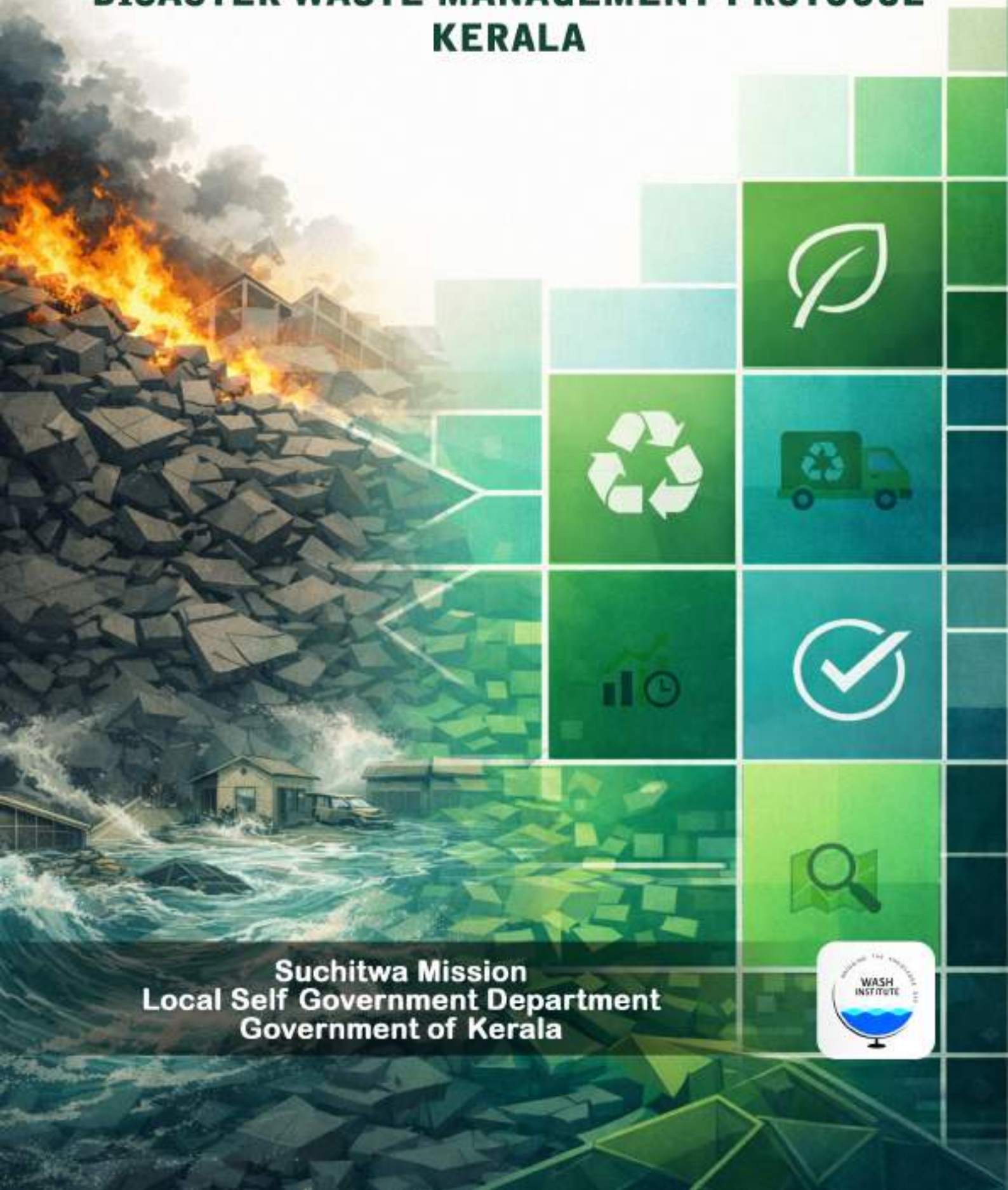
DISASTER WASTE MANAGEMENT PROTOCOL KERALA



Suchitwa Mission
Local Self Government Department
Government of Kerala

DISASTER WASTE MANAGEMENT PROTOCOL
KERALA

EXECUTIVE SUMMARY

The Government of Kerala, recognising the growing risks posed by climate-induced and human-made disasters, has approved the Disaster Waste Management Protocol for Kerala vide G.O.(Rt) No.3007/2025/LSGD dated 19.12.2025, issued by the Local Self Government Department (LSGD). The protocol is applicable to all districts and Local Self-Government Institutions (LSGIs) in the state and serves as a comprehensive framework for managing waste generated during and after disaster events in a scientific, safe, and coordinated manner.

Kerala's unique geography and settlement patterns make it highly vulnerable to floods, landslides, coastal erosion, fires, industrial accidents, and other emergencies, all of which generate large and complex waste streams. Past disaster responses—most notably the 2024 Wayanad landslide—demonstrated that while effective waste management is possible, the absence of a standardised protocol can lead to operational delays, health risks, and environmental damage. Existing waste management rules largely address routine conditions and are not designed to handle the scale and urgency of disaster-generated waste, necessitating a dedicated protocol.

This protocol provides an integrated approach covering pre-disaster preparedness, emergency response, and post-disaster recovery, and has been developed through applied research and field consultations, with technical and knowledge support from the WASH Institute, drawing on ground-level experiences and multi-stakeholder engagement. It emphasises advance risk assessment, waste forecasting, infrastructure mapping, capacity building, and Information, Education and Communication (IEC) systems. Post-disaster waste management is structured through a phased approach, prioritising rapid clearance during the emergency phase (0–72 hours) and systematic segregation, processing, recycling, co-processing, and disposal during the recovery phase.

Clear roles and responsibilities are defined for all stakeholders, including the Kerala State Disaster Management Authority (KSDMA), Suchitwa Mission, Local Self-Government Institutions, Kerala State Pollution Control Board, Kudumbashree and Haritha Karma Sena, Clean Kerala Company Ltd., empanelled private agencies, and relevant line departments. The protocol places strong emphasis on worker and volunteer safety, use of authorised facilities, inter-departmental coordination, and robust monitoring and documentation mechanisms.

By institutionalising scientific, coordinated, and adaptable disaster waste management practices, the protocol aims to prevent secondary environmental and public health risks, support faster and safer recovery, and strengthen Kerala's overall disaster resilience. The protocol is designed as a living document, with provisions for periodic review and updating based on evolving disaster patterns and field-level learnings.

ACKNOWLEDGEMENT

Suchitwa Mission sincerely acknowledges the collective efforts that enabled the development of the Disaster Waste Management Protocol for Kerala. We gratefully recognise the strategic guidance of Kerala State Disaster Management Authority and the institutional support of the Local Self Government Department in approving and operationalising this protocol across the State.

We place on record our appreciation for the research leadership and technical support provided by WASH Institute, which led applied research and stakeholder consultations, ensuring the protocol is evidence-based and field-ready. We also acknowledge the valuable operational learnings drawn from the Wayanad District Suchitwa Mission, particularly during the 2024 Wayanad landslide response, which significantly informed the protocol's phased approach and safety frameworks.

Suchitwa Mission thanks all Local Self-Government Institutions, Kerala State Pollution Control Board, Kudumbashree, Haritha Karma Sena, Clean Kerala Company Ltd., empanelled private agencies, and line departments for their technical inputs, field experience, and constructive feedback.

This protocol reflects a shared commitment to scientific, coordinated, and adaptable disaster waste management practices that safeguard public health, protect the environment, and ensure the safety and dignity of sanitation workers across Kerala.

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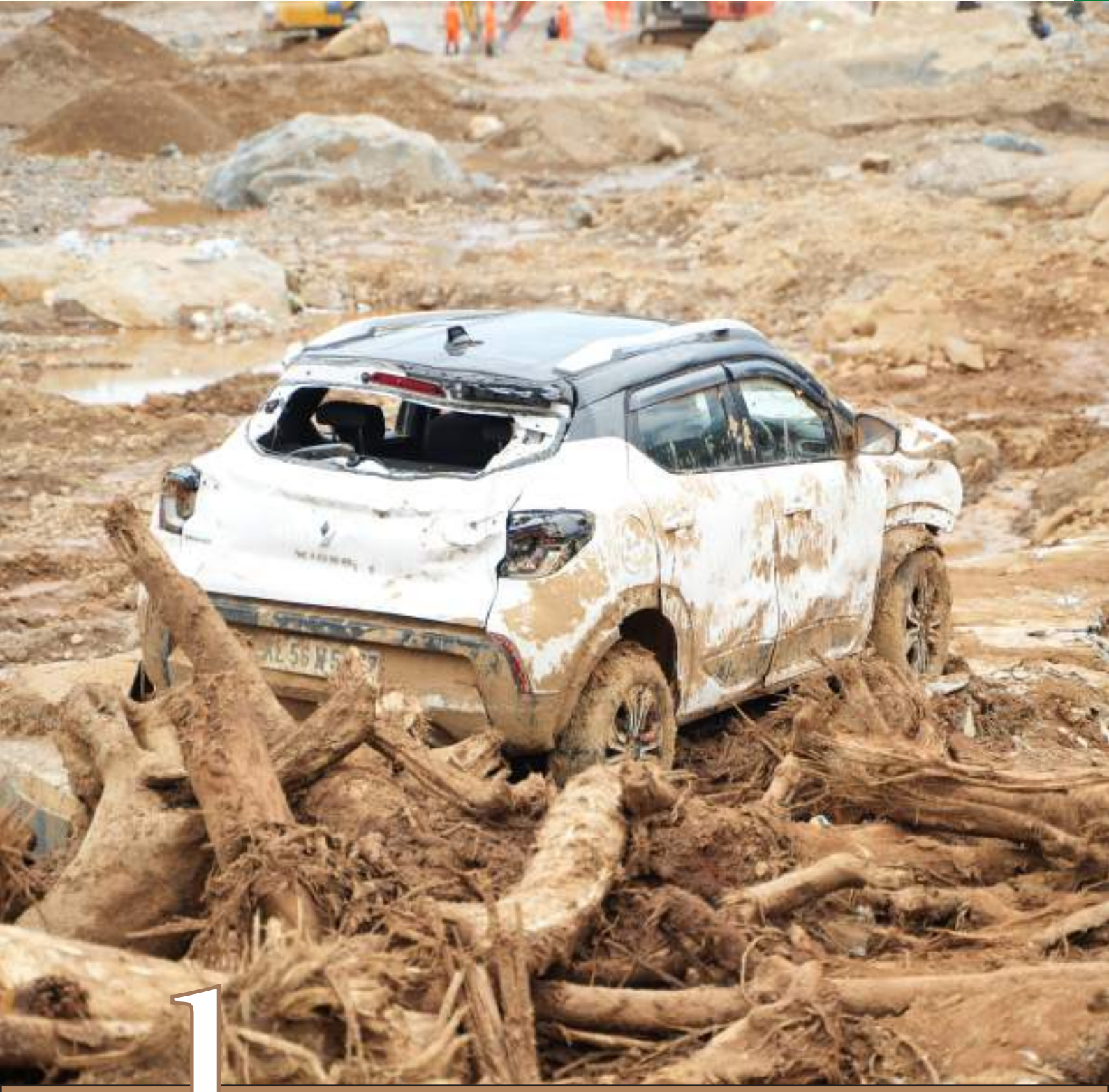


1 Introduction

Why Disaster Waste Matters

Kerala's vulnerability to climate-induced and human-made disasters results in large and complex waste streams. This chapter establishes disaster waste management as a core disaster response function. It sets the foundation for a dedicated, standardised protocol for the state.

Kerala is significantly vulnerable to natural disasters and shifting climate patterns due to its coastal location and the steep terrain of the Western Ghats. Floods are the most frequent natural hazards that occur in Kerala, affecting 14.5% of its land area and up to 50% in certain districts. Landslides in the Western Ghats, seasonal drought-like conditions, and water scarcity are significant issues in some districts during the summer months. Other hazards include lightning, forest fires, coastal erosion, soil piping, and high winds, and the state is situated in seismic zone III (PDNA, 2018). Additionally, the state faces man-made disasters, such as fires, industrial accidents, and related emergencies. In the aftermath of a disaster, one of the pressing challenges is the management of waste generated as a result of a disaster. Proper treatment and safe disposal of such waste are critical to mitigating health risks, restoring communities, and preventing secondary environmental disasters.

During the recent landslide in Meppadi panchayat, Wayanad on July 30, 2024, Suchitwa Mission[1], in collaboration with the district administration, Local Self Government Institutions (LSGIs), empanelled agencies, Haritha Karma Sena members, and volunteers from various organizations, efficiently managed waste from collection to disposal. Initially, the local body faced significant challenges in managing waste, due to the absence of pre-framed disaster management action plans. The absence of a protocol led to initial chaos, as the system was unprepared to handle the situation of this gravity. This highlights the need for a standardised approach to organise efforts more effectively.

Building on past experiences, the state's approach to waste management during the Wayanad landslide offers valuable insights into its waste management strategies. The current disaster management and waste management policies at the national and state level are not specifically designed for managing the disaster waste. Hence, a dedicated protocol for Disaster Waste Management is necessary to clarify the roles and responsibilities of each stakeholder departments and to coordinate the various mechanisms for efficient waste handling, promote safe recycling and disposal, encourage efficient resource use, ensure the safety of volunteers (through preventive medicine, vaccines, safety gear, PPE) and standardise the waste management practices during disasters.

1.1 Objectives

- ☞ Standardise waste management preparedness and practices for effective response in disaster scenarios, emphasising scientific disposal of disaster waste in a time-bound manner.
- ☞ Develop an institutional framework that clearly defines the roles and responsibilities of stakeholder departments and Local Self-Government Institutions (LSGIs), and facilitates the engagement of private sector and civil society organisations to ensure coordination and efficient waste management.
- ☞ To control the environmental pollution resulting from ineffective and unscientific waste management practices during disasters.

1.2 Rationale

Given Kerala's vulnerability to natural disasters, establishing a dedicated disaster waste management protocol is crucial for handling waste generated during such events in a more systematic and scientific manner. Current policies focus on handling waste during 'peacetime' and not specifically designed for managing disaster waste. The Suchitwa Mission's efforts to manage

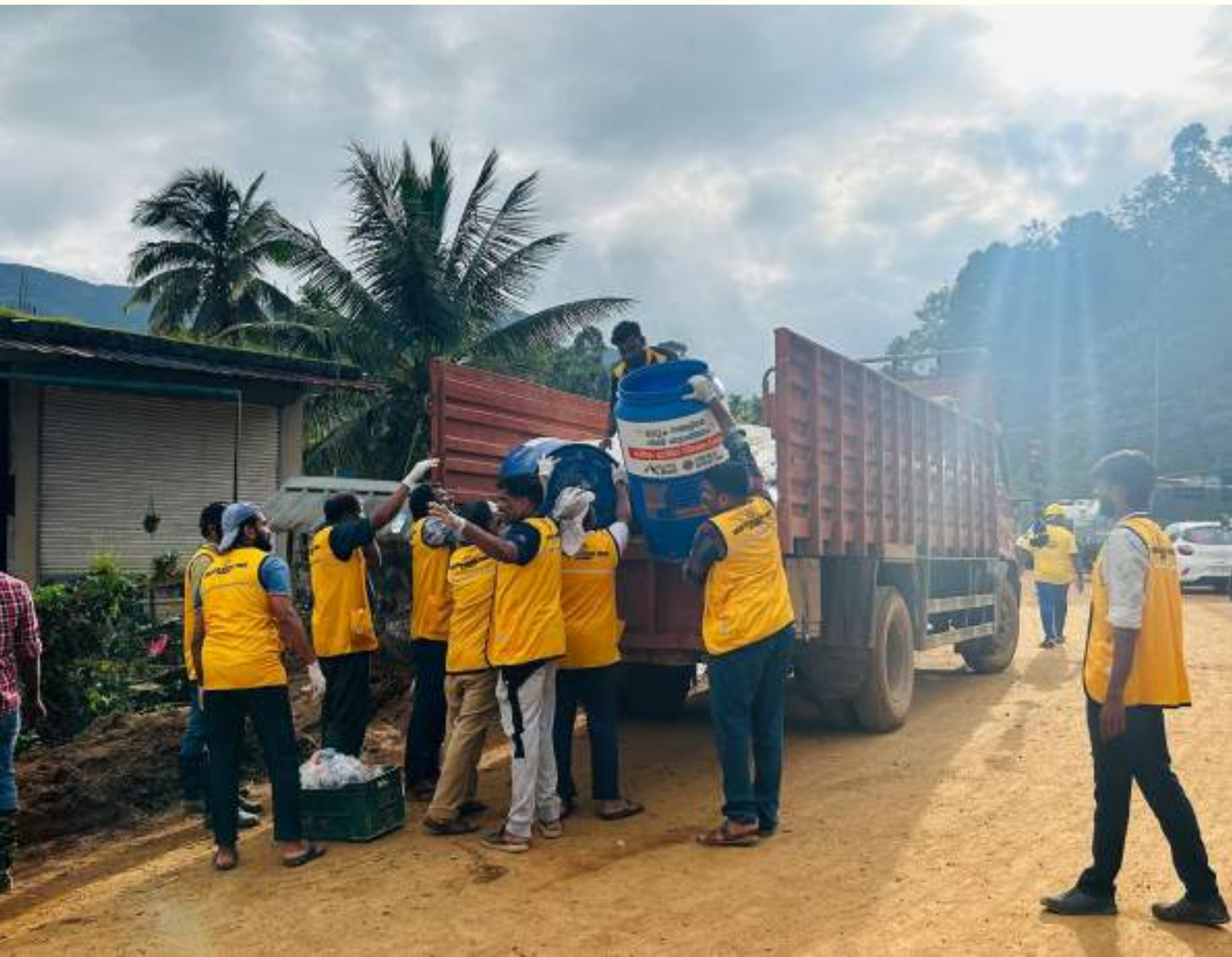
waste during the Wayanad landslide demonstrate that scientific and systematic approaches to waste handling are achievable and effective. Formalising these practices into a protocol shall help institutionalise best practices, ensure consistency across future disasters, and strengthen the enabling environment for effective disaster waste management.

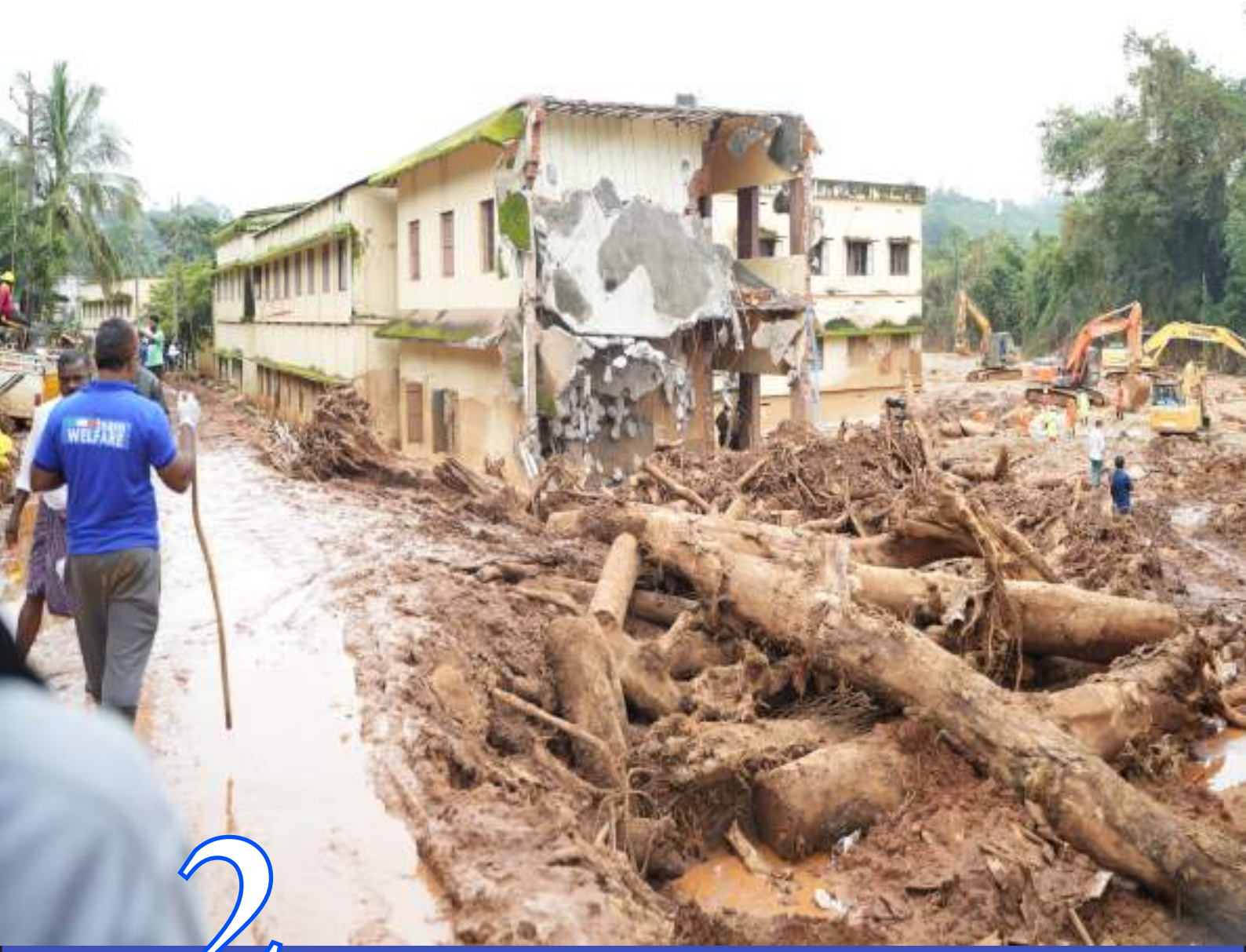
1.3 Scope

This protocol is applicable to all districts of Kerala and covers waste management during and after natural and human-induced disasters. This protocol shall focus on standardising the management of disaster-generated waste, including solid and liquid waste. It aims to define preparedness, response, and recovery measures, establish roles and responsibilities for government agencies, local bodies, and other stakeholders, and integrate sustainable practices like recycling and safe disposal. Additionally, it shall include safety guidelines for workers and volunteers, promote resource efficiency, and provide a framework for interdepartmental coordination to enhance disaster waste management in Kerala.

1.4 Definition of Disaster waste

Disaster waste includes a variety of solid, liquid, and soiled/mixed waste types generated during disasters, both at disaster sites and in relief camps. Solid waste consists of biodegradable and non-biodegradable materials, sanitary and biomedical waste, collapsed structure waste, natural debris, hazardous waste, e-waste, and animal carcasses. Liquid waste includes black water such as sewage and grey water from cleaning, washing, or cooking activities during disasters. Soiled/mixed waste refers to any type of waste contaminated or combined with other materials, particularly during the initial hours of a disaster.





2

Legal and Institutional Framework

The Governance Backbone

This chapter situates the protocol within national laws, state policies, and international guidelines. It clarifies institutional mandates and coordination mechanisms. The framework enables lawful, accountable, and coordinated disaster action.

2.1. Regulatory Compliance

This Disaster Waste Management Protocol is strictly adhered to the existing national and state guidelines and rules for waste management. Learnings from international guidelines such as Disaster Waste Management Guidelines by United Nations Environment Programme (UNEP)/ United Nations Office of Coordination of Humanitarian Affairs (OCHA) 2013, Disaster Waste Management Guidelines 2018 for Asia and the Pacific, Pacific Island Countries Regional Disaster Waste Management Guideline, Secretariat of the Pacific Regional Environment Programme (SPREP) 2021, Compendium of Sanitation Technologies in Emergencies and WHO Guideline for Technical Notes on Drinking-Water, Sanitation and Hygiene In Emergencies have been taken into account.

2.1.1 National Level

2.1.1.1 Waste management Rules and Guidelines by Ministry of Environment, Forests and Climate Change (MoEFCC) under Environment Protection Act, 1986

The Ministry of Environment, Forest, and Climate Change (MoEFC) has notified different waste management rules and guidelines under the Environment Protection Act, 1986, to ensure environmentally sound waste management. The MoEFC and Central Pollution Control Board are the nodal agencies for most of the waste management activities at the centre. Other ministries and departments such as the Ministry of Commerce & Industry, Ministry of Housing & Urban Affairs (MoH& UA), Ministry of Chemicals & Fertilizers and Ministry of Agriculture are also responsible for regulating, planning, coordinating, and implementing waste management within their respective jurisdiction. At the state level, State Pollution Boards and at the local level, Urban Local Bodies (ULBs) and Panchayati Raj Institutions (PRIs) are responsible for handling waste management activities (Aggarwal et al, 2023).

Existing list of rules on waste management includes

- Manufacture, Storage and Import of Hazardous Chemicals (MSIHC) Rules, 1989
- Chemical Accidents (Emergency Planning, Preparedness, and Response), Rules, 1996
- Solid Waste Management Rules, 2016
- Hazardous and other Waste Management Rules, 2016
- Hazardous Waste (Management Handling and Transboundary Movement) Rules, 2019
- Biomedical Waste Management Rules (BWMR), 2016
- Plastic Waste Management Rules, 2016
- E-Waste Management Rules, 2016
- Construction and Demolition Waste, 2017
- Solid Waste Management Rules, 2016

Solid Waste Management Rules, 2016 replaced the Municipal Solid Waste (Management and Handling) Rules of 2000. The updated rule expanded the scope of waste management beyond municipal boundaries. The rule focuses on recycling, reuse and recovery of dry waste and utilisation of organic waste for composting or bio-methanation. The rule encourages the integration of informal waste collectors into the formal waste management system by the state. However, the Solid Waste Management Rules, of 2016 focus on the day-to-day management of waste and not on large-scale disaster waste (Aggarwal et al, 2023; Singh, 2019).

Solid Waste Management Guidelines under Swachh Bharat Mission (SBM) by the Ministry of Housing and urban Affairs (MoH& UA)

The focus of the Swachh Bharat Mission (SBM) is to create awareness and provide a community-driven sanitation system that is both economical and efficient. It aims to provide ownership at the grassroot level and ensure community involvement at all stages to achieve sustainable waste management. It has two missions SBM (Gramin) and SBM (Urban). SBM (Gramin) focuses on rural sanitation in the first phase and ensuring effective solid and liquid waste management in the second phase. The Swachh Bharat Mission - Urban (SBM-U) focuses on making urban areas in India clean and free from open defecation through its first and second phases.

Guidelines on Minimum standards for relief by National Disaster Management Authority

The Guidelines set minimum standards for providing consistent and effective relief to disaster-affected populations in India. The guidelines emphasise minimum standards for shelter, food, access to safe drinking water, adequate nutrition, sanitation, and healthcare services while also addressing the special needs of women, children, the elderly, and people with disabilities. Additionally, they focus on livelihood restoration and call for coordination among agencies to minimise suffering and ensure timely relief (NDMA, 2016).

2.1.2 State Level

Kerala specific rules such as the Kerala Municipality Act (1994) and Kerala Panchayati Raj Act (1994) assign Panchayat and Municipal authorities to deal with the waste management. In Kerala, a system was evolved where collection of segregated waste at the source and handed over this waste to the Self-Help Group (SHG) members of Kudumbashree[2], and later transported to the processing plants. The government initiated a campaign on the 4R concept of Reduce, Reuse, Recycle and Recover place in the context of the generation of huge plastic waste in the state. Kerala's waste management involves multiple stakeholders working in close coordination with each other. Suchitwa Mission is the nodal agency for sanitation in Kerala and initiated the '**Green Protocol**' which framed dos and don'ts in sanitation and waste management and protocols to be followed to achieve the 4R principle. The two-pronged strategies followed by the Government of Kerala on solid waste management include

- ☞ Decentralised waste management comprising of source and community-level
- ☞ Centralised waste management wherever necessary.

2.1.2.1 Kerala State Policy on Waste Management, 2018

The State Policy aims to promote decentralised waste management practices, focusing on the principles of reduce, reuse, and recycle. The policy specified adopting the 'Green Protocol' to promote the principles of waste minimisation through reduce and reuse (LSGD, Government of Kerala, 2018).

2.1.2.2 Green Protocol

In the context of excessive plastic waste, the green protocol introduced by the Suchitwa Mission focuses on reducing the use of plastic and other non-degradable materials. The Government of Kerala made it mandatory and strictly enforced in conducting events like meetings, conferences, marriages, festivals, and other functions to reduce the use of non-degradable materials from society.

2.2 State-Level Institutional Framework

2.2.1 Suchitwa Mission

Suchitwa Mission is the state-level nodal agency for waste management under the Local Self-Government Department, which functions as technical support agency for Local Self-Government Institutions (LSGIs) in the waste management sector.

2.2.2 Kerala State Disaster Management Authority (KSDMA)-

KSDMA is responsible for coordinating disaster management activities in Kerala

2.2.3 Kerala State Pollution Control Board -

The Pollution Control Board is a regulatory authority for implementing various pollution control laws in the State.

2.2.4 Local Self-Government Institutions (LSGIs) -

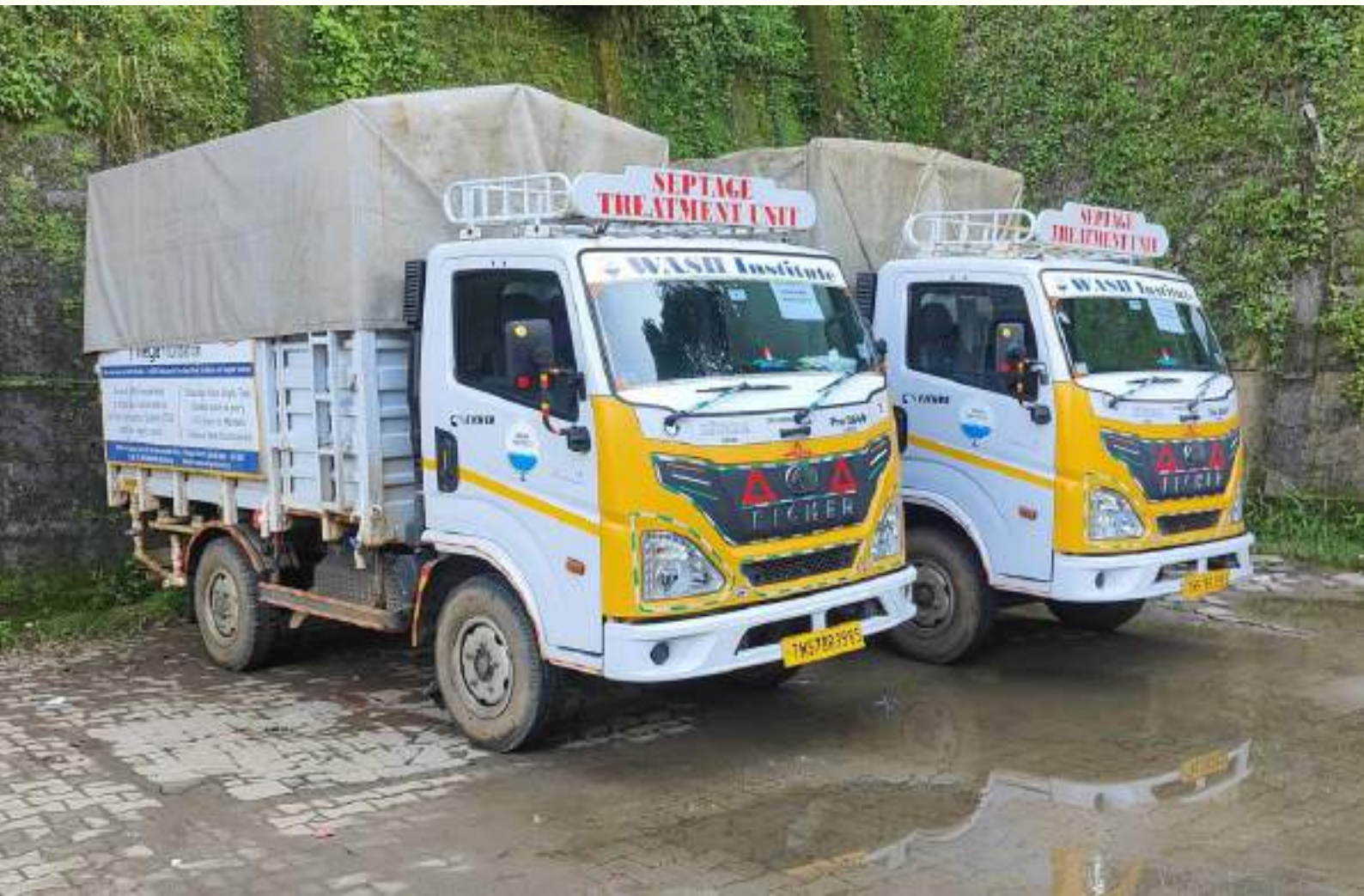
Local self-government institutions, such as panchayats and urban local bodies, are responsible for managing waste within their jurisdiction. This includes collecting, storing, and disposing of waste.

2.2.5 Line Departments:

Department of Health, Department of Environment and Climate Change, Kerala Water Authority, Civil Supplies Department, Revenue Department, General Education Department, Fire and Rescue Services, Police Department, and Public Works Department, or any relevant department based on the need of the disaster.

2.2.6 Private Sector and NGO

Private companies, organisations and self-help groups



3

Pre-Disaster Preparedness

Planning Before the Crisis

Preparedness determines the effectiveness of disaster waste management. This chapter focuses on risk assessment, waste forecasting, and infrastructure readiness. It emphasises capacity building and communication systems as critical enablers.

Pre-disaster preparedness is essential for minimising the challenges in disaster waste management and ensuring an effective response. This involves proactive measures such as district-level mapping of the existing waste management facilities of the LSGIs. It is also necessary to provide capacity building and training to equip stakeholders with the necessary skills for waste management during the occasion. These steps collectively strengthen preparedness and enable systematic management of disaster waste.

3.1 Risk assessment and waste forecasting

- Based on the types of disaster-prone areas identified by the KSDMA, the different types of waste that could be generated in disaster scenarios shall be forecasted.
- GIS-based systems maps shall be prepared for risk assessment and waste forecasting.

3.2 Waste Management Infrastructure

- Understand the issues and improve existing waste management facilities under the LSGIs
- Identifying and setting up temporary waste storage facilities nearest to the prone areas.
- Prepare a list of private cesspool vehicles(an underground container for the temporary storage of liquid waste and sewage) to the smallest unit possible (LSG level). Ensure safety training for workers.
- Identify service providers at the district level for the collection and processing of different categories of waste.
- Integrate climate-adaptive infrastructure and technology to enhance resilience.
- Create a comprehensive resource bank for disaster waste management, encompassing human resources, health care facilities, equipment, gender-friendly tools, waste management facilities in the private sector, technical experts, bio-toilets, mobile treatment units, and other essential resources.
- Develop a system for the rapid procurement of equipment, tools, protective gear, and containers needed for waste collection and segregation to ensure efficient waste management.
- All processing facilities in the government and private sectors, along with identified temporary storage facilities, shall be spatially mapped to facilitate effective planning.

3.3 Capacity Building and Training(CB)

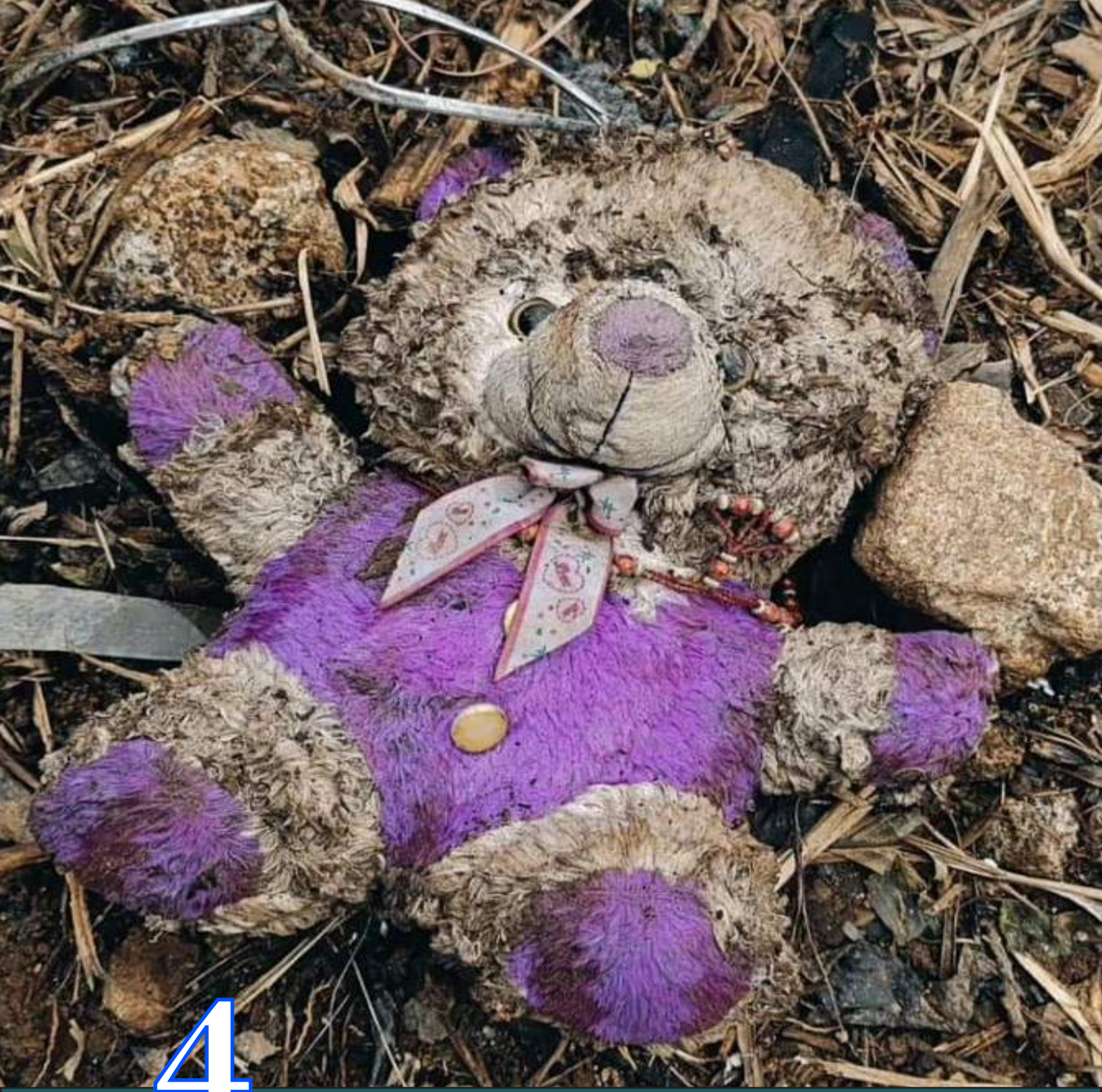
- Prepare a comprehensive capacity building plan including content, target audience, resource persons, financial resources, and timeline.
- Dedicated capacity building and training on the necessity of segregation and scientific disposal of waste shall be provided to all the stakeholders at regular intervals.
- Conduct school-level awareness and training programs, train the school staff to efficiently coordinate disaster waste management at relief camps.
- Prepare customisable content for Social and Behaviour Change Communication (SBCC) on waste management to streamline efforts during emergencies.

3.4 Information Education and Communication (IEC)

- Upload this content in the KSDMA website as a separate section or a virtual learning plat-

form, and make sure that this information has been communicated to all staff.

- Prepare customisable content for Social and Behaviour Change Communication (SBCC) on waste management to streamline efforts during emergencies and ensure quick access for all.
- Conduct training programs focused on handling biomedical waste during emergency situations to enhance skills and preparedness.
- Run pre- and post-disaster awareness programmes about waste segregation, safety, and the importance of proper disposal practices. Implement public campaigns to educate communities on their role in disaster waste management, focusing on waste segregation, health hazards, and emergency disposal points



4

Post-Disaster Waste Management

From Emergency to Recovery

This chapter outlines a phased approach to managing disaster waste after an event. It distinguishes immediate emergency actions from structured recovery processes. The focus remains on safety, rapid clearance, and prevention of secondary crises.

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Post-disaster waste management is a critical component of disaster response and recovery. This section discusses the phased approach to disaster waste management, starting with the Emergency Phase (0–72 hours[2]) characterised by immediate actions to manage waste often in challenging conditions. This is followed by the Streamlined Phase/Recovery Phase (after 72 hours), where systematic processes such as waste segregation and the engagement of specialised personnel and private/empanelled agencies come into action.

4.1 Emergency phase (0-72 hours)

This phase begins within hours of the disaster event and focuses primarily on immediate solutions for disaster waste management. During this phase, there is a likelihood of generating soiled/mixed waste both at rescue sites and camps. As a result, segregation of the waste is often not possible. The waste management activities taken up shall not interfere with the rescue/ healthcare operations on site. The service of the pre shortlisted agencies shall be available to manage the various types of wastes generated during the calamity. The priority shall be given to the immediate removal of waste from the location to enable rescue operations. This is followed by the steps outlined below.

4.1.1 Initial Planning

Establish a framework for quickly assessing the scale of waste being generated, types of waste present, and the immediate needs for waste management in disaster-hit areas. LSGIs shall coordinate with the district authorities to transport waste to the nearby identified interim storage facilities. Establish a help desk at the relief camp to coordinate all activities related to waste management. Ensure that contact information for all key individuals who can assist with waste management is readily available.

Disaster-affected areas shall be systematically divided into operational zones—high-priority rescue areas (such as healthcare facilities and rescue operation hubs), residential clusters, and public spaces (including schools, markets, and roads)—to enable organized, efficient, and prioritized clearance of waste.

Criteria such as accessibility, land use, slope, highest flood level (HFL), space availability, and environmental safety should guide the selection of temporary waste collection sites. Spatial mapping of these sites has been recommended as a preparedness measure in coordination with the State/ District Disaster Management Authority.

4.1.2 Estimation of Waste

Use drones, geographic information systems (GIS), and manual surveys to estimate the volume and type of waste generated for effective planning on site. Estimate the volume of waste generated at the relief camps based on the number of people accommodated to plan for appropriate waste management resources at the camps

4.1.3 Prioritisation of waste removal

Priority shall be given for the removal of waste from critical areas for enabling smooth rescue operation. Biodegradable, medical and animal carcasses shall be removed immediately after generation from the site for avoiding cross contamination.

4.1.4 Identification of Resources and Facilities

The number and type of tools and equipment, machinery, PPE kits, sanitizers, power sources, manpower etc. needed for addressing the warfoot situations shall be identified and listed. Identification of nearby facilities for managing each category of waste existing in the public or

private sector shall be identified. Temporary toilets facilities shall be installed in camps as well affected areas based on requirement.

4.1.5 Arrangements and procurement of waste management equipments and tools

- LSG shall procure colour coded waste bins, and covers for waste segregated waste collection.
- LSGIs shall purchase emergency tool kits and safety equipment for technicians working in relief camps and rescue sites for disaster waste management as needed.
- LSGs shall ensure the availability of gender-friendly safety gear for Haritha Karma Sena.
- LSGs shall designate an officer in charge of health/ sanitation to purchase emergency tool kits and safety equipment for technicians working in relief camps as needed.
- Suchitwa Mission shall equip waste collection and disposal teams with appropriate protective gear.
- Suchitwa Mission shall conduct SBCC activities to educate the public on proper waste disposal methods in relief camps.
- Suchitwa Mission shall distribute IEC Materials: Print and place Information, Education, and Communication (IEC) materials around the camp to promote proper waste disposal practices.
- LSGI shall purchase steel glasses and plates for use in relief camps to reduce waste, in line with Government Order G.O.(Rt)No.1863/2019/LSGD.

4.2 Streamlined phase/Recovery phase (after 72 hours)

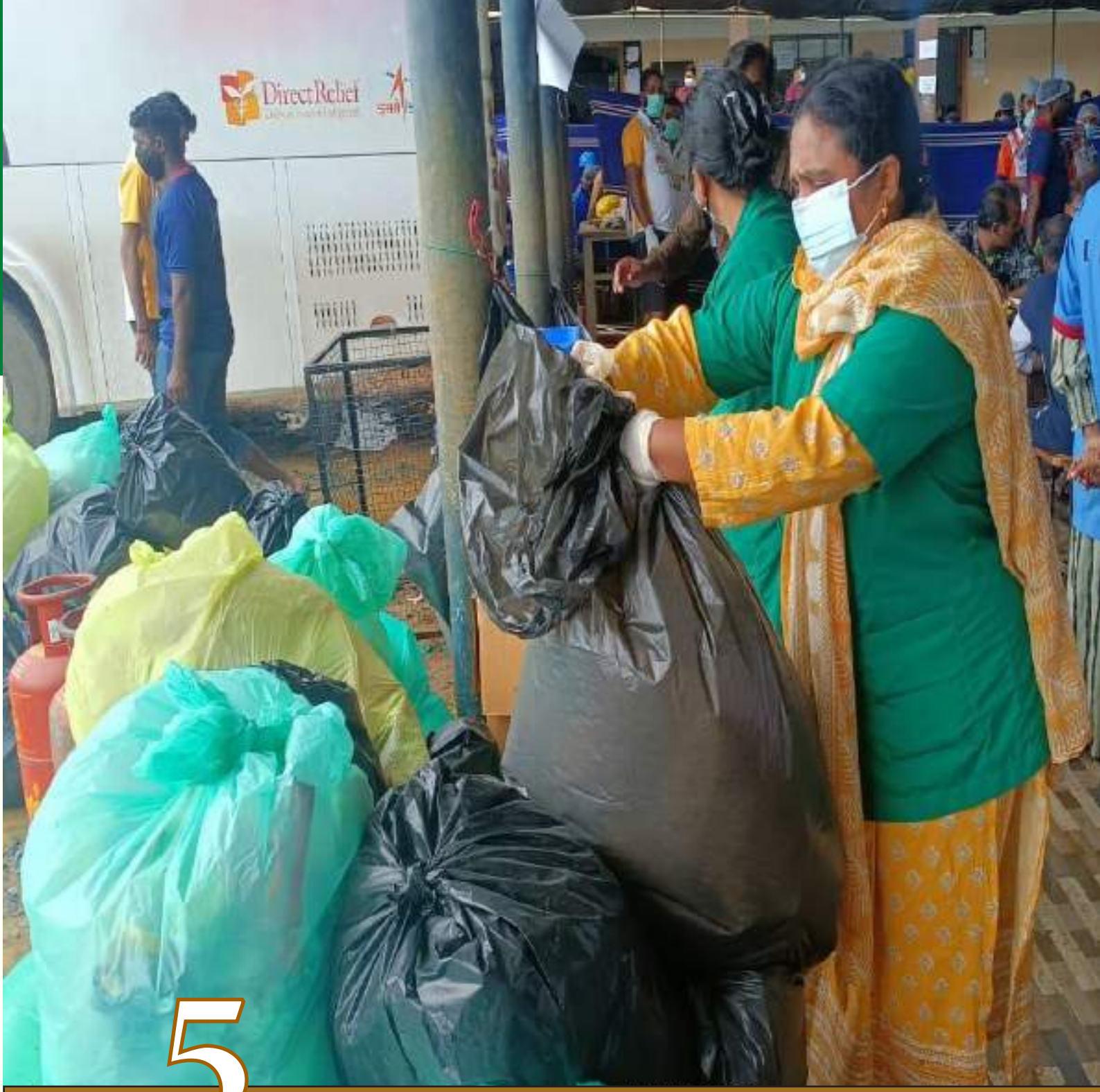
This phase follows the emergency phase and is part of the recovery process. It ends when all the disaster waste management activities at the rescue sites have been completed. In this phase, waste collection and segregation from rescue sites and relief camps shall be more systematic. Each type of waste shall be disposed of properly, with the involvement of LSGs/empanelled agencies. The collection and segregation of non-biodegradable waste shall be carried out by the Haritha Karma Sena members and all other types of waste shall be streamlined as per the pre-planned waste processing chains. Create a logistics plan for transporting waste from disaster-affected areas to designated waste treatment and disposal sites.

Final audit must be conducted before site closure to ensure:

- Complete removal of waste from all operational zones
- Documentation of waste types and quantities
- Compliance with segregation and disposal protocols
- Identification and rectification of any residual waste

4.3. Environmental Protection Measures

Environmental protection shall be an integral component of all clearance operations. Every activity undertaken must give due consideration to potential environmental impacts, with particular attention to preventing the contamination of water sources and soil. Appropriate safeguards, monitoring mechanisms, and corrective actions should be implemented to minimize ecological damage during and after waste clearance activities



5

Classification of Waste

Understanding What We Manage

Disasters generate diverse waste streams requiring different handling methods. This chapter classifies waste based on type, source, and risk. Accurate classification enables safe and scientific management.

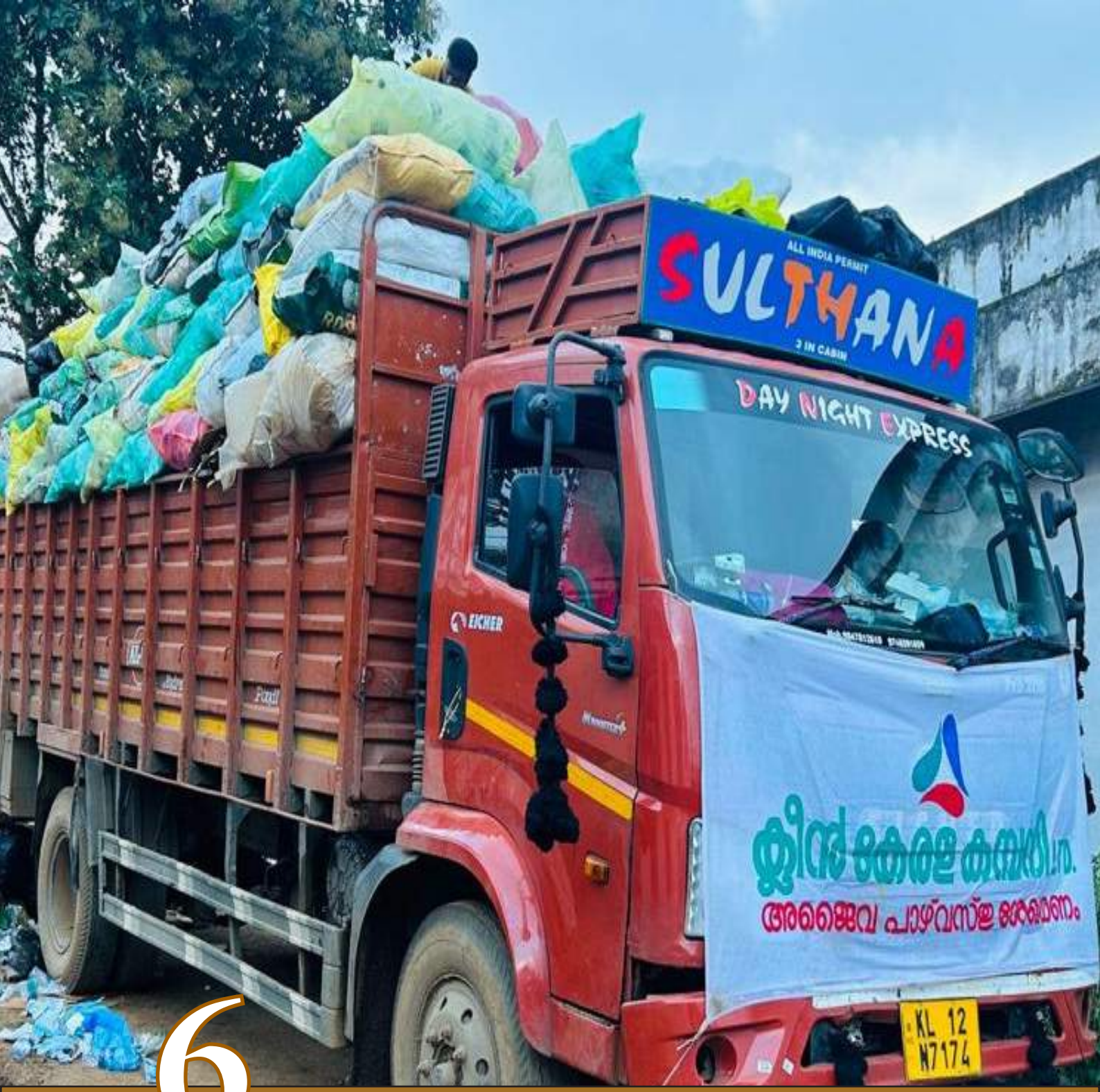
Classification of Waste

Table 1: Types of disasters and waste generated

Types of disasters	Types of waste that may be generated during natural calamities/ disasters
Earthquakes/ Building Collapse Landslides Floods Tsunamis Forest fires Fire Accidents Cyclones Industrial accidents Rail and road accidents, air strikes Other disasters	• Natural debris • C&D waste (collapsed structure waste) • Solid (Bio and non-bio) waste • Liquid waste • Sanitary and biomedical waste • E waste • Hazardous waste • Animal carcasses • Textile/Upholstery waste

Table2: Type of waste and its composition

Type of waste	Composition
Collapsed Structure Waste	Construction and Demolition waste including concrete, steel, wood, clay, pipes, wires and tar elements from damaged/destroyed buildings and infrastructures caused due to building collapse or demolition of the structures., transformers, parts from water and sewage distribution systems etc.
E-waste	Damaged electrical and electronic equipment, phones, television sets, and refrigerators.Parts from the power and telephone grids such as electrical poles, cable wire etc.
Natural debris	Sand, clay, mud, trees, branches, bushes and tree leaves.
Hazardous waste	Chemicals, nuclear, radio-active materials, pesticides, cleaners, paint, varnish, solvents, dyes, toxic gases, batteries, CFL bulbs and tubes
Solid waste	Biodegradable items such as left over food, and vegetable waste Non biodegradable items such as recyclable and non recyclable plastics, paper, textiles, leather, wood, glass, metals, Plastic water bottles, packaging material, polythene bags, containers, baskets etc.
Sanitary waste	Used diapers, sanitary towels or napkins, tampons, incontinence sheets etc
Textile and Upholstery waste	Used clothes, blankets, damaged furniture upholstery, beds, pillows and other fabric materials
Biomedical waste	Biomedical/ health care waste from relief camps. Yellow category: Human tissues, organs, body parts and foetus, soiled waste (items contaminated with blood, body fluids like dressings, plaster casts, cotton swabs and bags containing residual or discarded blood), Expired or Discarded Medicines including antibiotics, glass or plastic ampoules, vials, linen, mattresses, gauges, contaminated with blood or body fluid Red Category: tubing, bottles, intravenous tubes and sets, catheters, urine bags, syringes (without needles and fixed needle syringes) and gloves, medicine strips, White category: Needles, syringes with fixed needles, needles from needle tip cutter or burner, scalpels, blades, this includes both used, discarded, and contaminated metal sharps,
Liquid Waste	Grey water generated from kitchen, bathroom, laundry and Black water from toilets, damaged Septic tanks etc
Other waste	Damaged vehicles (cars, buses, bicycles and boats) and metals scraps, Fibre nets etc



6

Waste Collection, Transportation and Processing

From Ground to Final Treatment

This chapter presents the complete operational chain of disaster waste management. It integrates safe collection, regulated transportation, and scientific processing. Together, these steps ensure swift, safe, and compliant waste handling.

6. 1. Waste Collection

6.1.1 Provide properly marked and colour coded Waste Bins: Place labelled bins (types of waste) in relief camps and rescue sites for different types of waste, with clear instructions for users.

- ☞ Green bins:- for biodegradable waste leftover food, vegetable/fruit peels, egg shell, rotten eggs, chicken/fish bones, tea bags/coffee grinds, coconut shells and garden waste including fallen leaves/twigs.
- ☞ Blue bins :- for non-biodegradable waste like plastic covers, bottles, toffee wrappers, paper, tetra packs, cardboard cartons, paper, Metallic items like tins/cans foil paper and containers, rubber/thermocol (polystyrene), old mops/dusters/sponges etc.
- ☞ Black bins :- for domestic hazardous waste like blades, bandages, CFL, tube light, broken thermometer, batteries, expired medicine etc.
- ☞ Separate bins at toilets:- for Sanitary waste collection (use non chlorinated yellow coloured bags and plastic strip locks, Used sanitary waste shall be wrapped in sealed or Ziplock covers).
- ☞ Use prescribed containers for waste segregation and collection according to the Biomedical Waste Management Rules, 2016, and hand over to empanelled agencies.

6.1.2 Establish Rapid Collection Protocols: Implement immediate collection strategies to remove debris and hazardous materials to ensure safety and access for rescue and recovery operations.

6.1.3 Assign Haritha Karma Sena (HKS) members to collect and segregate waste, with transportation support from Local Self-Government Institutions (LSGIs) to temporary storage/ processing facilities.

6.1.4 Coordinate Regular Waste Collection through the authorized/empanelled agencies at regular intervals, preventing prolonged accumulation.

6.2 Transportation of Waste

Waste collected and segregated from the site shall be transported to the processing and co-processing facilities or to the secondary storage facilities only through GPS fitted vehicles. Proper coving shall be provided for the vehicle transporting the waste. The vehicle carrying the waste shall have proper records and manifest while transporting. Details of waste transporter and details of processing/ disposal facilities shall be kept while transportation.

6.3 Processing of Waste

Facilitate end-to-end waste processing through designated channels with the help of authorized agencies/CKCL/empanelled agencies of Suchitwa Mission

6.3.1 Biodegradable waste:

- Scientifically manage biodegradable waste, through in situ waste management facilities such as composting bins, compost pits, Organic waste converters, Biogas plants and Thumboormuzhy facilities.
- If onsite waste management is not viable for the specific site, necessary arrangements for collection and treatment of biodegradable waste shall be provided with the help of authorized/ empanelled agencies/ pig farmers or transport it to nearest biodegradable waste processing facilities.

6.3.2 Non-biodegradable waste

- The segregated dry waste shall be forwarded to the nearby MCF/RRF. Engage CKCL/empanelled agencies of Suchitwa Mission for forward linkage of the recyclable and non-recyclable wastes after drying and dedusting.
- Recyclable waste shall be segregated and forwarded for recycling facilities
- Non recyclable waste with high calorific value shall be transported to Co-Processing facilities.
- Proper baling of waste shall be promoted for easy transportation

6.3.3 Sanitary pads and Diapers

- Disposal via Biomedical Waste Treatment Facilities: Hand over the collected sanitary waste to the authorized/ empanelled collection agencies.
- The collected waste shall be transported to nearby Double Chambered Incinerators in Local bodies or Centralised treatment facilities such as KEIL, for disposal.
- On-site Incineration Option: Also use mobile or fixed incineration facilities complying with the KSPCB norms, to dispose of the waste safely on-site.

6.3.4 Biomedical waste management:

- Yellow Category: Dispose of through incineration, plasma pyrolysis, or deep burial.
- Red Category: Treat through autoclaving, microwaving, or hydro-claving, followed by shredding or mutilation to prevent reuse.
- White Category: Sterilise using autoclaving or dry heat, then shred or mutilate as required.
- Collaborate with the health department for proper disposal of biomedical waste at the IMAGE or KEIL using authorized or empanelled agencies.
- Provide necessary protective equipment and vaccinations for the waste handling team to ensure their safety while managing biomedical waste.

6.3.5 Cloth waste management:

- Engage CKCL/empanelled agencies of Suchitwa Mission for Textile Recycling/upcycling
- Donate Usable Items: Engage local organisations to facilitate the donation of usable textiles after sorting them.
- Sort and dry the contaminated items and engage the authorized agencies/empanelled agencies for their safe disposal.

6.3.6 C&D waste:

- On-site Segregation: Set up temporary sorting stations in safe areas to segregate waste materials into different categories (e.g., concrete, wood, metal etc) to facilitate effective management.
- Assessment of Salvageable Materials: Evaluate debris for potential reuse in reconstruction efforts, such as using undamaged materials for temporary shelters or rebuilding community structures.
- Innovative Solutions for Reuse: Identify ways to repurpose materials in rebuilding efforts, emphasising sustainable practices that reduce waste.

- Reuse and Recycling: Prioritise the reuse of viable materials in rebuilding disaster- affected structures, which can reduce costs and environmental impact.
- Collaborate with CKCL/empanelled agencies of Suchitwa Mission to process recyclable materials efficiently, ensuring a streamlined recovery operation.
- Develop safe transportation methods for moving C&D waste to designated disposal sites, ensuring that hazardous materials are handled according to safety protocols.
- Natural debris management:
- Evaluate the condition of the debris to determine its suitability for reuse, recycling, or safe disposal.
- Sort the collected debris into categories, such as wood, soil, and other organic materials, to facilitate reuse and recycling.
- Assess Material for Backfill: Identify debris materials (e.g., soil and smaller rocks) suitable for use as backfill in construction works.
- Excess material shall be auctioned.

6.3.7 Hazardous waste management:

- Hand over the segregated hazardous waste to the CKCL/empanelled agencies of Suchitwa Mission, to dispose of the same at the nearest landfill site.
- E-waste management
- Handover the e-waste to CKCL/empanelled agencies of Suchitwa Mission for further processing and scientific disposal.

6.3.8 Sanitation Facilities

Provide disabled/old-age/pregnant women/ child friendly toilets as per the requirement.

Provide separate bathing facilities to prevent septic tanks from filling too quickly.

Check the availability of water in the relief camps, and if necessary, coordinate with the relevant department to arrange it.

Engage sanitation workers and ensure the regular cleaning of toilets

6.3.9 Liquid waste management

Construct Onsite Wastewater Facilities: Build soak pits, dispersion trenches, and leach pits at the camp site to manage wastewater effectively.

Make sure that grey water and black water are treated separately.

Desludge and Treat Septage: Regularly desludge septage from the camp and rescue sites and temporary toilets/portable toilets shall be connected to the mobile Treatment Units or shall be transported to the nearby STP/ FSTPs

Use authorised agencies to provide cesspool vehicles for regular desludging of waste at relief sites.

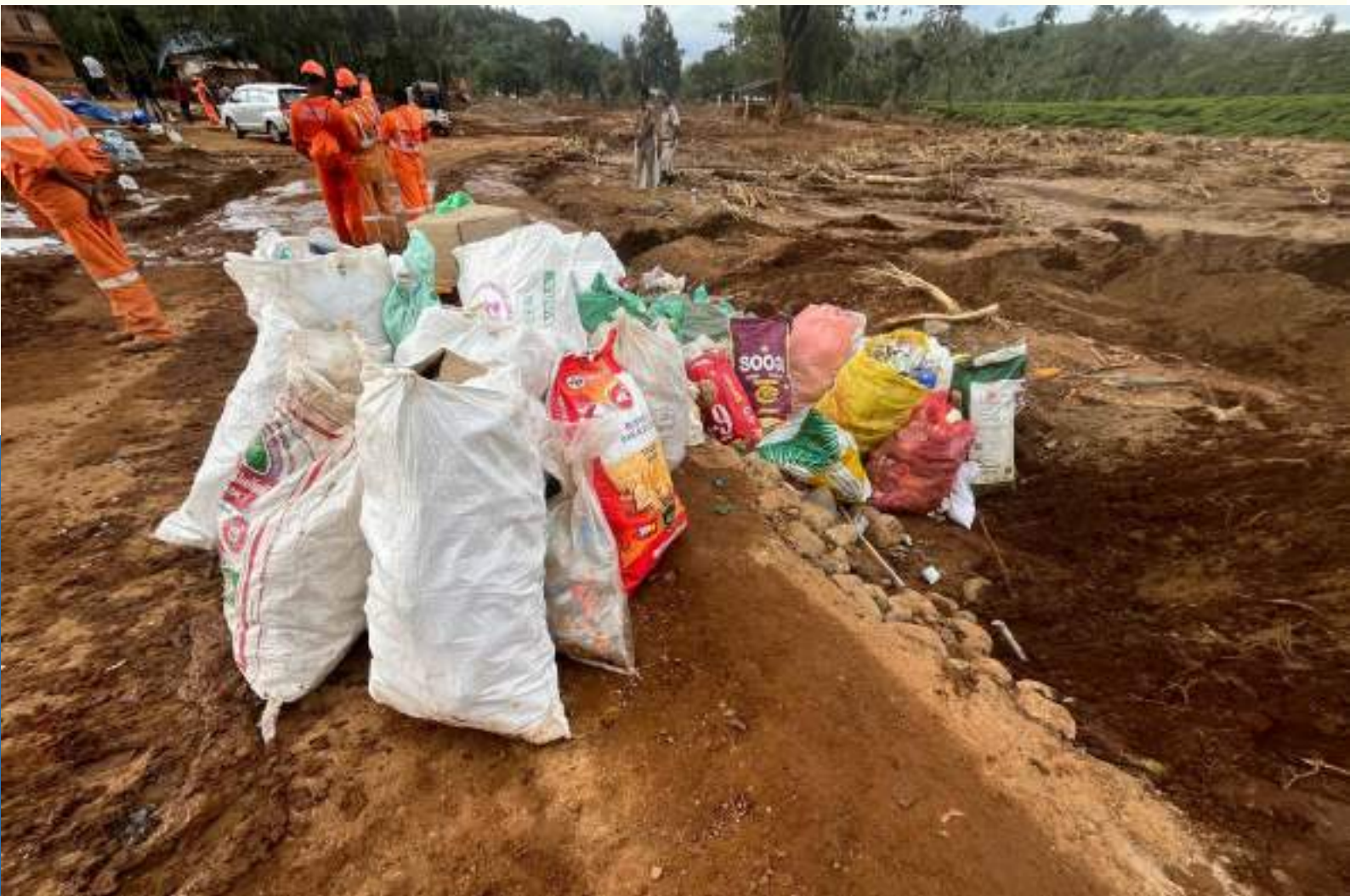
6.3.10 Animal Carcasses management Description:

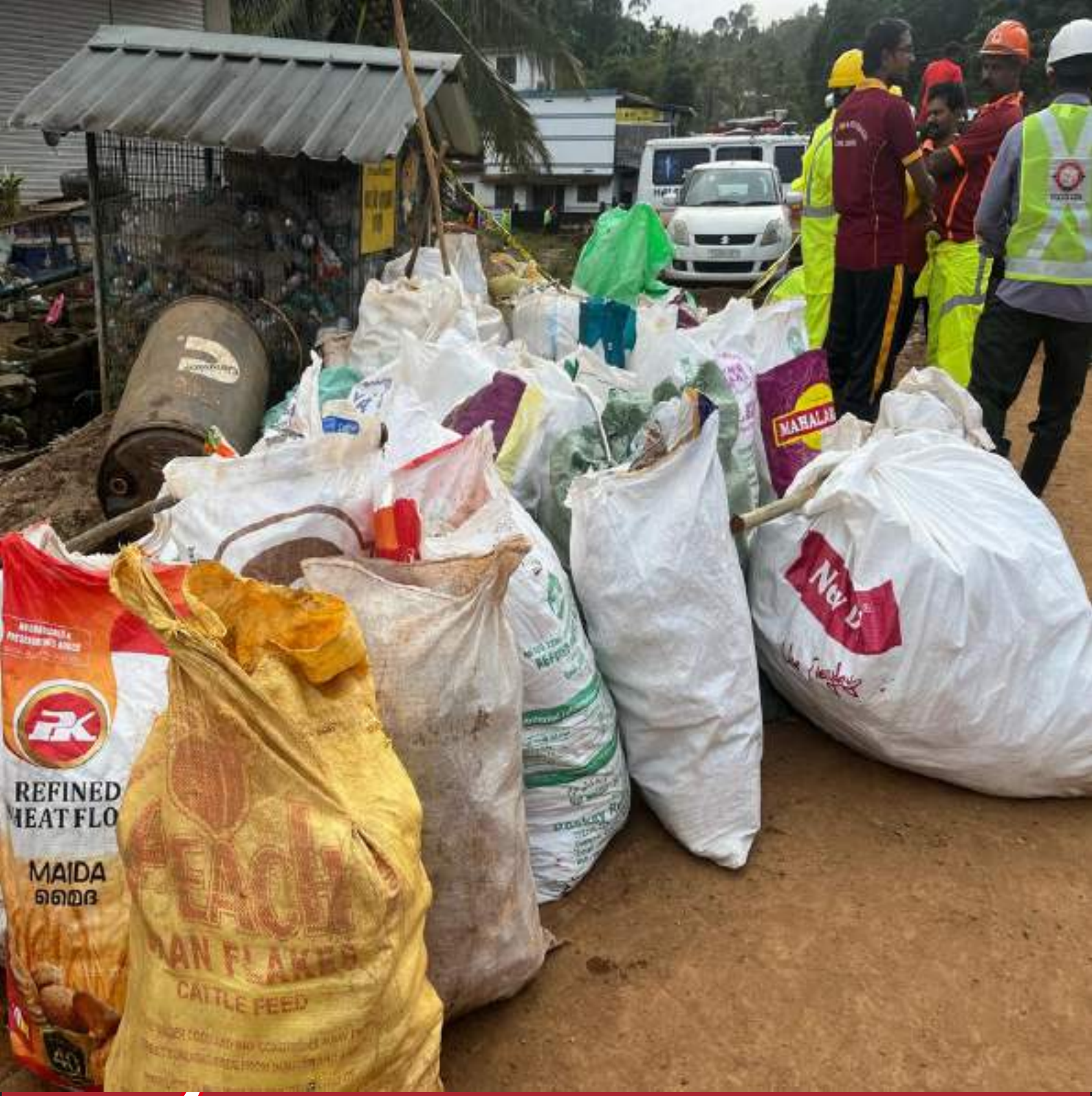
Manage the animal carcasses as per the guideline provided by Dept of Animal Husbandry.

Dispose the dead animal immediately in such a way that it does not cause pollution of surface or groundwater.

The carcass shall be buried at least 4-6 feet deep, depending on species, and shall be covered with lime.

The grave shall be at least 200 feet away from any drinking water wells.





Implementation, Capacity, Governance and Review

Making the Protocol Work

This chapter brings together capacity building, IEC, monitoring, stakeholder roles, financing, and review mechanisms. It focuses on institutional readiness, accountability, and resource mobilisation. The chapter ensures the protocol is implemented effectively, monitored continuously, and improved over time.

7.1 Capacity building and training

- Provide spot training for volunteers involved in waste management.
- NGOs, Nature clubs etc may be called for support and hanholding.

7.2 Information-Education and Communication(IEC)

- Distribute IEC Materials: Print and place Information, Education, and Communication (IEC) materials around the camp to promote proper waste disposal practices.
- Raise Public Awareness: Conduct SBCC activities to educate the public on proper waste disposal methods in relief camps.
- Conduct training programs focused on handling biomedical waste during emergency situations to prevent cross contamination and transmitting of disease.

7.3 Monitoring and evaluation

- Maintain records of different types and quantities of waste generated, collected, reused, recycled, processed, co-processed and disposed of during the disaster response.
- Regularly monitor waste management activities to ensure compliance with protocols.
- Vehicles carrying waste to processing/ co processingco processing facilities shall be tracked with GPS.
- As per KSPCB and protocol
- An officer from the LSGI shall be assigned for monitoring the waste management activities.

7.4 Roles and responsibilities of various stakeholders

7.4.1 Kerala State Disaster Management Authority (KSDMA)

- shall establish a comprehensive system to monitor both the preparedness and implementation of disaster waste management activities
- shall coordinate and oversee the activities of all stakeholder departments
- shall collaborate with Suchitwa Mission, LSGIs and other stakeholders to develop action plans for implementing this protocol.

7.4.2 Local Self-Government Institutions (LSGIs)

- Establish facilities for managing various categories of waste in collaboration with Suchitwa Mission and KSDMA.
- Purchase all essential items required for the efficient management of waste, without any delays.
- Create and maintain a database of all agencies/empanelled agencies involved in the activity, mapped locations for relief camps, equipment and sanitation facilities provided at these locations, statements regarding the quantity of waste collected and processed, etc.
- Identify temporary waste storage and processing sites.
- Disaster Waste management charge officers shall be assigned for coordinating with the stakeholders.
- Engage HKS and volunteers for waste management activities.

- Coordinate and oversee the waste management activities, including waste collection, segregation, and disposal.
- Provide sufficient safety measure for the people who involved in waste management activities
- Ensure that all sanitation workers and volunteers involved in disaster-related waste management activities have insurance coverage to protect against medical and occupational hazards.

7.4.3 Kerala State Pollution Control Board (KSPCB)

- Oversee disaster waste management facilities for compliance with pollution control standards.
- Monitor environmental impact and suggest additional measures to reduce the environmental impact by ensuring compliance with regulations.
- Assist the KSDMA and LSGIs in adhering to the protocol in alignment with PCB regulations.

7.4.4 Suchitwa Mission

- Provide technical guidance and formulating action plans for disaster waste management based on the data collected as part of the preparedness phase.
- Coordinating the waste management activities with KSDMA, and other stakeholders.
- Facilitating necessary capacity building and training programmes on disaster waste management.
- Coordinating activities to mobilise resources, such as technical expertise, equipment, waste management facilities, and mobile toilets
- Support LSGIs in disaster waste management operations focusing on maximum recovery of recyclable materials through multiple levels of segregation, with each category of waste processed separately.
- developing Information, Education, and Communication (IEC) materials on disaster waste management.
- Notify the agencies soon after the occurrence of the disaster and designate them to dispose of waste at regular intervals in coordination with LSGIs
- Monitoring the waste management protocol on the ground, ensuring that agencies engaged in /empanelled agencies are using appropriate methods for the treatment and disposal of waste collected during disaster, in line with the protocol.

7.4.5 Kudumbasree

- Kudumbasree shall deploy the required number of Haritha Karma Sena (HKS) in post-disaster waste segregation and collection as per the requirement of the LSGIs ensuring their management and financial aspects.
- Ensure the safety of Haritha Karma Sena and volunteers through preventive medicine, vaccines, safety gear, PPE.
- Kudumbasree shall ensure all HKS have insurance coverage to protect against medical and occupational hazards.

7.4.6 Clean Kerala CompanyLtd. (CKCL)

- Engage in disaster waste management activities in coordination with LSGIs and Suchitwa Mission.
- Provide all necessary equipment, vehicles, manpower, linkages for managing the waste on warfoot basis.
- Keep the record of type and quantity of waste collected and processed/ coprocessed by CKCL.
- Provide the necessary assistance to LSGIs and KSDMA to manage the situation, as directed by the government.

7.4.7 Empanelled/Private agencies

- Engage in disaster waste management activities in coordination with the Suchitwa Mission.
- Provide all necessary available equipment, vehicles, manpower, linkages for managing the waste on warfoot basis, based on requirement
- Keep the record of type and quantity of waste collected and processed/ co-processed by them

7.5 Resources and budget allocation

Resources and budget allocation for disaster waste management shall be met from the disaster management fund, with funding provided to the district administration and LSGIs based on the requirements during a disaster. Collaborating with NGOs and the private sector shall be pursued for financial and technical support.

7.6 Periodic Reviews

A mechanism shall be put in place by Suchitwa Mission to ensure that the disaster waste management protocol is updated on a regular basis. The update shall be based on the experiences and evolving challenges from each disaster event.

7.7 Auctioning of Excess Natural Debris

The process for auctioning excess natural debris shall clearly specify the agencies authorized to conduct such auctions in consultation with concerned department or agencies. This will ensure transparency, accountability, and efficient utilization of resources while minimizing risks of misuse or mismanagement.

Conclusion

Kerala's disaster waste management protocol can establish a well-structured disaster waste management system that incorporates preparedness, response, and recovery measures, promoting sustainability, public safety, and environmental protection. By establishing clear roles and responsibilities for various stakeholders, including government agencies, local self- government institutions, NGOs, CBOs and the private sector, the protocol ensures effective coordination and collaboration. Regular monitoring by the Suchitwa Mission shall ensure the effective implementation of the protocol, with periodic updates to adapt to evolving needs.

Suchitwa Mission emphasizes that waste management guidelines must remain flexible and adaptable to the type of disaster. Recognizing that the nature and quantity of waste generated can vary widely across different disaster scenarios, we recommend that protocols allow for context-specific strategies instead of relying on a rigid, one-size-fits-all approach

Strategic recommendations include strengthening the existing waste management system, capacity building, promoting climate adaptive technology, enhancing interdepartmental coordination, promoting community-based waste management, and ensuring sufficient resources for disaster waste management activities. By institutionalising these practices and ensuring proper safety protocols, Kerala can improve its resilience to disasters, effectively manage disaster-generated waste, and promote sustainable environmental outcomes.

Annexures

Annexure- 1 Rapid Waste Assessment Form for Relief Camps

Rapid Waste Assessment Form for Relief Camps	
Section	Details
Camp Details	
Camp Name	
Location	
Date of Assessment	
Assessor Name(s)	
Contact Information	

2. Waste Generation	
Types of Waste	Biodegradable
	Non-biodegradable
	Mixed waste
	Sanitary waste
	C&D waste
	Textile/ cloth waste
	E waste
	Hazardous waste
	Bio-Medical waste
	Septage
	Natural Debris
	Others: specify
Estimated Volume of Waste	Biodegradable
	Non-biodegradable
	Mixed waste
	Sanitary waste
	C&D waste
	Textile/ cloth waste
	E waste
	Hazardous waste
	Bio-Medical waste
	Septage
	Natural Debris
	Others: specify
Major Sources of Waste	

3. Waste Management Practices	
Collection Methods	Segregated at source
	Collected as mixed waste
	Other (Specify):
Collection Frequency	Daily:
	Twice a week:
	Weekly:
	Others (Specify):
Disposal Methods	specify:
Challenges	Lack of collection points
	Insufficient manpower
	Lack of waste segregation awareness
	Inadequate disposal facilities
	Others (Specify):
4. Waste Management Resources	
Available Resources	Number of waste bins:
	Waste collection vehicles:
	Number of trained personnel:
	Availability of PPE (gloves, masks, etc.):
Additional Resources Needed	Bins/Collection Points
	Waste Segregation Kits
	Transportation Facilities
	Training Programs
	Others (Specify):
5. Recommendations	
Immediate Actions	
Medium- to Long-Term Suggestions	
6. Assessor's Remarks	
Remarks	
Name, Signature and designation	
Date	

Annexure- 2 Rapid Waste Assessment Form for Rescue Sites

Rapid Waste Assessment Form for Rescue Sites				
LOCATION (Using Phone GPS App)	DESCRIPTION / DETAILS	TYPE OF WASTE OBSERVED	ESTIMATED VOLUME / COUNTS	RECOMMENDED FOLLOW UP ACTIONS
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				

Source: Pacific Island Countries Regional Disaster Waste Management Guideline, Secretariat of the Pacific Regional Environment Programme (SPREP) 2021

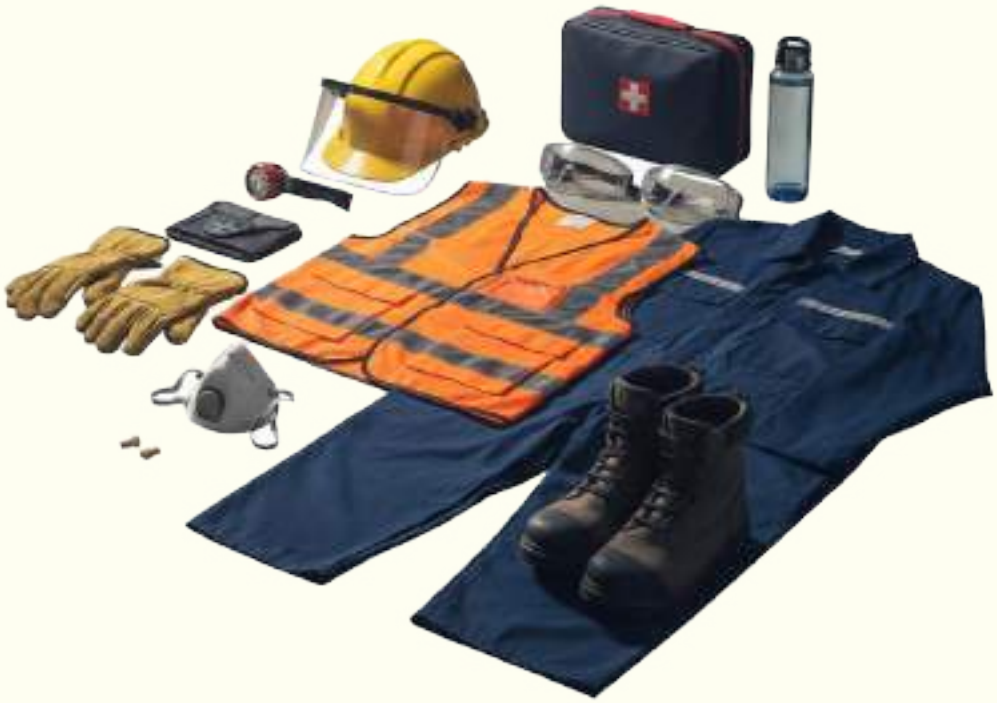
Annexure- 3

Checklist for Occupational and Health Safety measures

PERSONAL PROTECTION EQUIPMENT

Have the following PPE for all staff and workers involved in DWM activities.

1. Overalls or light clothing
2. Eye protection / sunglasses
3. Ear Protection
4. Gloves
5. Safety Boots
6. Bright Vest



REQUIRED FOR WASTE RECOVERY FOR RECYCLING, COLLECTION AND DISPOSAL OPERATIONS

1. Safety boots
2. Gloves
3. Disinfectants
4. Sanitizers
5. Sunglasses
6. Long pants
7. Long sleeve shirt
8. Drinking water bottle

ALL STAFF AND WORKERS SHALL BE BRIEFED ON WORK, HEALTH, AND SAFETY REQUIREMENTS

Eye protection / face shield where a risk of eye injury exists. Typical hazards might include flying particles, dust, splashing substances, harmful gases, vapours, aerosols, and high intensity radiation.

Hearing protection where a risk of noise-induced hearing loss exists. The need for hearing protection shall be assessed from noise monitoring surveys in potential noise hazard areas.

Respiratory protection where all other practicable measures have been taken to provide control measures to ensure that no staff member is exposed to an atmosphere that is injurious to health.

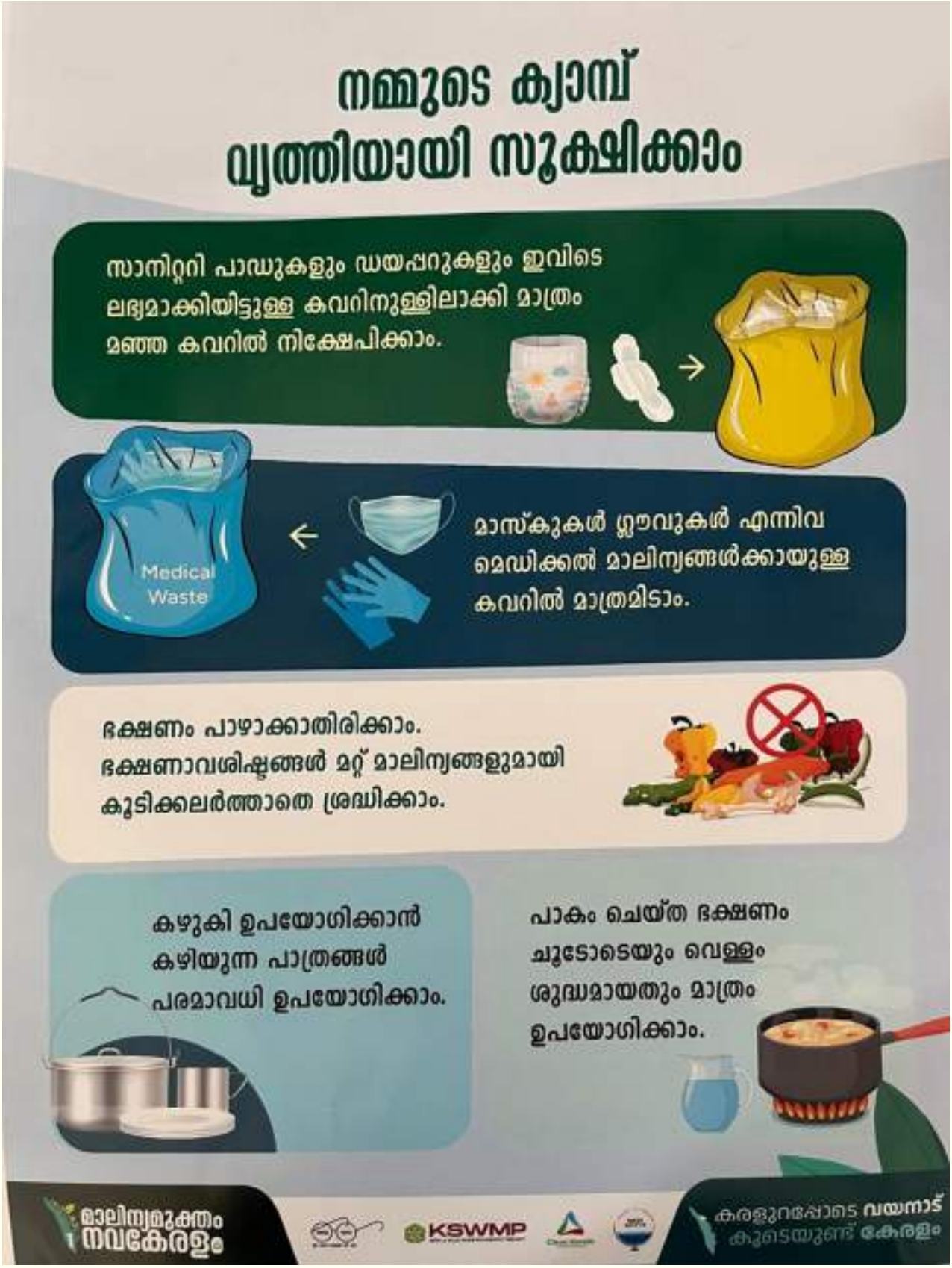
Protective clothing and sunscreen for workers who work outdoors and are exposed to the sun's rays for continuous periods. Direct exposure of the skin to UV radiation from outdoor work shall be minimised by providing hats, long sleeves / trousers, and an adequate supply of sunscreen.

Hand protection where there is an identified hazard with a potential for hand injury, transmission of infection or absorption of substances via the skin.

Protective footwear (safety footwear) shall be provided where the nature of the work exposes the employee to a medium to high risk of injury to feet (for example. occupations such as workshop maintenance and gardening staff).

High visibility safety vests where there is a risk of injury associated with working on or near roadways, near moving traffic or plant or other circumstances where high visibility of the worker is required.

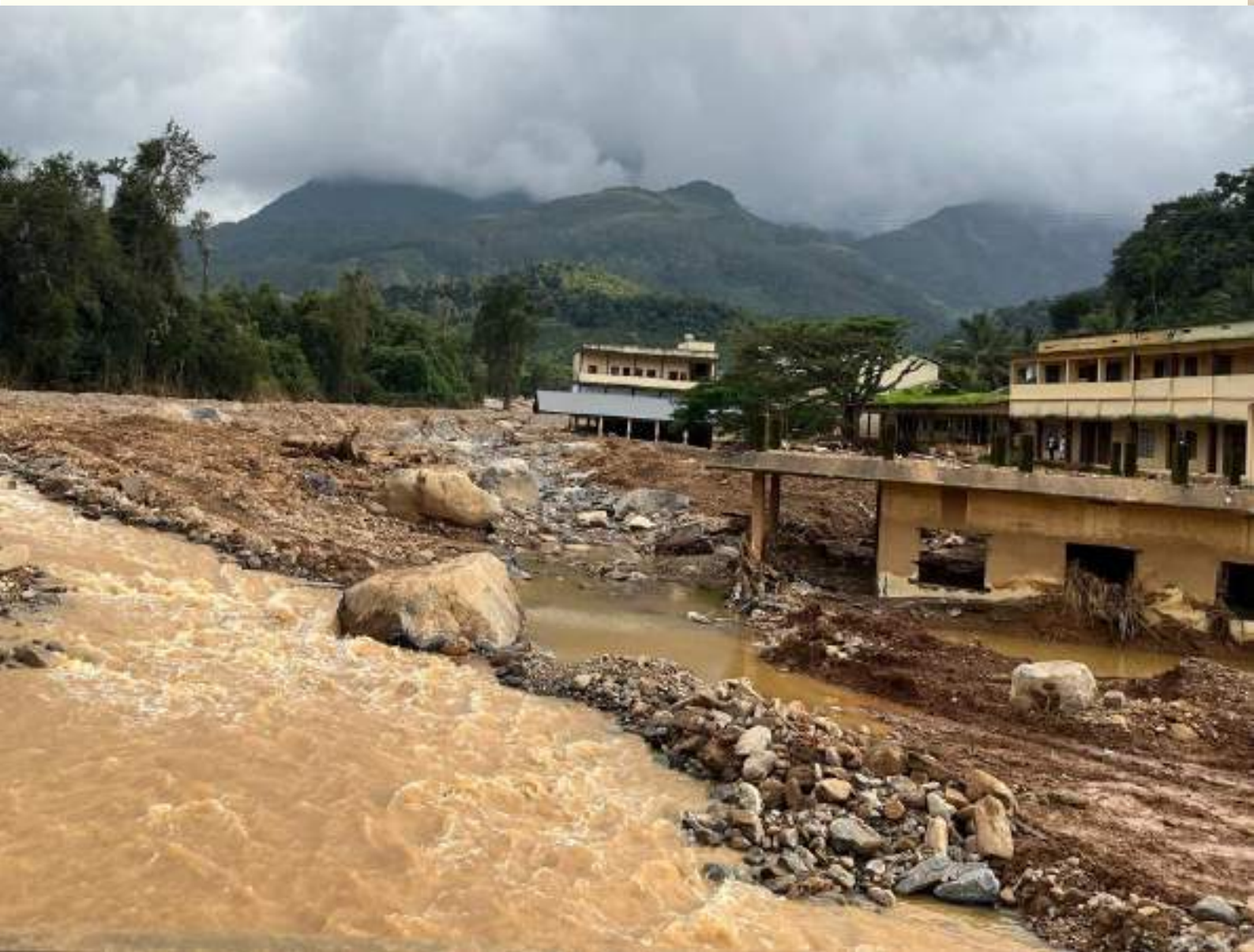
(Source: Pacific Island Countries Regional Disaster Waste Management Guideline, Secretariat of the Pacific Regional Environment Programme (SPREP) 2021)

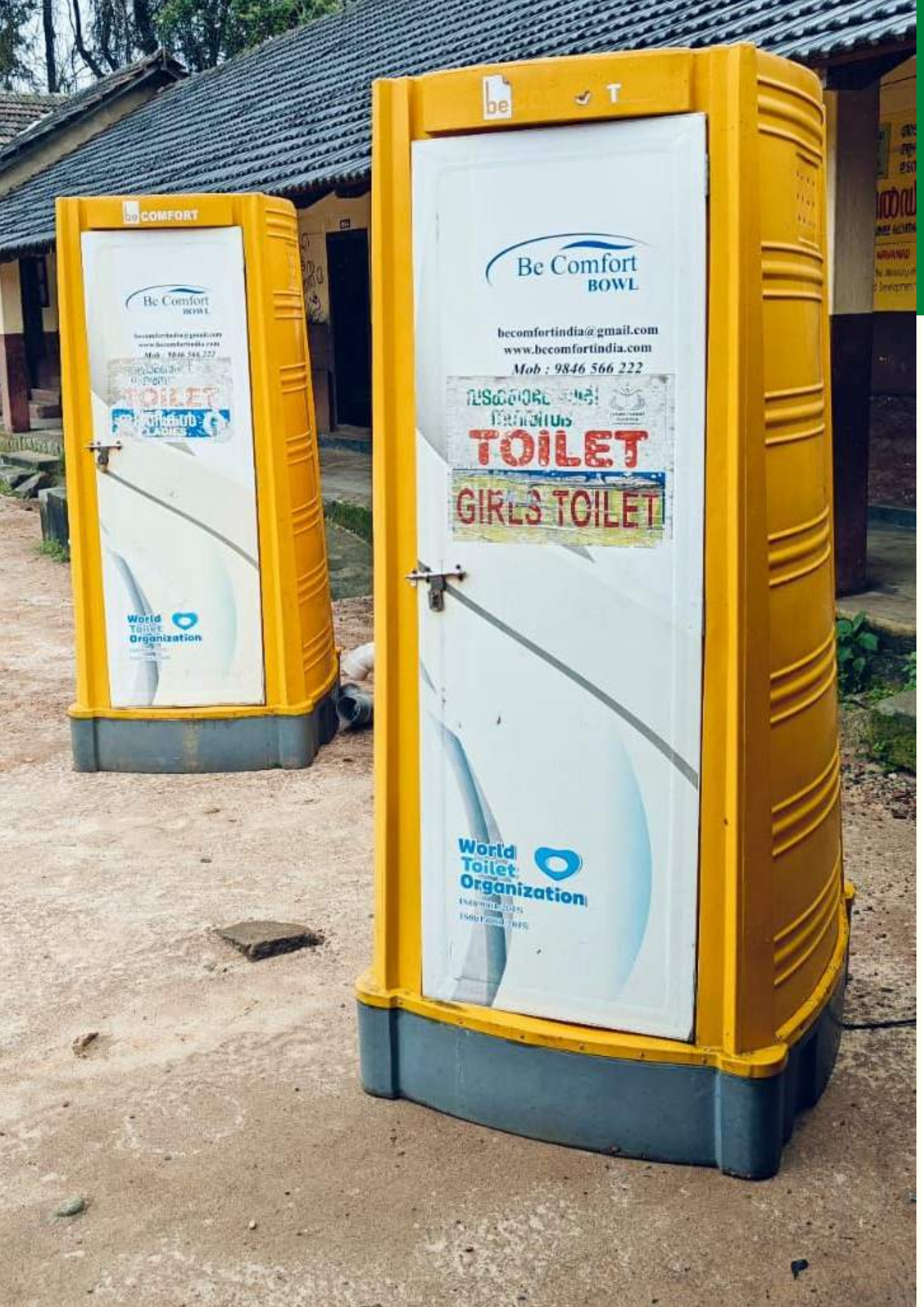


IEC poster displayed during Wayanad Landslide Relief 2024

In disasters, waste is not just a by-product of destruction;
it is a test of our preparedness, coordination,
and commitment to protect life, health, and the environment

-- Suchitwa Mission

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