स्वच्छ भारत
एक कदम स्वच्छता की ओर

पेयजल एवं स्वच्छता विभाग
जल शक्ति मंत्रालय
भारत सरकार
DEPARTMENT OF DRINKING WATER AND SANITATION
MINISTRY OF JAL SHAKTI
GOVERNMENT OF INDIA

Development of Climate Resilient Sanitation technical designs and service delivery management protocols for rural sanitation

Climate resilient sanitation asset creation/ retrofitting protocol

JULY 2025

In keeping with the advancements in this sector, updates as and when found necessary will be hosted on the Ministry website www.jalshakti.gov.in and the reader is advised to refer to these also.

Developed with support of UNICEF India and PriMove, Pune.

Preface

The journey of rural sanitation and water security in India has seen transformational strides over the past decade. With the Swachh Bharat Mission (Grameen) and the Jal Jeevan Mission, the Department of Drinking Water and Sanitation (DDWS) has worked to ensure every rural household has access to safe sanitation and drinking water services. As the mission evolves into its next step, there is a growing recognition that building durable infrastructure alone is not enough, we understand that we must also build systems that are climate-resilient, sustainable, and future-ready.

This document "Climate Resilient Sanitation technical designs and service delivery management protocols for rural sanitation" is a critical step in this direction. It provides a structured and forward-looking framework to guide the design, implementation, and upgradation of sanitation and water assets across rural India. By embedding principles of lifecycle planning, resource efficiency, and user-centricity, this is a vision document for how infrastructure must evolve in service of people and the planet.

We understand climate-resilient infrastructure is no longer optional, it is essential. In the face of increasing climatic vulnerabilities such as droughts, floods, and water contamination, this protocol emphasizes not just creation of assets, but the development of systems that are adaptive and robust. The focus on retrofitting existing infrastructure ensures that legacy systems can be upgraded to meet modern standards of safety, accessibility, and environmental sustainability.

The protocol highlights the importance of participatory planning and convergence. From leveraging local knowledge and community institutions like VWSCs and Gram Panchayats, to aligning with flagship initiatives such as MGNREGS, AMRUT, and Jal Shakti Abhiyan, this framework aims to embed sanitation and water infrastructure within the broader development narrative of rural India. It reflects the vision of a Viksit Bharat, where basic services are not just available but are resilient, inclusive, and dignified.

We urge all implementing partners, local governments, and field functionaries to actively adopt and implement this protocol in letter and spirit.

The collective ownership of this framework will not only strengthen the outcomes of SBM-G and JJM but also help establish a resilient rural WASH ecosystem for generations to come.

Department of Drinking Water and Sanitation
Ministry of Jal Shakti, Government of India

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Abbreviations

AI	Artificial Intelligence
BCC	Behaviour Change Communication
BDO	Block Development Officer
BoQ	Bill of Quantities
BRC	Block Resource Centre
CBO	Community-Based Organization
CE	Chief Engineer
CSC	Community Sanitary Complex
CW	Constructed Wetland
DDWS	Department of Drinking Water and Sanitation
DEWATS	Decentralized Wastewater Treatment System
DLP	Defect Liability Period
DPR	Detailed Project Report
DWSC	District Water and Sanitation Mission
EE	Executive Engineer
FSTP	Faecal Sludge Treatment Plant
GHG	Greenhouse Gas
GI	Galvanized Iron
GIS	Geographic Information System
GL	Ground Level
GP	Gram Panchayat
HFL	High Flood Level
IEC	Information, Education and Communication
IHHL	Individual Household Latrine
IoT	Internet of Things
ISI	Indian Standards Institute
MB	Measurement Book
NADEP	Narayan Deotao Pandhari Pandey
NGO	Non- Government Organisation
ODF	Open Defecation Free
PCC	Plain Cement Concrete
PHED	Public Health Engineering Department
PVC	Polyvinyl Chloride
PWM	Plastic Waste Management
RCC	Reinforced Cement Concrete
SBM (G)	Swachh Bharat Mission (Gramin)
SDMPs	State Disaster Management Plan
SE	Superintendent Engineer
SLWM	Solid Liquid Waste Management
SWM	Solid Waste Management
UNICEF	United Nation's Children's Fund
VDMP	Village Disaster Management Plan
VSI	Vertical Shaft Impact
VWSC	Village Water and Sanitation Committee
WASH	Water, Sanitation & Hygiene
WSP	Waste Stabilization Pond

A. Background

A1. Context

India is marching towards becoming an ODF plus country. SBM (G) Phase I and II have contributed in creating huge number of sanitation assets across all verticals in all GPs of India. However, increasing frequency and severity of extreme weather events such as floods, droughts and cyclones pose a threat to sustainability of these assets. Climate change induced risks come from extreme events or climate shocks, but also from slower-onset changes causing long term impact i.e. climate stress.

Sanitation infrastructure is particularly susceptible to climate-related disruptions. Rising global temperatures and altered precipitation patterns have already led to water scarcity in arid regions and exacerbated flooding in others, creating severe challenges for maintaining safe and functional sanitation facilities. In this context, access to sanitation services and ensuring sustained practice of hygiene behaviours is central to building a healthy resilience to climate change.

Developing robust sanitation designs and community-centric service delivery protocols that can withstand climate shocks is essential to safeguard public health. Furthermore, empowering local officials with the knowledge and skills to develop, maintain, and manage these systems will ensure long-term sustainability and resilience. UNICEF is supporting DDWS for "Development of Climate Resilient Sanitation technical designs and service delivery management protocols for rural sanitation". PriMove has been selected as the technical support agency for the same. This is the protocol for creation/ retrofitting of climate resilient sanitation assets developed as a part of the support.

A2. Objectives of the protocol

The purpose of this protocol is to ensure continuity of sanitation assets in an efficient manner in the face of changing climate. The specific objectives of the protocol are as follows-

- To set out the activities required for creation/ retrofitting of climate resilient sanitation assets in rural areas of the country.
- To develop drawings, designs and estimates for climate resilient sanitation assets in floods, droughts, and cyclone prone rural areas.
- To elaborate the supportive actions required for implementation of the proposed designs and estimates for climate-resilient sanitation assets on ground.

A3. Target users of the protocol

The target users of the Climate Resilient Sanitation Asset Creation and Retrofitting Protocol include local governments, rural planners, engineers, contractors, and non-governmental organizations (NGOs) involved in sanitation infrastructure development. This protocol is also intended for community leaders, decision-makers, and disaster risk management professionals seeking to integrate climate resilience into sanitation systems. Additionally, it serves as a resource for

policymakers and academic institutions aiming to adopt or promote sustainable and adaptive practices in sanitation asset design, construction, and retrofitting.

A4. Structure of the protocol

This protocol consists of 5 main sections. The initial section of Background discusses the context, objectives and target users of this protocol. Second section outlines the impacts of disasters on sanitation structures and the need for retrofitting/repair or reconstruction of sanitation assets to make them climate-resilient. Third section presents the activities required for creation/ retrofitting of disaster-resilient sanitation assets which include vulnerability assessment, incorporating resilience in technical designs and estimates, Technical sanction, Implementation, Monitoring, CB, IEC, completion certificate and handing over, etc. Fourth section presents the roles and responsibilities of key stakeholders for implementing disaster-resilient sanitation and last section of annexure presents the supportive formats.

B. Impact of climate change on sanitation structures

Disasters directly and indirectly affect continuity, quality and access of WASH services. They result in total or partial destruction of sanitation structures, increase in incidence of open defecation due to lack of water and functional toilets, contamination due to overflow of sanitation systems, defunct SWM systems leading to open dumping of solid waste including menstrual waste and medical waste, unsafe distance between leach pits and groundwater levels leading to contamination, etc. In short, these disasters damage sanitation infrastructure, disrupt services and exacerbate public health risks. Embedding disaster resilience approach in sanitation is the way forward to ensure sustained sanitation service delivery in rural India.

B1. Impacts of disasters on sanitation structures

Impacts of floods and cyclones on sanitation structures

- ⇒ Total or partial destruction of toilets including collapse of superstructure
- ⇒ Total or partial destruction of septic tanks / toilet pits
- ⇒ Total or partial destruction of faecal sludge intake, transmission, treatment, storage and distribution systems
- ⇒ Increase in incidence of open defecation due to lack of water to clean and use toilets
- ⇒ Repair and maintenance affected due to lack of manpower
- ⇒ Collapse of pit latrines due to rising water levels leading to open defecation
- ⇒ Leaching/soaking systems like pits will not prove efficient in areas with high ground water table or prone to frequent flooding
- ⇒ Unsafe distance between leach pits and groundwater levels, leading to contamination
- ⇒ Toilets filled with debris and soil after floodwater recedes leading to open defecation (OD)
- ⇒ Overflow or obstruction of septic systems if drainage pipes get choked by waste
- ⇒ Treatment plants receive flows that exceed their design capacities, resulting in flows bypassing the treatment processes
- ⇒ Flooding of FSTPs – Drying beds, deep row trenches, etc. Flooding of on-site sanitation systems causing spillage and contaminating ground water
- ⇒ Submersion of garbage dumps
- ⇒ Flooding of NADEP / compost pits, biogas infrastructure
- ⇒ Flooding of PWM units affecting plastic processing and its forward linkages
- ⇒ Widespread distribution of plastic waste in the environment due to floods

Impacts of droughts on sanitation structures

- ⇒ Declining water supply impeding function of water-reliant sanitation systems (e.g., flush toilets, septic tanks, faecal sludge) leading to open defecation
- ⇒ Hardened sewage in pits impeding suction by machine leading to manual cleaning

⇒ 'High strength wastewater' is formed as its solids content remains the same but the contaminant dilution capacity decrease

B2. Retrofitting/repair or reconstruction of sanitation assets to make them climate-resilient

The existing infrastructure in disaster-affected areas will need to be retrofitted or repaired to make them disaster-resilient. Similarly, all infrastructure built in future will need to adopt disaster-resilient approach. Following are the indicative disaster-resilient measures recommended for retrofitting and new construction of individual and community level sanitation infrastructure-

1.1 Developing or upgrading technical designs/ drawings and estimates of sanitation structures

- Developing designs/design upgrades, BoQs and estimates for disaster-resilient sanitation infrastructure with appropriate balance between needs for disaster resilience, implementation suitability of the designs, social acceptability and financial implications.
- Framing of construction norms, quality control and verification standards, and material quality standards in simple and easily understandable language for non-technical staff at GP level.
- Protocol for district/ block level engineers for making appropriate changes in technical designs/ drawings and estimates based on local context.

1.2 Ensuring physical resilience of sanitation systems

Flood resilience

- Selection of appropriate siting in elevated areas (above potential flood level) with round the year access through raised pathways
- Deeper foundations or use of small piles in places having loose subsoil strata, e.g. alluvial soil
- Raising the plinth height above potential flood level, construction of ramps or additional steps for safe access and ensuring structural stability of foundation to support added weight
- Watertight seals around pit openings to prevent floodwater ingress and sewage outflow, lining of Septic tanks and leach pits with impermeable materials in high groundwater table areas to avoid leakage and contamination of groundwater during floods, use of prefabricated septic tanks wherever possible
- For SLWM facilities located near streams or rivers, adoption of measures to mitigate riverside erosion, installation of erosion barriers around the facility periphery
- Prioritization of centralized greywater treatment plants as technologies like soak pits, magic pits, and leach pits are unsuitable for flood-prone regions
- Construction of drainage channels to direct floodwaters away from structures
- Adoption of innovative technologies suitable for flood prone areas like Bio-digester toilets

Cyclone Resilience

- Securing the foundations with anchor bolts or ground reinforcements to prevent collapse during cyclones.

- Sufficiently deep foundations, adequately reinforced walls, and firmly cemented (or 'J-hook' anchored), yet lightweight, roofs to withstand strong currents and high winds
- FSM plants, and containment units strengthened with cyclone-resistant materials and design features to withstand high winds and debris impact.
- Installation of anchored or heavy-duty waste bins to prevent scattering of waste during high winds

Drought Resilience

- Water-saving retrofitting like replacing urban pans with rural pans, use of dry composting toilets or ECO-SAN toilets
- Systems equipped with rainwater collection systems to ensure reliable water supply during droughts.
- Promotion of reuse of treated wastewater for non-human consumption purposes

C. Activities for creation/ retrofitting of disaster-resilient sanitation assets

Following section presents the activities required for creation/ retrofitting of disaster resilient sanitation assets.

C1. Vulnerability assessment and need identification

It is important to understand the disaster resilience status of existing assets and identify the need for repairs/ reconstruction of sanitation assets to make them resilient to disasters. This will clearly bring forth the scope and extent of retrofitting/ new construction to be done in every GP of the country.

The key indicative pointers to be assessed in every GP will include –

Indicative pointers for Vulnerability assessment and need identification

Status of existing sanitation assets

- No. of sanitation assets created
- No of assets needed to cover the entire population

Likelihood of disaster occurrence

- Identifying likelihood of disaster occurrence considering their historical frequency and future trends

Impact of disasters on sanitation assets

- No. of assets (IHHLs, CSCs, SLWM structures) exposed to high/ medium/low risks during disasters
- No. of assets which are partially/ fully damaged during disasters
- Nature of impacts of disasters, especially on vulnerable groups- access, functionality, safe disposal, security

Retrofitting/ reconstruction needs

- Existing structural resilience methods adopted
- No. of assets which need to be retrofitted/ reconstructed and details of which parts need to be retrofitted/ reconstructed and how
- Availability of local technicians (Engineers, masons, etc.) and their adequacy
- Prioritization of the assets to be retrofitted/ constructed

The assessment will need to be conducted in every GP and the priorities for retrofitting/ new construction will need to be set at district/ state level based on the levels of exposure to hazards, risks and vulnerability.

C2. Development of a retrofitting/ new construction plan

Based on the data collected from the GPs, a plan for retrofitting and new construction will be developed at the block level. The priorities for retrofitting/ construction will be taken into consideration while developing the plan. This block level plan will be further compiled at district level and also at the state level.

The plans will clearly bring forth the number of assets to be retrofitted/ constructed, nature and extent of retrofitting, which assets to prioritise, etc.

C3. Incorporating resilience in technical designs and estimates

For construction of climate resilient sanitation infrastructure in the disaster affected areas, the first and most important step is to integrate climate resilience into the drawings, designs and estimates of rural sanitation infrastructure in India.

UNICEF and PriMove have developed drawings, designs and estimates for sanitation structures in flood prone areas, cyclone affected areas and drought prone areas. The development of these drawings and estimates are based on thorough assessment of the existing infrastructure and existing standard drawings and estimates developed by the states.

a. Core principles for integrating climate resilience into the drawings, designs and estimates

The core principles for the design upgrades consist of high technical and environmental adaptability, good social acceptability and sound financial viability; aligned with and adhering to the foundational principles of UNICEF's sustainability agenda, which encompass social, environmental, and economic aspects. These principles are described below-

- **Balanced Design Approach:** The starting point for developing appropriate designs/design upgrades for climate-resilient sanitation infrastructure was studying contextualised designs and documents developed by project States. Key principles and considerations of existing designs were considered if necessary along with the recommendations of the field level assessment. While developing technical designs, a balance between the needs for climate resilience, implementation suitability of the designs and financial implications was sought. Efforts were made to synchronize technology and human interface.
- **Engineering adaptability:** Factors such as durability, structural sustainability, operational efficiency, and ease of maintenance were considered in the designs.
- **Social acceptability:** Designs were so developed that they are not extremely complex in nature and easy to understand and implement, which will in turn be accepted by the community.
- **Financial viability:** Care was taken that the designs/ upgrades are not cost-intensive and are optimised for financial sustainability of the sanitation system.
- **Localized Approach:** Local wisdom, practices and innovative technologies were studied and incorporated in the climate resilient designs.
- **Simplified Norms:** After preparation of the draft designs, appropriate bill of quantities and financial estimates for the designs were also prepared. The construction norms, quality control and verification standards, and material quality standards were framed in simple and easily understandable language for non-technical people at GP level.

- **Easy Quantification:** Bills of Quantities included a material-wise analysis with practical methods of quantification that can be easily monitored by stakeholders at the GP level.

b. Selection of appropriate technology in disaster-affected areas-

There is no standard intervention or one-size-fits-all approach that can be adopted here – aspects that make WASH facilities more resilient to flooding in different areas will vary according to different factors. These can include type of disaster and its magnitude, geographic and geological factors, political and social / cultural context, financial and economic factors, etc.

To ensure safe and effective waste management during disasters, it is important to choose appropriate SLWM technologies that can function in disaster conditions. The right technology depends on factors such as the type of disaster, local geography, water availability, and community needs.

Criteria for selection of appropriate technology for disaster-resilient sanitation

- Disaster-Specific Suitability of the technology
- Geo-hydrological conditions of the area
- Ease of Maintenance & emergency repairs
- Availability of spare parts and

Where technology selection is demand driven, there is a need to make sure that information on climate resilience, as well as on cost, social and other concerns, is available in order to ensure more effective decision-making. Following matrix presents appropriateness of SLWM technologies in case of different disasters. It provides an overview of different SLWM technologies and their suitability for various disasters. It will help to select the best options for waste disposal during emergencies.

Table 1: Technology appropriateness matrix

Sr. No	Sanitation infrastructure	Key considerations		
		Flood	Cyclone	Drought
1	**IHHL (Individual Household Latrine)**			
i	Twin Pit	Not recommended (because of high water table and flood prone area)	Not recommended in case of high water table	Suitable
ii	Septic tank with Soak pit	Suitable with modifications	Suitable with modifications	Suitable
iii	Eco-san/ *Phaydemand* toilets/ dry toilets	Suitable with modifications	Suitable with modifications	Suitable
iv	Bio digester Toilet	Suitable with modifications	Suitable with modifications	Suitable
	Floating toilets for emergencies	Suitable with modifications	Suitable with modifications	Not needed
2	**CSC (Community Sanitary Complex)**			
i	Twin Pit	Not recommended (because of high water table and flood prone area)	Not recommended in case of high water table	Suitable

Sr. No	Sanitation infrastructure	Key considerations		
		Flood	Cyclone	Drought
ii	Septic tank with Soak pit	Suitable with modifications	Suitable with modifications	Suitable
iii	Biogas toilet	Suitable with modifications	Suitable with modifications	Suitable
3	**Biodegradable waste management**			
i	Pit Composting	Not recommended (because of high water table and flood prone area)	Suitable with modifications	Suitable
ii	Pile Composting	Not recommended (because of high water table and flood prone area)	Suitable with modifications	Suitable
iii	NADEP (Narayan Devrao Pandhari Pandey)	Suitable with modifications	Suitable with modifications	Suitable
iv	Vermicomposting Pit	Suitable with modifications	Suitable with modifications	Suitable
v	Windrow Composting	Suitable with modifications	Suitable with modifications	Suitable
vi	Rotary Drum Composting	Suitable with modifications	Suitable with modifications	Suitable
4	**GOBAR DHAN**			
i	Fixed Dome/ Janta Model	Suitable with modifications	Suitable with modifications	Not recommended in water scarce areas (because of high water requirement)
ii	Floating Drum	Suitable with modifications	Suitable with modifications	Not recommended in water scarce areas (because of high water requirement)
iii	Flexi Model/ Deenbandhu	Suitable with modifications	Not recommended	Not recommended in water scarce areas (because of high water requirement)
5	**Greywater management**			
i	HH level soak pit	Not recommended (because of high water table and flood prone area)	Suitable with modifications	Suitable
ii	HH level leach pit	Not recommended (because of high water table and flood prone area)	Suitable with modifications	Suitable
iii	HH level magic pit	Not recommended (because of high water table and flood prone	Suitable with modifications	Suitable

Sr. No	Sanitation infrastructure	Key considerations		
		Flood	Cyclone	Drought
		area)		
iv	Community Leach Pit	Not recommended (because of high water table and flood prone area)	Suitable with modifications	Suitable
v	Waste Stabilization Pond (WSP)	Suitable with modifications	Suitable with modifications	Suitable
vi	Constructed Wetland (CW)	Suitable with modifications	Suitable with modifications	Suitable
vii	DEWATS	Suitable with modifications	Suitable with modifications	Suitable
7	**Faecal sludge management**			
i	Deep Raw Entrenchment	Not recommended	Suitable with modifications	Suitable
ii	Planted Sludge Drying Bed	Suitable with modifications	Suitable with modifications	Suitable
iii	Unplanted Sludge Drying Bed	Suitable with modifications	Suitable with modifications	Suitable

c. Overview of drawings and estimates developed

Based on a preliminary assessment in 8 states of India, UNICEF-PriMove has developed drawings, designs and estimates for disaster resilient sanitation structures in 7 verticals- IHHLs, CSCs. Biodegradable Waste Management, Plastic Waste Management, Gobardhan, Greywater Management and Faecal Sludge Management. Presently, for flood prone and cyclone prone areas, we are considering raising plinth of 1 meter for the standard drawings. On ground, this will vary for each structure based on the HFL.

Following table presents the key changes adopted in each sanitation structure to make them resilient to floods/ cyclones/ droughts.

Table 2: Changes adopted to make sanitation structures resilient to floods/ cyclones/ droughts

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
1	• **IHHL (Individual Household Latrine)**			
i	• Twin Pit	• Pits and the structure plinth raised above flood level and access through staircase • Rings used for pits above ground level, with joints properly filled and sealed • Pits covered with an RCC cover • Sand jacketing to the pits to avoid flood water ingress into the pit • Boulders filling and PCC layer around the pit above GL to avoid percolation of flood water into sand jacketing • Use of good quality doors; provision of ventilator; roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• Pits and the structure plinth raised above flood level and access through staircase • Rings used for pits above ground level, with joints properly filled and sealed • Pits covered with an RCC cover • Sand jacketing to the pits to avoid flood water ingress into the pit • Boulders filling and PCC layer around the pit above GL to avoid percolation of flood water into sand jacketing • The foundation firmly secured with anchor bolts or ground reinforcements • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 230 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• No change • Ensure use of rural pans instead of urban pans
ii	• Septic tank with Soak pit	• The septic tank, soak pits, and toilet structure plinth raised to approximately 1 meter above ground level; access through staircase • Adoption of pile foundation in loose soil area • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak	• Pits and the structure plinth raised to approximately 1 meter above ground level and access through staircase • Adoption of pile foundation in loose soil area • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak	• No change • Ensure use of rural pans instead of urban pans.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Use of good quality doors; provision of ventilator; roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 230 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	
iii	• Eco-san/ Phaydemand toilets/ dry toilets	• The tank and the toilet structure plinth raised to approximately 1 meter above ground level (GL). • Access through stairs • Use of good quality doors; provision of ventilator; roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• The tank and the toilet structure plinth raised to approximately 1 meter above ground level (GL). • Access through stairs. • The toilets' foundations firmly secured with anchor bolts or ground reinforcements • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 230 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• Dry toilet with provision for urine and washing water disposal arrangements.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
iv	• Bio digester Toilet	• Use of Bihar Bio-digester design (raised plinth) with raised soak pit • Access through stairs • Use of good quality doors; provision of ventilator; roofing of corrugated GI/ AC sheets • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• Use of Bihar Bio-digester design (raised plinth) with raised soak pit • Access through stairs • The toilets' foundations firmly secured with anchor bolts or ground reinforcements • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 230 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Beneficiary to ensure round the year access through raised pathways	• *Normal Bio-digester toilets without increasi ng plinth
v	• Floating toilets for emerge ncies	• Entire structure resting on bamboo mat attached with 6 plastic drums • Three drums used for keeping the latrine floating, remaining three used as toilet components- one used for installation of toilet pan; other two used for installing filtration system for preliminary treatment of cleansing water. • Toilet pan has three holes; central hole fitted with a lid is for faecal matter, hole in front is for urine, and	• --	• ---

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		hole at the back is for cleansing water. • Faecal matter drops directly into the drum through central hole and accumulates. When the drum becomes full, faecal matter is disposed of safely • Urine diverted through a pipe to urine collection jar. • Vent pipe provided for removing obnoxious gas from the collection drum • Cleansing water partially treated through a dual filtration process, discharged into water • Bamboo/ lightweight superstructure with sandwich roof of Chatai and Polyethylene		
2	• **CSC (Community Sanitary Complex)**			
i	• Twin Pit	• Pits and the structure plinth raised to approximately 1 meter above ground level and access through staircase • Rings used for pits above ground level, with joints properly filled and sealed • Pits covered with an RCC cover • Sand jacketing to the pits to avoid flood water ingress into the pit • Boulders filling and PCC layer around the pit above GL to avoid percolation of flood water into sand jacketing • Use of good quality doors; provision of ventilator; roofing of RCC slab • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Need to ensure round the year access through raised pathways	• Pits and the structure plinth raised to approximately 1 meter above ground level and access through staircase • Rings used for pits above ground level, with joints properly filled and sealed • Pits covered with an RCC cover • Sand jacketing to the pits to avoid flood water ingress into the pit • Boulders filling and PCC layer around the pit above GL to avoid percolation of flood water into sand jacketing • The foundation firmly secured with anchor bolts or ground reinforcements • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 200 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Necessary to identify appropriate siting in	• No change • Ensure use of rural pans instead of urban pans

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
			elevated areas (above potential flood level) • Need to ensure round the year access through raised pathways	
ii	• Septic tank with Soak pit	• The septic tank, soak pits, and toilet structure plinth raised to approximately 1 meter above ground level; access through staircase • Adoption of pile foundation in loose soil area • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Use of good quality doors; provision of ventilator; roofing of RCC slab • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Need to ensure round the year access through raised pathways	• Pits and the structure plinth raised to approximately 1 meter above ground level and access through staircase • Adoption of pile foundation in loose soil area • Rings used for soak pit above ground level, with joints properly filled and sealed, covered with an RCC cover • Sand jacketing to the soak pit to avoid flood water ingress into the pit • Boulders filling and PCC layer around the soak pit above GL to avoid percolation of flood water into sand jacketing • Provision of RCC slab for roofing • Wall thickness of superstructure increased to 200 mm • Use of good quality doors; provision of ventilator, roof & walls with proper joints • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Need to ensure round the year access through raised pathways	• Same as above
3	• **Biodegradable waste management**			
i	• NADEP (Narayan Devrao Pandhari Pandey)	• The Nadep Tank plinth raised to approximately 1 meter above ground level; access through staircase • Superstructure wall thickness increased to 230 mm • Use of good quality roofing of corrugated GI/ AC sheets	• The Nadep Tank plinth raised to approximately 1 meter above ground level; access through staircase • Superstructure wall thickness increased to 230 mm • Use of good quality roofing of corrugated GI/ AC sheets	• No Change.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		• Necessary to identify appropriate siting in elevated areas (above potential flood level)	• Necessary to identify appropriate siting in elevated areas (above potential flood level) • Truss - GI sheet thickness increased to 0.8 mm, additional bracing provided, pitch height increased	
ii	• Vermicompostin g Pit	• The vermi compost tank plinth raised to approximately 1 meter above ground level; access through staircase • Use of good quality roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• The vermi compost tank plinth raised to approximately 1 meter above ground level; access through staircase • Truss - GI sheet thickness increased to 0.8 mm, additional bracing provided, pitch height increased • Use of good quality roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• No Change.
iii	• Windrow Composting	• The windrow composting unit plinth raised to approximately 1 meter above ground level; access through Ramp • Platform provided from all sides for easily accessing the unit • A ramp provided for entry and parking of vehicles • Use of good quality roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• The windrow composting unit plinth raised to approximately 1 meter above ground level; access through Ramp • Platform provided from all sides for easily accessing the unit • A ramp provided for entry and parking of vehicles • Use of good quality roofing of corrugated GI/ AC sheets • Necessary to identify appropriate siting in elevated areas (above potential flood level) • Truss - GI sheet thickness increased to 0.8 mm, additional bracing provided, pitch height increased	• No Change.
iv	• Rotary Drum Composting	• The Rotary Drum unit platform raised to approximately 1 meter above ground level; access through steps • Necessary to identify	• The Rotary Drum unit platform raised to approximately 1 meter above ground level; access through steps • Necessary to identify	• No Change.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		appropriate siting in elevated areas (above potential flood level) • Ensure that the selected site is located outside the blue line	appropriate siting in elevated areas (above potential flood level) • Ensure that the selected site is located outside the blue line.	
4	• **GOBAR DHAN**			
i	• Floating Drum	• All units of the Gobardhan plant raised to approximately 1 meter above ground level; access through staircase for processing unit	• No Change. Connect the Dome with side wall.	• No Change.
5	• **Plastic Waste Management**			
i	• Village level shed	• The plinth raised to approximately 1 meter above ground level; access through Ramp • A ramp provided for entry and parking of vehicles • Use of good quality roofing of corrugated GI/ AC sheets • To minimize the potential for flooding, choose a site with higher elevation.	• The plinth raised to approximately 1 meter above ground level; access through Ramp • A ramp provided for entry and parking of vehicles • Use of good quality roofing of corrugated GI/ AC sheets • Truss - GI sheet thickness increased to 0.8 mm, pitch height increased • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• No Change.
ii	• Block PWM unit	• The plastic waste management unit plinth raised to approximately 1 meter above ground level; access through staircase • Superstructure wall thickness increased to 0.3 m • Use of good quality roofing of corrugated GI/ AC sheets • A ramp provided for entry and parking of vehicles • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• The plastic waste management unit plinth raised to approximately 1 meter above ground level; access through staircase • Superstructure wall thickness increased to 0.3 m • Use of good quality roofing of corrugated GI/ AC sheets • Truss - GI sheet thickness increased to 0.8 mm, pitch height increased • A ramp provided for entry and parking of vehicles • Necessary to identify appropriate siting in elevated areas (above potential flood level)	• No Change.
6	• **Greywater management**			

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
i	• Waste Stabilization Pond (WSP)	• Stone pitching provided for polishing pond • Appropriate liner provided to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to select a site with higher elevation, ensure that the selected site is located outside blue line	• No Change.	• No Change.
ii	• Constructed Wetland (CW)	• Screen chamber and wet well added at a place where waste water can be collected through gravity. It is further transported to other elevated components for treatment • Stone pitching provided for polishing pond • Appropriate liner provided for polishing pond to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to select a site with higher elevation, ensure that the selected site is located outside blue line	• No Change.	• No Change.
iii	• DEWATS	• Screen chamber and wet well added at a place where waste water can be collected through gravity. It is further transported to other elevated components for treatment • Stone pitching provided for polishing pond	• No Change.	• No Change.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		• Appropriate liner provided to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to select a site with higher elevation, ensure that the selected site is located outside blue line		
7	• **Faecal sludge management**			
i	• Planted Sludge Drying Bed	• Stone pitching provided for polishing pond • Appropriate liner provided for polishing pond to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to select a site with higher elevation, ensure that the selected site is located outside blue line	• Stone pitching provided for polishing pond • Appropriate liner provided for polishing pond to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to select a site with higher elevation, ensure that the selected site is located outside blue line	• No Change.
ii	• Unplanted Sludge Drying Bed	• Stone pitching provided for polishing pond • Appropriate liner provided for polishing pond to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to	• Stone pitching provided for polishing pond • Appropriate liner provided for polishing pond to avoid percolation of water • Embankment of polishing pond raised to 1 m • Flap valve introduced at outlet pipe to avoid back flow and entry of flood water • Red line drawn to indicate the flood level. • To minimize the potential for flooding, necessary to	• No Change.

Sr. No	Sanitation infrastructure	Flood	Cyclone	Drought
		select a site with higher elevation, ensure that the selected site is located outside blue line	select a site with higher elevation, ensure that the selected site is located outside blue line	

Presently, for flood prone areas, we are considering raising plinth of 1 meter for the standard drawings. On ground, this will vary for each structure based on the HFL.

C4. Technical sanction

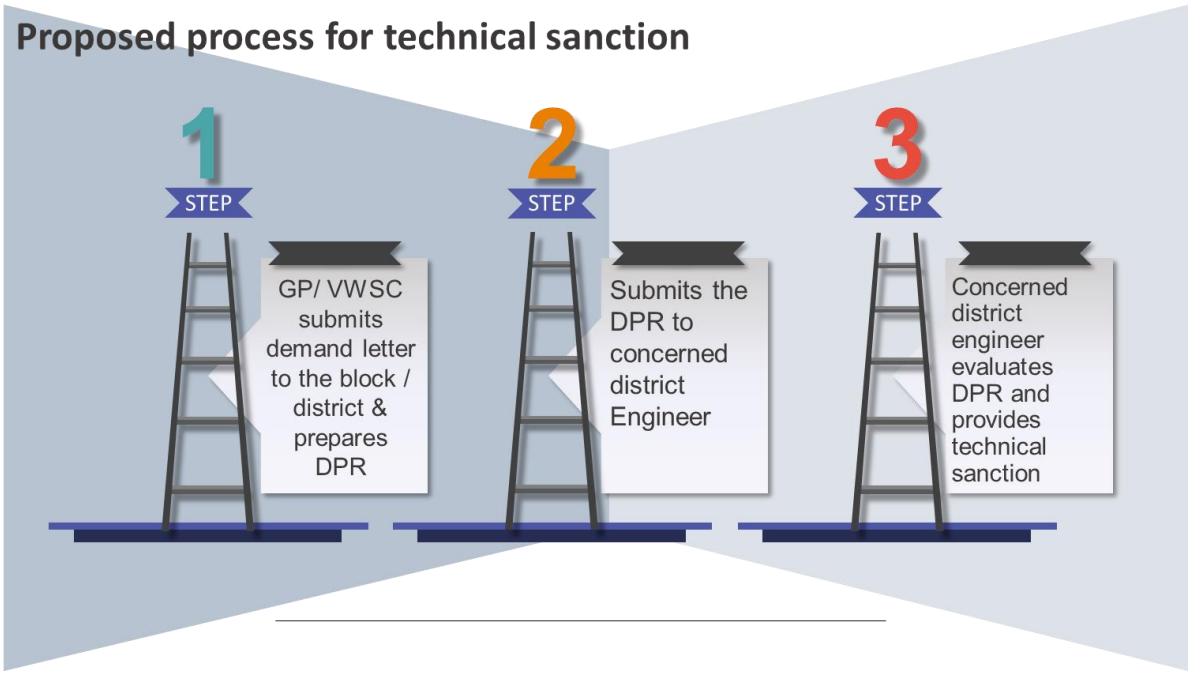
The GP/ VWSC will firstly submit a demand letter to the block for construction of climate resilient sanitation structures. A DPR including technology selected, design, drawing & estimates of each structure based on the standard drawings/ estimates, location of the structures, block costs for each structure and other technical details will be prepared by the GP/ VWSC with the help of local engineers, technical support agency. The key components of the DPR may be approved in Gramsabha.

The DPR will be submitted to the concerned district engineer based on the total cost of the DPR, as per state norms. Generally, the EE has the rights to sanction DPRs up 2 Crores, the SE can sanction the DPRs from 2 to 5 Crores and the CE can sanction DPRs above 5 Crores. However, this can vary from state to state.

The District Engineer shall carefully check the DPRs and then provide technical sanction to the DPR if found technically appropriate. The District Engineer should make sure that the structures are resilient in disaster situations.

A format of the letter for technical sanction is attached as annexure-1.

The process for technical approval of the DPRs is presented in the schematic below-



For finalising the rates, the state specific schedule of rates linked with cost index or market rates whichever is lower, should be taken into consideration. After the technical approval, the administrative and financial approval shall be accorded by the DWSC.

Site Selection

Selecting suitable construction sites reduces risks associated with natural hazards. Avoiding flood-prone areas, choosing stable ground for building foundations, and considering factors like slope stability and soil type can help decrease a building's vulnerability to disasters. Following are few considerations for selecting site of disaster resilient sanitation structures-

Floods:

- Avoid all low lying areas for construction as it can be inundated with water in case of heavy rain, flood
- If higher ground is not available then construct on artificially raised ground or on stilts

Cyclones:

- Select site that is sheltered from cyclonic winds
- The shelters should not be laid out in straight rows to prevent the tunnel effect during cyclones, adopt a non-regular layout
- Construct building at least 1m away from top of slope and 1m away from the cut. Also construct retaining wall to support very steep cut slope
- While trees near the house act as a natural barrier against the wind, caution must be taken that the distance of tree from the house may be kept 1.5 times the height of the tree.

C5. Capacity Building for Climate-Resilient Sanitation Infrastructure

Building the capacity of stakeholders is essential for successful implementation and sustainability of climate-resilient sanitation infrastructure. Capacity-building initiatives focus on enhancing the knowledge, skills, and resources of stakeholders involved in the planning, construction, operation, and maintenance of such infrastructure at GP, block, district and state levels.

1. **Training designing and developing modules for key stakeholder groups:** Tailored training programs will be developed by the State/ district SBM(G) Cell for key stakeholder groups such as block and district engineers, SBM and PHED officials, masons, etc. Modules will also be developed for these training programs. These modules will cater to the specific needs of the stakeholder groups and language understood by them. Training plans will be developed at district levels which will be further consolidated at State levels.

2. **Training Programs**: Specialized training will be conducted for engineers, contractors, and local authorities on climate-resilient design principles, construction techniques, and material selection. The district SBM(G) Officials will conduct trainings programs for stakeholder groups based on the modules developed on climate resilient sanitation structures.

3. **Community Involvement**: Community members will be oriented about operation and maintenance of sanitation systems, emphasizing the importance of climate-resilience features like flood resistance and sustainable waste management.

4. **Technical Support**: The SBM(G) officials at district and block levels will ensure that continuous technical assistance is provided to the masons and contractor staff on designs of climate resilient sanitation structures, use of appropriate material, quantity of material required, precautions to be taken during construction, etc. This will be done through expert consultations, manuals, and toolkits to ensure adherence to climate-resilient standards.

5. **Monitoring and Evaluation Training**: The training programs will be monitored and evaluated by district and state SBM(G) officials for their effectiveness and inputs will be incorporated in training design. The key monitoring indicators include logistic arrangements, effectiveness of the delivery of required content, stakeholders targeted, etc.

Capacity building ensures that all stakeholders are equipped to implement, manage, and sustain sanitation systems that are resilient to climate challenges, fostering ownership and long-term impact.

C6. Information, Education, and Communication (IEC) for Climate-Resilient Sanitation Infrastructure

IEC activities play a critical role in raising awareness, encouraging behaviour change, and fostering community support for climate-resilient sanitation infrastructure. Effective communication ensures that communities and stakeholders understand the significance of such infrastructure and their role in its success.

Firstly, the state SBM(G) cell will develop an IEC plan which will be a consolidation of district level IEC plans based on district specific needs. The plan will consist of the IEC activities to be conducted, organizers of activities, time period, place, message to be delivered, etc. Then the state and district level SBM(G) Cells will develop tailored IEC material for Climate-Resilient Sanitation Infrastructure based on the specific needs of the state/ districts. Implementation of the IEC activities as per the plan will be the responsibility of district SBM(G) cell. This implementation will be monitored by the state on sample basis.

Following are the indicative IEC activities for Climate-Resilient Sanitation Infrastructure-

1. **Awareness Campaigns**: Awareness campaigns will be conducted through various media (e.g., radio, social media, posters) to inform communities about the benefits of climate-resilient sanitation systems, such as improved health and disaster preparedness.
2. **Behaviour Change Communication (BCC)**: Targeted BCC materials will be developed to encourage proper usage, maintenance, and waste management practices.
3. **Community Engagement**: Community meetings and participatory sessions will be organized to address concerns, gather feedback, and build trust.
4. **School Programs**: School-based programs will be implemented to educate children on hygiene, sanitation, and climate resilience, fostering early awareness.
5. **Crisis-Specific Communication**: IEC materials tailored for emergency scenarios will be developed to emphasize safe use of temporary, mobile, or floating toilets during disasters.

Through effective IEC strategies, communities become active participants in the adoption, proper use, and maintenance of climate-resilient sanitation infrastructure, ensuring its sustainability and long-term success.

C7. Community Involvement for Climate-Resilient Sanitation Structures

Community involvement is a cornerstone for the successful implementation, operation, and sustainability of climate-resilient sanitation structures. Engaging local communities ensures that the infrastructure is aligned with their needs, fosters a sense of ownership, and promotes long-term usage and maintenance. Following key activities will be conducted for community Involvement for Climate-Resilient Sanitation Structures-

1. **Participatory Planning and Design:**
    - The GPs will ensure that the community members, especially women, marginalized groups, and persons with disabilities are involved in the planning and design phases to ensure the infrastructure meets diverse needs.
    - The district level officials may also consider organization of participatory workshops to gather input on location, features, and preferred sanitation technologies.
2. **Capacity Building and Training:**

- The districts will involve community representatives during the training sessions on maintaining and managing the infrastructure, emphasizing climate-resilience features such as flood resistance and waste management systems.
- Community-led task forces or committees will be set up to oversee operations and monitor functionality.

3. **Behaviour Change and Awareness Campaigns:**
    - Awareness programs will be conducted by the GPs with guidance from block/ district officials on the importance of climate-resilient sanitation and proper usage of facilities. Culturally relevant communication strategies will be used to promote hygienic practices and environmentally sustainable behaviour.
4. **Monitoring and Feedback Mechanisms:**
    - Mechanisms for regular community feedback to address issues, ensure proper usage, and improve infrastructure functionality will be established by the districts and used regularly. Communities will be involved in monitoring environmental impacts, such as water quality and waste disposal.

By actively engaging communities at every stage, climate-resilient sanitation structures can become not only functional but also sustainable, fostering better health outcomes and environmental protection.

C8. Implementation

The GP/ VWSC and Block level engineers are expected to monitor the construction of disaster resilient structures on regular basis. This will include monitoring the quality of material used, quantity of material and labour days utilized, construction norms, etc. Along with these, the GP and block officials will also need to ensure reduction in Greenhouse Gas Emissions and use of advanced digital technologies to enhance climate resilience of sanitation infrastructure.

a. Selection of construction material

Choosing durable materials capable of enduring harsh environmental conditions is crucial for resilient construction. Materials should resist moisture, corrosion, and decay while maintaining structural integrity over time. Additionally, opting for locally sourced and sustainable materials can enhance long-term resilience.

1. Materials for Flood Resistance

- Water-Resistant Concrete: Prevents water absorption and reduces damage during floods.
- Sealants and Waterproof Coatings: Protect walls and floors from water infiltration.

Building materials like porous concrete and permeable pavements permit storm water to slowly soak into the ground rather than run off surfaces. Flood-resistant drywall and insulation can withstand water exposure inside homes and buildings without warping or mold growth. Using these

types of flood-resilient materials reduces costly flood damage and repairs. They provide passive flood protection without the need for temporary emergency flood barriers.

Modular and Prefabricated Construction- Modular and prefabricated building techniques are becoming more common as an adaptable and resilient construction method in flood-prone regions. Modular structures are designed in sections manufactured offsite and then transported and assembled on location. This allows for rapid construction or relocation if needed.

Green Infrastructure and Natural Flood Management- Implementing green infrastructure is an effective way to mimic natural hydrology and minimize flooding from heavy rainfall events. Green roofs with rainwater-capturing vegetation help divert storm water. Rain gardens filled with native plants provide beautiful landscaping while absorbing runoff.

2. Materials for Cyclone Resistance

- Reinforced Concrete and Steel Frames: Provide strong structural support against high winds.
- Metal Roofing: Durable, fire-resistant, and wind-resistant, ideal for cyclone-prone areas.
- Impact-Resistant Glass: Reduces the risk of shattering during strong winds and flying debris.

3. Materials for Drought Resistance

- Cool Roof Materials: Reflect sunlight and reduce heat absorption, keeping buildings cool.
- Earth-Based Materials: Materials like clay bricks and rammed earth provide thermal stability.
- Green Roofs and Walls: Incorporate vegetation to retain moisture and reduce heat build-up.

Choosing the right materials for flood, cyclone, and drought-prone areas improves safety, durability and comfort. These materials also support sustainable construction practices, making buildings more adaptable to climate challenges.

b. Disaster-Resistant Construction Principles

⇒ Building Codes and Standards Compliance: Following building codes and standards is essential to ensure that structures are designed and built to withstand expected hazards. These codes often include requirements for seismic design, wind resistance, floodplain management, and structural integrity.

⇒ The design and construction of the foundation of flood-resistant buildings should be such that it withstands design flood circumstances. It should have adequate capacity to resist floating, collapse, and permanent lateral movement under the critical load combinations. The foundation design of flood-resistant buildings should depend on the geotechnical characteristics of soil and strata beneath the foundation.

⇒ In case of cyclones, the best shape (house/ toilet structure) to resist high winds is a square.

⇒ If relocating or elevating the building isn't feasible, then wet or dry floodproofing can reduce the risk of flood damage. Dry floodproofing techniques essentially make the building watertight by adding sealants to the walls, shields to the openings, and secondary drainage

and pumps to remove the water that seeps inside the building. This technique is good for concrete or masonry construction with low levels of flooding. But it does require significant levels of maintenance. Wet floodproofing involves controlled and safe passage of floodwater through lower levels of the house. The sewers and water system should be above water level or should be sealed when the water rises above them to avoid health hazards. Keep the inlet points open well before any pile-up of water fills up to avoid pressure at the structure. The use of flood vents, flood damage-resistant building materials, and protecting service equipment by locating them above the anticipated flood elevation are all methods of wet floodproofing.

c. Material and labour quantities required for construction

Building disaster-resilient sanitation infrastructure requires careful planning, including the selection of durable materials and the estimation of labour needs. Different disasters—such as floods, cyclones, and droughts—demand specific construction techniques and materials to ensure sanitation facilities remain functional and safe during and after extreme weather events.

The material and labour requirements for each disaster resilient structure has been developed by UNICEF-PriMove which is provided as annexure 3.

This table provides a detailed breakdown of the material and labour quantities required for constructing and retrofitting disaster-resilient sanitation assets across seven key verticals. It serves as a practical guide for Gram Panchayats (GPs) and implementing agencies to ensure that sanitation facilities are built to withstand natural disasters while maintaining hygiene and public health standards. The GP/ VWSC are expected to monitor the construction based on these norms.

The table outlines the necessary components, including construction materials like reinforced concrete, water-resistant bricks, corrosion-free pipes, and waterproof coatings, as well as labour estimates for excavation, masonry, plumbing, and reinforcement work. It helps planners and field functionaries estimate resources accurately, ensuring efficient allocation of materials and workforce for each type of sanitation asset. By using this structured approach, GPs can enhance preparedness, minimize damage, and ensure uninterrupted sanitation services in disaster-prone areas.

d. Ensuring availability of floating/ temporary/ mobile toilets for emergency response

In emergency scenarios, providing safe and hygienic sanitation solutions is critical to prevent the spread of diseases and ensure the well-being of affected communities. For ensuring access to sanitation services during disasters, floating/ temporary/ mobile toilets or necessary supplies will be procured/ constructed beforehand so as to avoid discontinuity of sanitation services.

e. Reducing Greenhouse Gas Emissions in Climate-Resilient Construction

Climate-resilient construction can reduce greenhouse gas (GHG) emissions by prioritizing sustainable practices. Using low-carbon materials such as recycled steel, bamboo, and geopolymer concrete minimizes embodied carbon. Incorporating renewable energy systems like solar panels and energy-efficient designs reduces operational emissions. Additionally, promoting local sourcing of materials

lowers transportation-related emissions. These practices not only enhance climate resilience but also contribute to environmental sustainability.

f. Advanced Technologies:

The digital technologies have the potential to enhance climate resilience of critical infrastructure, by providing rapid and accurate assessment of asset condition and support decision-making and adaptation. E.g. - Internet of Things (IoT) can be used for data collection, wireless conveyance of data, data processing, etc.; Artificial Intelligence (AI) and Machine Learning (ML) can be used for data processing and inspection using engineering algorithms to interpret the condition of infrastructure; Mobile Applications; mobile platforms can facilitate communication and can be used for reporting system failures, monitoring hygiene practices, and disseminating emergency information.

Use of digital technologies in climate resilient sanitation: few examples

Flood-Resilient Toilets in Bangladesh: GIS mapping and IoT sensors were employed to monitor flood-prone areas and design raised latrines that remain functional during floods.

Early Warning Systems in Kenya: Mobile applications provided early warnings about potential floods, enabling communities to protect sanitation facilities in advance.

C9. Monitoring Construction of Climate-Resilient Sanitation Infrastructure

Monitoring the construction of climate-resilient sanitation infrastructure involves a structured approach to ensure quality, compliance with environmental norms, and timely delivery. Key steps include establishing a monitoring framework with clear objectives, performance indicators, and a schedule for site inspections.

The Block engineers will monitor the construction process at GP level. On-site monitoring will focus on verifying material quality, evaluating workmanship, and ensuring adherence to safety and environmental standards. Regular documentation, including progress reports, inspection checklists, and photo evidence, will help to track progress and maintain accountability. Following is an indicative checklist for monitoring construction of Climate-Resilient Sanitation Infrastructure-

Checklist for monitoring construction of Climate-Resilient Sanitation Infrastructure

1. Site Preparation and Contextual Suitability
- Appropriate site selection as discussed above in section C4, so that impact of disasters is minimum
- Soil condition assessed for structural stability and permeability
- Technical drawings and estimates
- Contextualization of the standard drawings and estimates approved by the state with incorporation of components like raised platforms, sealed tanks, ventilated designs, etc.
- Use of appropriate BoQs for purchase of material

2. Material used
- Use of locally appropriate, durable, and climate-resilient materials

3. Construction Quality and Structural Integrity
- Foundation depth and quality as per drawings
- Masonry, concrete, and reinforcement work done per standards
- Joints, seals, and connections are watertight and weather-resistant
- Superstructure and roofing designed for ventilation, protection, and durability
- Proper slope and alignment for storm water and greywater drains
- Safe outlets provided for treated effluent or greywater reuse
- Silt traps, inspection chambers, and filters installed as per design
- Provision for backflow prevention during heavy rains or floods

4. Environmental and Health Safeguards
- Avoidance of damage to existing ecosystems (trees, wetlands, natural drainage paths)
- Temporary sanitation facilities for construction workers
- Proper containment of construction waste and hazardous materials

5. Community and Gender Inclusion Measures
- Inclusive infrastructure (e.g., accessible toilets, menstrual hygiene-friendly design)
- Safe access routes, lighting, and privacy ensured
- Community members informed/involved in monitoring and feedback

6. Documentation and Compliance
- All materials, labour, and construction stages documented
- Compliance with national building codes and climate-resilient guidelines

Additionally, the physical and financial progress of construction works will also be monitored regularly by block and district officials.

The GP/ VWSC will also monitor the construction on a day-to-day basis. Progress against the DPR and contract terms with the contractor will be monitored by the GP/ VWSC.

To ensure accountability of the concerned officials, signatures of the JE, VWSC/GP members and the contractor should be obtained on the Measurement Book (MB) and store book.

C10: Completion certificate and handing over

Upon successful completion of the construction of climate-resilient sanitation structures, the following steps will be undertaken to ensure the project is formally concluded and the structures are handed over to the concerned authority or community.

Inspection and Verification

A thorough inspection will be conducted by the concerned block/ district engineer to ensure the structures meet the agreed specifications, quality standards, and climate-resilience criteria. Key elements to verify include the use of approved materials, compliance with environmental guidelines, structural integrity, and functionality of sanitation systems.

Final Testing and Demonstration

A final round of testing will be carried out to confirm operational efficiency, such as water flow, drainage, and any additional climate-resilient features (e.g., flood resistance, water-saving systems). A demonstration session may be organized to acquaint stakeholders or users with the operational aspects of the facilities.

Rectification of Defects

Any issues identified during the inspection will be documented and promptly addressed by the contractor or implementing agency. A Defect Liability Period (DLP) may be established during which the contractor remains responsible for rectifying any unforeseen issues.

Issuance of Completion Certificate

Upon successful inspection and rectification of any defects, a formal Completion Certificate will be issued by the concerned engineer. The certificate will confirm that the structures are ready for use, meet the specified standards, and align with climate-resilient construction practices. *A format of completion certificate is attached as annexure 2.*

Formal Handing Over

The sanitation structures will be formally handed over to GP/ VWSC or the concerned authority. A formal handing-over ceremony will be organized involving all stakeholders, including the community representatives, local authorities, and implementing agencies. A Handing Over Document will be signed by the receiving authority, marking the transfer of ownership, operation, and maintenance responsibilities. Maintenance manuals and contact details for technical support will be provided.

A brief training session will be conducted to ensure that the end-users are equipped with the necessary knowledge to operate and maintain the facilities effectively.

This process ensures transparency, accountability, and the sustainability of the climate-resilient sanitation structures, fostering long-term benefits for the community and the environment.

D. Roles and responsibilities of key stakeholders for implementing disaster-resilient sanitation

Below is an elaboration of the roles and responsibilities at the **Gram Panchayat (GP)**, **district**, and **state** levels to implement disaster-resilient sanitation in India:

1. Gram Panchayat (GP) Level

The GP is the frontline body for implementing disaster-resilient sanitation systems at the local level. The key stakeholders at GP level will consist of the Mukhiya/ Pradhan/Sarpanch, Village secretary, VWSC members, Jalsurakshak, village level government functionaries, SHG members, youth group members, CBO members, community members, etc. The key functions at GP level will involve the following-

Roles and Responsibilities

1. **Awareness and Community Engagement**:
    - Conduct awareness campaigns on the importance of disaster-resilient sanitation.
    - Engage with communities to promote participatory planning for sanitation infrastructure.
2. **Planning and Preparedness**:
    - Assess local vulnerabilities (flood-prone areas, cyclone-prone zones, etc.).
    - Develop Village Disaster Management Plans (VDMPs) that include sanitation resilience measures.
    - Identify safe zones for locating sanitation facilities.
    - Prepare DPRs for disaster resilient sanitation infrastructure and submit to the district for sanctioning
3. **Implementation of Resilient Infrastructure**:
    - Promote eco-friendly and resilient toilet designs (e.g., raised latrines in flood-prone areas).
    - Ensure proper drainage and wastewater management systems to avoid contamination during disasters.
    - Work with local masons and workers to build durable structures.
4. **Monitoring and Maintenance**:
    - Regularly monitor construction work to ensure its quality, durability and ability to function during disasters

- Regularly inspect sanitation facilities to ensure functionality.
- Promote the use of local resources for quick repair and maintenance post-disaster.
- Encourage community participation in maintaining shared sanitation facilities.

5. **Coordination and Reporting**:
    - Liaise with block and district authorities for technical and financial support.
    - Report damage to sanitation infrastructure and seek immediate assistance during emergencies.

2. Block/District Level

District and block authorities are responsible for providing technical expertise, funding, and oversight. The functionaries include BDOs, block level engineers, BRCs, BSBM(G) members, etc.

Roles and Responsibilities

1. **Technical and Financial Support**:
    - Allocate funds under schemes like SBM-G (Swachh Bharat Mission-Gramin) or State Disaster Relief Funds for resilient sanitation projects.
    - Provide technical assistance and guidelines for disaster-resilient designs.

2. **Technical sanction and completion certificate**
    - Provide technical sanction to DPRs based on their technical viability and considerations for climate resilience
    - After completion of construction, check if it is completed in accordance with the approved design, specifications, and terms of the contract and provide completion certificate
    - Hand over the structures to GP/ appropriate authority

3. **Capacity Building**:
    - Train GP officials, masons, and local workers on disaster-resilient construction techniques.
    - Organize workshops on sanitation-related disaster management for local bodies and NGOs.

4. **Supervision and Monitoring**:
    - Monitor construction work to ensure its quality, durability and ability to function during disasters

- Regularly monitor the implementation of sanitation projects in vulnerable areas.
- Ensure that sanitation infrastructure adheres to disaster-resilient guidelines.

5. **Emergency Response**:
    - Provide portable toilets and mobile sanitation units during emergencies.
    - Coordinate with NGOs and relief agencies to restore sanitation facilities post-disaster.
    - Ensure safe drinking water and proper sanitation during relief operations.
6. **Data Collection and Reporting**:
    - Maintain databases on vulnerable areas and sanitation infrastructure.
    - Compile reports from GPs and submit them to state authorities for further action.

3. State Level

The state government plays a pivotal role in policy formulation, resource allocation, and interdepartmental coordination.

Roles and Responsibilities

1. **Policy Development**:
    - Formulate policies and guidelines for disaster-resilient sanitation systems.
    - Ensure integration of sanitation in State Disaster Management Plans (SDMPs).
2. **Resource Allocation**:
    - Allocate funds for disaster-resilient sanitation under state schemes and programs.
    - Ensure equitable distribution of resources, prioritizing high-risk areas.
3. **Capacity Building and Training**:
    - Organize large-scale capacity-building programs for district and block officials.
    - Develop training modules on disaster-resilient sanitation.
4. **Interdepartmental Coordination**:
    - Collaborate with departments like Rural Development, Water Supply, and Disaster Management.
    - Promote public-private partnerships for sanitation resilience projects.

5. **Monitoring and Evaluation**:
    - Evaluate the implementation of disaster-resilient sanitation measures across districts.
    - Conduct periodic assessments of vulnerabilities and resilience levels.
6. **Disaster Response and Recovery**:
    - Ensure rapid deployment of emergency sanitation facilities in disaster-affected areas.
    - Provide post-disaster rehabilitation support for rebuilding sanitation infrastructure.
    - Leverage technological solutions (e.g., GIS mapping) for tracking sanitation recovery.

By effectively coordinating these roles and responsibilities, India can build a disaster-resilient sanitation ecosystem that minimizes health risks and enhances community resilience during disasters.

E. Annexure

Annexure 1: Format of Letter for Technical Sanction

Annexure 2: Format of Completion Certificate for Climate-Resilient Sanitation Structures

Annexure 3: Material and labour requirements for disaster resilient sanitation structures

Annexure 1: Format of Technical Sanction

[Department Letterhead]
Ref. No.: _____
Date: _____

Subject: Grant of Technical Sanction for DPR of ------- GP for **Climate-Resilient Sanitation Structures**

Dear [Recipient's Name/Designation],

With reference to the DPR submitted by ----- GP dated -------- regarding the construction of climate-resilient sanitation structures mentioned below, this office has conducted a detailed examination of the project's design, specifications, and cost estimates.

I am pleased to grant **Technical Sanction** for the implementation of the proposed DPR as per the details mentioned below:

1. **DPR of GP ----------**
2. **Scope of Work:**

No	Structure	Key climate-resilient features incorporated

3. **Estimated Cost:** INR [Amount] (inclusive of all applicable taxes)
4. **Project Duration:** [Expected duration of the project in months/weeks]
5. **Other Technical Specifications if any:**

The sanction is granted with the following conditions:

1. The construction must strictly adhere to the approved design, technical specifications, and climate-resilience features, including disaster-resistance features.
2. All activities must comply with relevant environmental, safety, and disaster-resilience standards.
3. Periodic site inspections will be conducted by this office to ensure quality and adherence to the approved designs and specifications.
4. Any deviation from the sanctioned plan must receive prior approval from this office.
5. Documentation and reporting of project progress, including photographs and technical reports, must be submitted at regular intervals.

This technical sanction is specific to the scope and specifications detailed in the DPR, and does not imply financial sanction. A separate process must be followed for the financial approval of the project.

For any clarifications or further assistance, please contact this office.

Yours sincerely,

[Name of the District Engineer]
[Designation]
[Contact Information]

Enclosures:

1. Approved project plan and design
2. Detailed cost estimate
3. Technical specifications emphasizing climate-resilience features
4. Relevant supporting documents

Annexure 2: Format of Completion Certificate for Climate-Resilient Sanitation Structures

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COMPLETION CERTIFICATE

For Climate-Resilient ---------- (name of Sanitation Structure) in ---------- GP

Certificate No.: _____
Date: _____

GP Name: _____
Block and District: _____
Contract/Work Order No.: _____
Date of Commencement: _____
Date of Completion: _____

This is to certify that the construction of **climate-resilient** ---------- (name of Sanitation Structure) has been completed in accordance with the approved design, specifications, and terms of the contract.

1. Details of climate-resilient features incorporated

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

2. Inspection and Testing:

- Date of final inspection: _____
- Inspection conducted by: _____
- Names of the GP representatives and contractor present during the inspection:

  1. ----------
  2. ----------
  3. ----------
  4. ----------
  5. ----------
- Remarks: _____

3. Handing Over:

- Whether formal training on O&M of the assets conducted? If yes, details of the training- _____
- Handover date: _____
- Handed over to: _____ GP, _____ Block, _____District
- (Name and Contact Details of GP Pradhan and Secretary)

5. Signatures:

Issued By:

(Name, Designation and Contact Details)

Verified By:

(Name, Designation and Contact Details)

Counter-signed By (GP functionaries and contractor):

1. ----------
2. ----------
3. ----------
4. ----------
5. ----------

Enclosures:

1. Approved design and specifications of the structure
2. Photographs of disaster-resilient features
3. Hand-over note

Annexure 3: Material and labour requirements for disaster resilient sanitation structures

1. Individual Household Latrines (IHHLs)

Flood resilience

No.	Description	Quantity					Unit
		Twin Pit	Septic tank	Bio digester	Phyd emand toilet	Eco San	
A)	**Material Component**						
1	2nd Class Bricks (Good quality)	1055	1680	1140	1205	1385	Nos
2	Cement (Reputed brand with ISI mark)	11.5	18	11	10	12	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	6.12	4.34	3.65	1.18	1.37	Cum
		2.16	1.53	1.29	0.42	0.48	Brass
4	40 mm Aggregates	0.61	0.47	0.49	0.29	0.32	Cum
		0.22	0.17	0.17	0.1	0.11	Brass
5	20 mm Aggregates	0.39	0.76	0.35	0.19	0.26	Cum
		0.14	0.27	0.12	0.07	0.09	Brass
6	12//10 mm Aggregates	0.06	0.2	0.06	0.03	0.05	Cum
		0.02	0.07	0.02	0.01	0.02	Brass
7	Supply of quarried stone 150 - 200 mm size for Hand Broken at site	1.05	0.83	0.73	0.88	0.99	Cum
		0.37	0.29	0.26	0.31	0.35	Brass
8	TMT-FE-500 reinforcement	22	72	23	11	18	Kg
9	G.I. Pre coated trapezoidal 0.50 mm thick roof Metallic Coloured Sheet	1.9549	1.7289	2.55	2.3636	2.909352	Sqm
10	Water proofing Compound	-	2.5	-	-	-	Kg
11	Cement Paint	5.93	7.77	6.82	7.74	8.86	Kg
12	Door (0.75 m *2.0m) FRP Door Shutter 30 mm thick Factory Made Shutter	-	1	1	-	-	Sqm
13	Ferro Cement Door	1	-	-	1	1	Sqm
14	Ventilator R.C.C.Jali 80mm thick	-	1	1	-	-	Nos
15	Precast RCC Jali	1	1	-	1	1	Nos
16	Specialized WC Pan	-	-	-	-	2	Nos
17	Wooden Purlin (0.05x 0.05x 1m)	4	-	-	4	4	Nos
18	Wooden Purlin (0.05x 0.05x 1m)	-	4	4	-	-	Nos
19	Washer, Nut-Bolt, Black annealed wire (for binding), GI wire (if ferro cement rings used), Hinges, Sikols, Polythene sheet etc.	1	1	1	1	1	LS
20	Polyethylene water storage tank with cover	-	-	-	1	1	No

No.	Description	Quantity					Unit
		Twin Pit	Septic tank	Bio digester	Phyd emand toilet	Eco San	
21	Providing & fixing Rural Pan including P trap	1	-	-	-	-	No
22	Providing & fixing Rural Pan including P trap	-	-	1	-	-	No
23	Providing & fixing Rural Pan including P trap with 20 mm water seal	-	1	-	-	-	No
24	P.V.C.pipe 110mm dia.4kg/cm2 pressure	3	3	-	-	-	Rmt
25	P.V.C.pipe 110mm dia.4kg/cm2 pressure (class II)	-	-	3	-	-	Mtr
26	900 mm Dia RCC ring 50 mm thk. And 300 mm Height For Leach pit	12	6	6	-	-	Nos
27	110 mm Dia PVC Tee	-	2	-	-	-	Nos
28	75 mm Dia PVC Tee	-	-	-	1	1	No
29	40 mm Dia PVC Tee	-	-	-	1	1	No
30	110 mm Dia PVC Bend	-	-	2	-	-	Nos
31	P.V.C. pipe 40mm dia.10kg/cm2 pressure(class IV)	-	3	-	1	1	Mtr
32	Providing, laying and fixing P.V.C. pipe of 75 mm dia.	-	-	-	3	3	Mtr
33	75 mm Dia PVC Cowl	-	-	-	1	1	No
34	50 mm PVC Cowl	-	1	-	-	-	No
35	Nails iron all size	-	1	-	-	-	LS
36	Nails iron all size	-	-	1	-	-	Kg
37	Bio Digester (700 Liters capacity)	-	-	1	-	-	No
B)	**Labour Component**						
1	Mason (Skilled labour)	7	8	7	8	9	Person /Day
2	Un-skilled labour	24	29	22	20	23	Person /Day

Cyclone resilience

Sr. No.	Description	Quantity					Unit
		Twin Pit	Septic tank	Bio digester	Phyde mand toilet	Eco San	
A)	**Material Component**						
1	2nd Class Bricks (Good quality)	1600	2145	1755	1880	2120	Nos
2	Cement (Reputed brand with ISI mark)	15	20	14	14	16.5	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	6.57	4.64	4.06	1.7	1.97	Cum
		2.32	1.64	1.43	0.6	0.7	Brass
4	40 mm Aggregates	0.61	0.47	0.34	0.29	0.34	Cum
		0.22	0.17	0.12	0.1	0.12	Brass
5	20 mm Aggregates	0.54	0.79	0.51	0.36	0.48	Cum
		0.19	0.28	0.18	0.13	0.17	Brass
6	12//10 mm Aggregates	0.11	0.21	0.13	0.09	0.12	Cum
		0.04	0.07	0.05	0.03	0.04	Brass
7	Supply of quarried stone 150 - 200 mm size for Hand Broken at site	1.15	0.83	0.79	0.96	1.07	Cum
		0.41	0.29	0.28	0.34	0.38	Brass
8	TMT-FE-500 reinforcement	40	75	47	32	43	Kg
9	G.I. Pre coated trapezoidal 0.50 mm thick roof Metallic Coloured Sheet	2.6656	2.2936	3.34	3.13962	3.757592	Sqm
10	Water profing Compound	-	2.5	-	-	-	Kg
11	Cement Paint	6.45	8.38	7.39	8.27	9.43	Kg
12	Door (0.75 m *2.0m) FRP Door Shutter 30 mm thick Factory Made Shutter	-	1	1	-	-	Sqm
13	Ventilator R.C.C.Jali 80mm thick	-	1	1	-	-	No
14	Ferro Cement Door	1	-	-	1	1	No
15	Precast RCC Jali	1	-	-	1	1	No
16	Specialized WC Pan	-	-	-	-	2	Nos
17	Wooden Purlin (0.05x 0.05x 1m)	4	-	-	4	4	Nos
18	Wooden Purlin (0.05x 0.05x 1m)	-	4	4	-	-	Nos
19	Washer, Nut-Bolt, Black annealed wire (for binding), GI wire (if ferro cement rings used), Hinges, Sikols, Polythene sheet etc.	1	1	1	1	1	LS
20	Polyethylene water storage tank with cover	-	-	-	1	1	No
21	Providing & fixing Rural Pan including P trap with 20 mm water seal	-	1	-	-	-	No
22	Providing & fixing Rural Pan	-	-	1	-	-	No

Sr. No.	Description	Quantity					Unit
		Twin Pit	Septic tank	Bio digester	Phyde mand toilet	Eco San	
	including P trap						
23	Precast RCC Jali	-	1	-	-	-	No
24	Providing & fixing Rural Pan including P trap	1	-	-	-	-	No
25	P.V.C.pipe 110mm dia.4kg/cm2 pressure	3	-	-	-	-	Rmt
26	900 mm Dia RCC ring 50 mm thk. And 300 mm Height For Leach pit	12	6	6	-	-	No
27	P.V.C.pipe 110mm dia.4kg/cm2 pressure (class II)	-	3	3	-	-	Mtr
28	110 mm Dia PVC Tee	-	2	-	-	-	No
29	75 mm Dia PVC Tee	-	-	-	1	1	No
30	40 mm Dia PVC Tee	-	-	-	1	1	No
31	110 mm Dia PVC Bend	-	-	2	-	-	Nos
32	P.V.C. pipe 40mm dia.10kg/cm2 pressure(class IV)	-	3	-	1	1	Mtr
33	Providing, laying and fixing P.V.C. pipe of 75 mm dia.	-	-	-	3	3	Mtr
34	75 mm Dia PVC Cowl	-	-	-	1	1	No
35	50 mm PVC Cowl	-	1	-	-	-	No
36	Nails iron all size	-	1	-	-	-	LS
37	Bio Digester (700 liters capacity)	-	-	1	-	-	No
38	Nails iron all size	-	-	1	-	-	Kg
B)	**Labour Component**						
1	Mason (Skilled labour)	8	10	8	9	10	Person / days
2	Un-skilled labour	29	32	27	26	30	Person / days

Drought resilience

Sr. No.	Description	Quantity	Unit	Rate
A)	**Material Component**			
1	2nd Class Bricks (Good quality)	945	Nos	8.5
2	Cement (Reputed brand with ISI mark)	6	Bags	300
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	0.62	Cum	1670
		0.22	Brass	
4	40 mm Aggregates	0.12	Cum	900
		0.04	Brass	
5	20 mm Aggregates	0.04	Cum	1050
		0.01	Brass	
6	12//10 mm Aggregates	0	Cum	1050
			Brass	
7	G.I. Pre coated trapezoidal 0.50 mm thick roof Metallic Coloured Sheet	2.665	Sqm	958
8	Cement Paint	7.17	Kg	70
9	Ferro cement door	1	Sqm	1800
10	Precast RCC Jali	1	No	300
11	Specialized WC Pan	0	No	2000
12	Wooden purlin (0.05x0.05x1 m)	4	No	100
13	Washer, Nut-Bolt, Black annealed wire (for binding), GI wire (if ferro cement rings used), Hinges, sikols, polythene sheet, etc.	1	LS	500
14	Polyethylene water storage tank with cover	1	No	350
15	Providing, laying and fixing P.V.C. pipe of 40mm dia. with fittings such as bends,	1	No	93
16	40 mm Dia PVC Tee	1	No	50
17	Providing, laying and fixing P.V.C. pipe of 75 mm dia.	3	Mtr.	285
18	75 mm Dia PVC Tee	1	No	135
19	75 mm Dia PVC Cowl	1	No	50
B)	**Labour Component**			
1	Mason (Skilled labour)	6	Person /Days	677
2	Un-skilled labour	16	Person /Days	615

2. Community Sanitary Complexes (CSCs)

Flood resilient

Sr. No	Description	Quantity		Unit
		Twin Pit	Septic tank	
A)	**Material Component**			
1	2nd Class Bricks (Good quality)	9335	11845	Nos
2	Cement (Reputed brand with ISI mark)	93	128	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	18.5	21.94	Cum
		6.53	7.75	Brass
4	40 mm Aggregates	3.7	3.71	Cum
		1.31	1.31	Brass
5	20 mm Aggregates	1.8	3.7	Cum
		0.64	1.31	Brass
6	12//10 mm Aggregates	0.17	0.8	Cum
		0.06	0.28	Brass
7	Supply of quarried stone 150 - 200 mm size for Hand Broken at site	23.86	23.86	Cum
		8.43	8.43	Brass
8	TMT-FE-500 reinforcement	63	290	Kg
9	Cement Paint	27.61	36.96	kg
10	Door (0.75 m *2.0m) FRP Door Shutter 30 mm thick Factory Made Shutter	4.8	4.8	Sqm
11	Ventilator R.C.C.Jali 80mm thick	0.68	0.68	Sqm
12	Washer, Nut-Bolt, Black annealed wire (for binding), GI wire (if ferro cement rings used), Hinges, Sikols, Polythene sheet etc.	1	1	LS
13	Providing & fixing Rural Pan including P trap	3	3	Nos
14	P.V.C.pipe 110mm dia.4kg/cm2 pressure (class II)	15	15	Mtr
15	110 mm Dia PVC Y	1	1	No
16	P.V.C. pipe 40mm dia.10kg/cm2 pressure(class IV)	2		Nos
	P.V.C. pipe 40mm dia.6kg/cm2 pressure(class IV)		2	Nos
17	40 mm Dia PVC TEE	3	3	Nos
	110 mm Dia PVC TEE		2	Nos
18	40 mm Dia PVC Bend	2	2	Nos
19	Wash Basin	2	2	Nos
20	900 mm Dia RCC ring 50 mm thk. And 300 mm Height For Leach pit	12	6	Nos
21	Nails iron all size	1	1	Kg
22	Colour wash hand basin 45*30cm	2		No
23	200 Ltr. Polyethylene water storage tank	200	2	Ltr
B)	**Labour Component**			
1	Mason (Skilled labour)	47	56	Person/Day
2	Un-skilled labour	178	217	Person/Day

Cyclone resilience

Sr. No.	Description	Quantity		Unit
		Twin Pit	Septic tank	
A)	**Material Component**			
1	2nd Class Bricks (Good quality)	9410	11925	Nos
2	Cement (Reputed brand with ISI mark)	93.5	128.5	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	18.54	21.98	Cum
		6.55	7.76	Brass
4	40 mm aggregates	3.69	3.71	Cum
		1.3	1.31	Brass
5	20 mm aggregates	1.8	3.7	Cum
		0.64	1.31	Brass
6	12//10 mm aggregates	0.18	0.8	Cum
		0.06	0.28	Brass
7	Supply of quarried stone 150 - 200 mm size for Hand Broken at site	23.86	23.86	Cum
		8.43	8.43	Brass
8	TMT-FE-500 reinforcement	65	290	Kg
9	Cement paint	27.71	36.96	Kg
10	Door (0.75 m*2.0 m) FRP Door Shutter 30 mm thick Factory Made Shutter	4.8	4.8	Sqm
11	Ventilator R.C.C. Jali 80 mm thick	0.68	0.68	LS
12	Washer, Nut-Bolt, Black annealed wire (for binding) , GI wire (if ferro cement rings used), Hinges, Sikols, Polythene sheet etc.	1	1	Nos
13	Providing & fixing Rural Pan including P trap	3	3	Mtr
14	P.V.C.pipe 110mm dia.4kg/cm2 pressure (class II)	15	15	Mtr
15	110 mm Dia PVC Y	1	1	Nos
16	P.V.C. pipe 40mm dia.10kg/cm2 pressure(class IV)	2	2	Nos
17	100 mm Dia PVC TEE		2	Nos
18	40 mm Dia PVC TEE	3	3	Nos
19	40 mm Dia PVC Bend	2	2	Nos
20	Wash Basin	2		Nos
21	900 mm Dia RCC ring 50 mm thk And 300 mm Height For Leach pit	12	6	Nos
22	Nails iron all size	1	1	Kg
23	Colour wash hand basin 45*30cm		2	Nos
24	Colour wash hand basin 45*30cm	2		Nos
25	200 Ltr. Polyethylene water storage tank	200	2	Ltr
B)	**Labour Component**			
1	Mason (Skilled labour)	48	56	Person /Day
2	Un-skilled labour	178	218	Person /Day

3. Solid Waste Management

Flood Resilience

Sr. No.	Description	Quantity				Unit
		Nadep Tank	Rotary Drum	Vermi compost tank	Windrow composting	
1	2nd Class Bricks (Good quality)	2737	135	2071	17808	Nos
2	Cement (Reputed brand with ISI mark)	15	2	25	270	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	6.03	0.17	6.41	225.01	Cum
		2.13	0.06	2.26	79.46	Brass
4	aggregates	0.64	0.09	1.83	29.59	Cum
		0.23	0.03	0.64	10.45	Brass
6	G.I. Pre coated sheet	23.78	-	24.34	-	Sqm
B)	**Labour Component**					
1	Mason (Skilled labour)	2	2	2	2	Person /Day
2	Un-skilled labour	4	4	4	4	Person /Day

Cyclone Resilience

Sr. No.	Description	Quantity				Unit
		Nadep Tank	Rotary Drum	Vermi compost tank	Windrow composting	
A)	**Material Component**					
1	2nd Class Bricks (Good quality)	2737	135	2071	17808	Nos
2	Cement (Reputed brand with ISI mark)	15	2	25	270	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	6.03	0.17	6.41	225.01	Cum
		2.13	0.06	2.26	79.46	Brass
4	aggregates	0.64	0.09	1.83	29.59	Cum
		0.23	0.03	0.64	10.45	Brass
5	G.I. Pre coated sheet	23.78	-	24.34	31.62	Sqm
B)	**Labour Component**					
1	Mason (Skilled labour)	2	2	2	2	Person /Day
2	Un-skilled labour	4	4	4	4	Person /Day

4. Greywater management

Flood and cyclone resilient

Sr. No.	Description	Quantity			Unit
A)	Material Component	DEWAT	VFCW	WSP	
1	2nd Class Bricks (Good quality)	5360.00	18785.00	-	Nos.
2	Cement (Reputed brand with ISI mark)	472.50	1291.00	479.00	Bags
3	Sand - Natural/V.S.I.(Vertical Shaft Impact Crusher)Quality Artificial Sand	42.21	112.02	66.00	Cu.m
4	40 mm Aggregates	24.69	45.45	97.00	Cu.m
5	20 mm Aggregates	42.08	120.85	35.00	Cu.m
6	12//10 mm Aggregates	11.04	34.57	0.43	Cu.m
7	Stones for pitching	151.31	-	379.17	Cu.m
8	TMT-FE-500 reinforcement	4013.49	12569.65	156.08	Kg
9	Water profing Compound	31.00	54.50	-	Kg
10	Fencing	190.00	220.00	320.00	Rmt
11	Sluice valve	2.00	3.00	-	Nos.
12	PVC 160 mm/ 6 kg pipe	25.00	140.00	-	Rmt
13	PVC 110 mm/ 6 kg pipe	-	30.00	-	Rmt
14	90 mm vent pipe	10.00	-	-	Rmt
15	PVC tee	10.00	-	-	Nos
16	PVC Bend 160 mm	5.00	2.00	-	Nos
17	3 HP pump Toshio	2.00	2.00	-	Nos
18	Flap Valve	1.00	1.00	1.00	Nos
19	LED Street light	1.00	1.00	1.00	No
20	Light pole	1.00	1.00	1.00	No
21	Fine screen L-1 m W- 5 m	1.00	1.00	1.00	No
22	Coarse screen	1.00	1.00	-	No
23	Gravel at bottom (5-10 mm)	8.25	100.80	-	Cum
24	Gravel at top (5-10 mm)	-	50.40	-	Cum
25	Sand (5 mm)	51.75	252.00	-	Cum
26	MCCB Panel Board	1.00	1.00	-	No
27	DOL starter	1.00	1.00	-	No
28	Main power cable	15.00	15.00	-	m
29	Power cable	10.00	10.00	-	m
30	control cable	10.00	10.00	-	m

B)	Labour Component				
i	Mason (Skilled labour)	61	138	135	Person Days
ii	Un-skilled labour	753	913	4071	Person Days