- ****Hygiene Promotion Tools****: Technology-enabled hygiene promotion tools and behavior change communication strategies foster climate-resilient hygiene practices among coastal communities.

Financing Mechanisms and Resource Mobilization

- ****Technical Training****: Capacity building programs equip local technicians and WASH practitioners with the skills to maintain and repair climate-resilient WASH infrastructure.
- ****Community Workshops****: Interactive workshops and training sessions engage coastal communities in disaster preparedness, climate-resilient WASH practices, and the maintenance of WASH facilities.
- ****Knowledge Transfer****: The exchange of best practices and knowledge sharing among stakeholders enhances the resilience of WASH services in the face of climate change.

Recommendations : Community Engagement and Behavioral Change

Community-Led Adaptation

- ****Participatory Planning****: Community-driven adaptation planning ensures that climate-resilient WASH strategies align with the specific needs and vulnerabilities of coastal communities.
- ****Local Knowledge Integration****: Traditional ecological knowledge and community insights are integrated into climate-resilient WASH initiatives, enhancing their relevance and effectiveness.
- ****Social Cohesion****: Climate-resilient WASH programs foster social cohesion and collective action, strengthening community resilience in the face of climate-related challenges.

Behavioral Change Communication

- ****Risk Communication****: Tailored communication strategies raise awareness about climate risks and the importance of climate-resilient WASH practices, fostering behavioral change.
- ****Gender-Sensitive Approaches****: Gender-responsive communication and engagement strategies ensure the inclusion of women and marginalized groups in climate-resilient WASH initiatives.
- ****Youth Empowerment****: Educational campaigns and youth-led initiatives promote climate-resilient WASH behaviors, empowering the next generation as agents of change.

Community Resilience Building

- ****Livelihood Diversification****: Climate-resilient WASH programs support livelihood diversification and income-generating activities, enhancing community resilience to climate impacts.
- ****Ecosystem Restoration****: Initiatives for coastal ecosystem restoration and conservation contribute to the overall resilience of communities and WASH infrastructure.
- ****Social Safety Nets****: Community-based safety nets and mutual support systems are established to address climate-induced shocks and protect vulnerable households.

Monitoring and Evaluation

- ****Community-Led Monitoring****: Participatory monitoring mechanisms engage communities in tracking the performance and impact of climate-resilient WASH interventions, ensuring accountability and sustainability.
- ****Adaptive Management****: Continuous evaluation and adaptive management enable the refinement of climate-resilient WASH strategies based on real-time feedback and changing climate dynamics.
- ****Knowledge Sharing Platforms****: Platforms for knowledge exchange and learning facilitate the dissemination of successful practices and lessons learned in climate-resilient WASH initiatives.

Recommendations : Policy Integration and Institutional Collaboration

Policy Framework for Climate-Resilient WASH

- ****Legislative Alignment****: Integration of climate resilience considerations into national and regional WASH policies and frameworks, ensuring a cohesive approach to climate adaptation.
- ****Incentive Mechanisms****: Policy incentives and regulatory frameworks promote private sector engagement and investment in climate-resilient WASH infrastructure and services.
- ****Cross-Sectoral Coordination****: Intersectoral coordination and policy coherence across climate, water, and sanitation sectors enhance the effectiveness of climate-resilient WASH governance.

Multi-Stakeholder Collaboration

- ****Public-Private Partnerships****: Collaboration with private sector entities and industry stakeholders fosters innovation and investment in climate-resilient WASH solutions.
- ****Civil Society Engagement****: Partnerships with civil society organizations and community-based groups amplify the reach and impact of climate-resilient WASH programs.
- ****Research and Academic Partnerships****: Collaboration with research institutions and academia facilitates evidence-based decision-making and the development of climate-resilient WASH technologies.

Knowledge Management and Learning

- ****Best Practice Documentation****: Systematic documentation of best practices and case studies in climate-resilient WASH services, enabling knowledge sharing and replication.
- ****Learning Networks****: Establishment of learning networks and communities of practice for practitioners and policymakers to exchange experiences and expertise in climate-resilient WASH.
- ****Capacity Development****: Training programs and knowledge-sharing initiatives build the capacity of government officials and stakeholders in climate-resilient WASH governance and management.

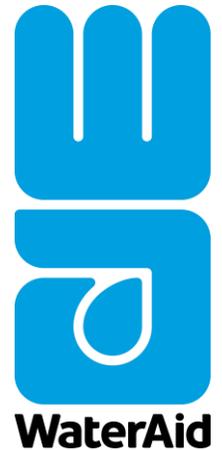
Financing Mechanisms and Resource Mobilization

- ****Climate Finance Access****: Facilitation of access to climate finance and innovative funding mechanisms to support the implementation of climate-resilient WASH projects.
- ****Resource Mobilization Strategies****: Development of resource mobilization strategies to ensure sustained investment in climate-resilient WASH infrastructure and services.
- ****Economic Valuation****: Integration of economic valuation and cost-benefit analysis to demonstrate the long-term benefits of climate-resilient WASH investments and interventions.

- ❑ **Inclusion in Infrastructure** : Implementation of innovative Standard Operating Procedures (SOPs) that prioritize inclusivity, accessibility, and resilience in flagship programs.
- ❑ **Policy Integration**: Advocate for the integration of climate resilience considerations into national and local WASH policies and strategies.
- ❑ **Capacity building**: Initiatives for key stakeholders such as CSMMC, SMC, child cabinet, RKS, and Community WASH Taskforces, focusing on resilient infrastructure development.- strengthening
- ❑ **Integration and convergence**: of various missions and programs, such as JJM and SBM, through a revised policy on a Water, Sanitation, and Hygiene (WASH) resilient action plan, alongside initiatives like MNREGA.
- ❑ **Inclusion of resilient WASH services in O & M Framework**: Development and adherence to SOPs for the operation and maintenance (O&M) of infrastructure, ensuring sustainability and longevity.
- ❑ **Integrating Monitoring Frameworks**: Establishment of policies and monitoring frameworks to track the progress and impact of infrastructure projects, fostering accountability and effective governance.
- ❑ **Data and Research**: Support research initiatives to better understand climate change impacts on WASH services and use data-driven approaches to inform decision-making.

Special Thanks to:

WaterAid Odisha Team & CFAR Odisha team



Ar. Amita Pathria
Sanitation Specialist,
Policy and Technical Support Unit

amitapathria@wateraid.org
+91 9660052551

Thank You

CWAS CENTER
FOR WATER
AND SANITATION
CRDF CEPT
UNIVERSITY

BILL & MELINDA
GATES foundation



Global South Academic Conclave on WASH and Climate Linkages