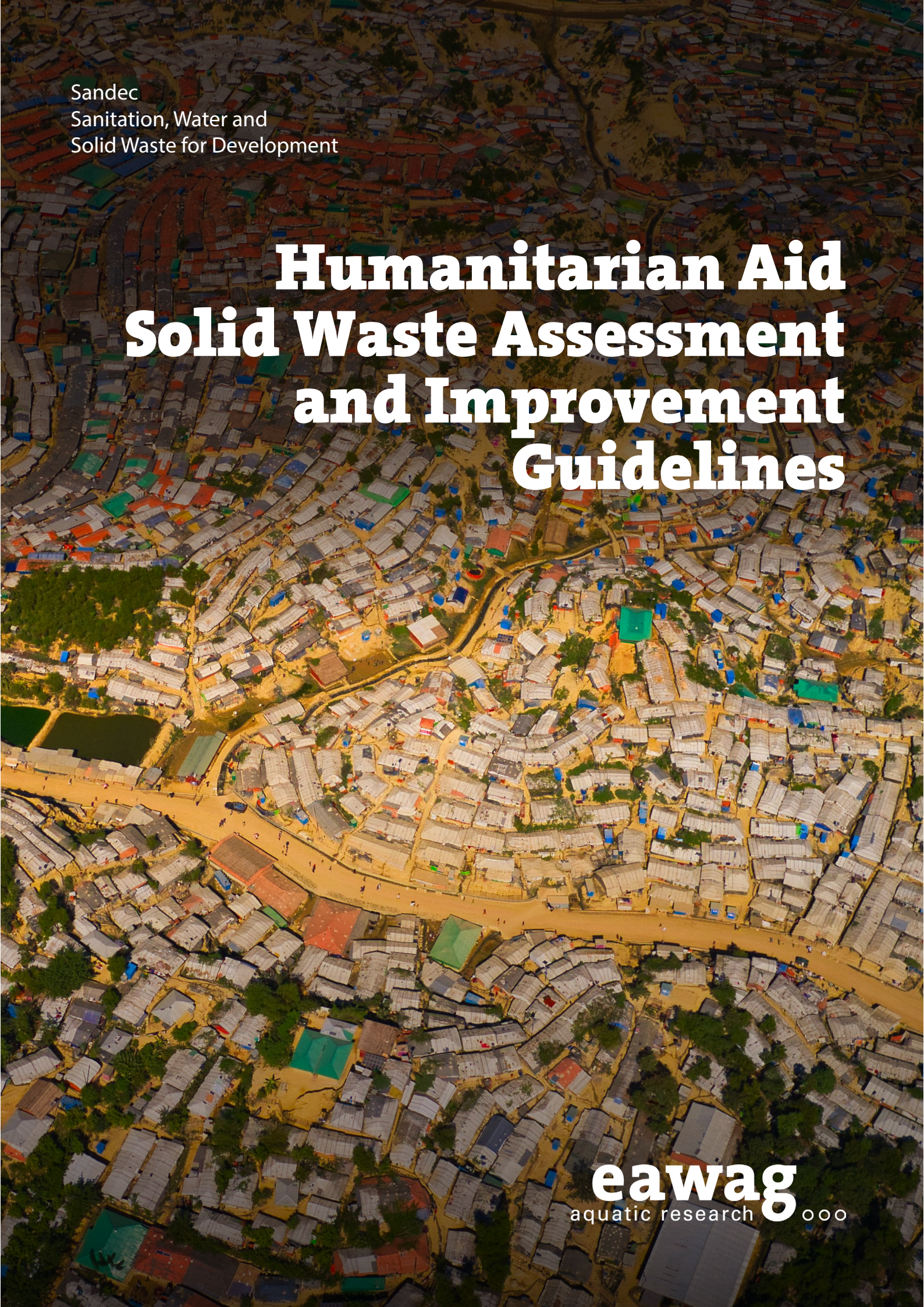




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Humanitarian Aid Solid Waste Assessment and Improvement Guidelines

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Humanitarian Aid Solid Waste Assessment and Improvement Guidelines (HAWAI)

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Introduction

The safe management of solid waste is crucial for protecting both human health and the environment. This is of even higher importance in humanitarian contexts, where displaced or crisis-affected populations are especially vulnerable. Furthermore, the waste generated can significantly affect host locations where displaced communities are temporarily or indefinitely located.

The **Humanitarian Aid Solid Waste Assessment and Improvement (HAWAI)** Guidelines are designed to support effective Solid Waste Management (SWM) in humanitarian contexts. They are intended for technical and management staff from governmental, local, national, international, and multilateral organisations involved in humanitarian operations. The guidelines also target academic institutions, capacity-building agencies, the private sector, donors, and stakeholders from other sectors and humanitarian clusters that intersect with SWM.

The HAWAI guidelines provide practical actions and are seen as a complementary resource and companion publication to the [Compendium of Solid Waste Management in Humanitarian Contexts \(Ewers et al., 2025\)](#), which provides essential background on solid waste management, processes and technologies. For this reason, the introduction to these guidelines is intentionally kept brief. Readers are encouraged to consult the Compendium – Introduction (pp. 20–29) for further background on key topics, including:

- **What is Solid Waste Management?**
- **Why Solid Waste Management?**
- **Response Phases and Implications for SWM**
- **Roles and Responsibilities of SWM Actors**
- **Principles and Standards Related to SWM**

This publication is referred to as the Compendium throughout the HAWAI guidelines for simplicity.

Solid waste is defined as the residue materials that people generate during their daily lives. Solid waste generated in a settlement or city is often referred to as ‘Domestic Waste’ or ‘Municipal Solid Waste’. It includes discarded materials from households, commerce and trade, small businesses, institutions, and public spaces. Characteristically, solid waste is composed of organics, recyclables and other waste materials. These guidelines focus on municipal solid waste and exclude consideration of the management of special waste, such as hazardous medical waste, construction and demolition debris, or industrial waste.

Solid waste systems and services can be described by a series of stages that are closely linked to each other, often referred to as the SWM service and value chains. This includes the generation, storage, collection, transportation, treatment, and recycling of waste, as well as the final disposal of waste. These guidelines take into consideration each of these stages and the links between them, as well as governance aspects, including financial sustainability, stakeholder engagement and inclusivity, and rules and regulations.

The starting point of any SWM assessment, as described in these guidelines, is to obtain reliable and comprehensive baseline information, which serves as a foundation for making informed decisions regarding the planning, implementation, and improvement of SWM systems. By understanding the weaknesses of the SWM system, i.e. how solid waste is mismanaged and which of these deficiencies pose the highest risk and have the most negative effect, humanitarian practitioners can then prioritise actions and available means, both financial and in terms of human resources, to minimise the impacts through a risk-based decision-making approach.

Following key SWM principles and priorities to protect public health and minimise negative impacts on the environment, these guidelines provide tools to:

- a. identify hotspots, assess risks and set priorities
- b. assess and improve existing SWM services
- c. design and plan for new service delivery

This guide includes tools that assist in situations where the first rapid response phase of a humanitarian emergency has somewhat stabilised, and medium- and long-term measures are required. Nonetheless, some of the help in this guide is also relevant for acute response, for instance, to establish initial SWM services when none are available.

How to use the guidelines

Users of these guidelines are invited to have the [Compendium of Solid Waste Management in Humanitarian Contexts publication \(Ewers et al., 2025\)](#) or access to the [online version](#). The Compendium publication provides essential background on solid waste management processes and technologies, and is frequently referenced throughout the HAWAI guidelines. A link to the online portal is provided whenever possible, and the corresponding page number in the publication is always referred to. Users are expected to be familiar with the fundamental concepts of SWM, going back to the Compendium as needed.

These guidelines provide a step-by-step guide and tools to evaluate and improve SWM services in humanitarian contexts. These guidelines can be used to:

Step 1: Identify hotspots and prioritise immediate and long-term actions

Step 2: Assess and improve the SWM service and value chains

Step 3: Design and plan new services from scratch

Navigation through these guidelines

Part 1: Introduces and highlights the key principles of SWM in humanitarian contexts.

Part 2: Details each step of the SWM for assessing, improving and designing SWM systems.

- **Step 1: Hotspot identification and prioritisation**

By combining hazard, exposure, and vulnerability, hotspot identification helps determine the significant risks to public health and the environment. This, along with recognising who is involved in these unsafe practices, helps understand the reasons behind them and provides a foundation for defining immediate actions and long-term improvement measures.

- **Step 2: Assessment and improvement of existing SWM systems**

In this step, the solid waste service chain is evaluated through a detailed analysis of existing services related to storage, collection, transport, disposal, and recovery of waste. A section is dedicated to the self-management of waste for remote and sparsely populated areas where conventional waste management services might not be feasible to provide. The assessment of each element is divided into two parts: the first part aims to gain an overview of the current system, while the second part provides an in-depth evaluation and potential improvements.

- **Step 3: Design and plan new SWM systems**

This step highlights what needs to be considered when expanding existing services to new areas or designing and setting up new SWM services.

Part 3: Contains a summary of the tools of these guidelines.

Part 4: Contains a list of key resources for SWM in humanitarian contexts.

Glossary

Part 1 - Key principles

The HAWAI guidelines and their recommendations are based on the following key principles:

- A. Protection of public health
- B. Adherence to the Sphere minimum standards for SWM
- C. Integrated Solid Waste Management
- D. Engagement of stakeholders

Each of these key principles is further described in the sub-chapters below. Furthermore, the Compendium – Principles and Standards Related to SWM (pp. 27-29) also highlights the important principles of SWM in humanitarian contexts.

A) Protection of public health

In humanitarian contexts, the primary objectives of a SWM system are:

Priority 1: Protect the health of the affected population and host communities

Priority 2: Ensure the dignity and well-being of the affected population and host communities by maintaining a clean and safe environment

Priority 3: Minimise environmental impact

Priority 4: Facilitate resource recovery

Depending on the population density in the affected area, fulfilling these objectives can be translated into different main priority actions:

For high-density population areas, the primary focus is to protect the health of the population and remove waste from the vicinity of people. Priority actions can be ranked as:

1. **Store, collect and remove waste from densely populated areas** to reduce immediate health risks. This can include an initial overall clean-up whenever needed.

The HAWAI guidelines cover this priority in the chapters covering storage, collection and transport.

2. **Dispose of waste in safe and controlled disposal sites** to ensure proper containment and mitigation of health and environmental risks.

The HAWAI guidelines cover this priority in the chapters covering waste disposal.

3. **Whenever possible, recover resources from waste and follow 3R (reduce, reuse, recycle) principles**, to reduce the burden on disposal systems, support livelihoods, circular economy initiatives and promote sustainability. For more information on waste prevention, waste separation, and the 3R principle, refer to the [Compendium – Preparing for SWM \(pp. 32-37\)](#).

The HAWAI guidelines cover this priority in the chapters on organic and recyclable waste management.

For low-density population areas, similarly, the primary focus is to protect the health of the population. However, as collection services in dispersed low-density settlements are likely unrealistic and come at a very high cost, the HAWAI guidelines propose self-management as an alternative with these priorities:

1. **Encourage self-management at the household-level with resource recovery / 3R**, including organics and recyclables, to optimise resource use and reduce residual waste.
2. **Promote self-management for safe disposal at the household level**, such as the construction of small-scale disposal pits for residual waste.

These priority actions are guiding principles throughout these guidelines, ensuring that recommended actions are context-specific, practical, and aligned with the primary goals of health protection, environmental preservation, and resource recovery. In this regard, minimum requirements were defined to protect public health throughout the SWM service chain, considering both SWM services and self-management. These minimum requirements are presented in **Table 1**. These requirements build on the SPHERE minimum standards, extending and shaping them into the SWM service chain.

Table 1: Overview of minimum requirements throughout the SWM service chain

SWM service						Self-management
Storage, collection and transport			Disposal	Treatment and recycling		
Safe storage	Door-to-door, summoned or roadside collection	Collection point service		Organic waste management	Recyclable waste management	
• A designated area with a container (bag or solid) is used to store waste. • Waste is not accessible to animals that might spread the waste.	• Collection follows a planned schedule • Collection frequency is appropriate to waste generation trends • Reliability of frequency is ensured • Workers are protected by personal protective equipment (PPE)	• Collection points are easily accessible • Collection points are located within 200 m of waste generators • Frequency of collection is sufficient to maintain cleanliness • Capacity is sufficient to contain the waste • Cleaning of the immediate areas surrounding the collection point is ensured • No burning in and around collection points • Workers are protected by personal protective equipment (PPE)	• Waste is disposed of according to a waste placement plan and following the filling plan • Unloading of waste at a designated location called the tipping face • Waste should be compacted and covered periodically • The site should be fenced, and the access supervised by staff • For the operations, qualified staff is required as well as equipment for manual or mechanical handling of the waste and cover material • No smoke nor fire should be present at the site • Rainwater is carefully managed to prevent it from entering the site • Workers are protected by personal protective equipment (PPE)	• <i>Whenever possible, divert organics, preferably at source, and treat them separately</i>	• <i>Whenever possible, divert recyclables, preferably at source, and treat them separately</i>	• No open burning • Residual waste must be disposed of using controlled waste pits, which should be regularly covered with inert material • Organics and recyclables should be separated from general waste and either managed on-site or sent off-site for proper handling

B) Sphere minimum standards for SWM

The Sphere is a widely recognised set of common principles and minimum standards for humanitarian assistance. The Sphere standards define minimum requirements for SWM as follows:

- **Standard 5.1: Environment free from solid waste**

Solid waste is safely contained to avoid pollution of the natural, living, learning, working and communal environments

- **Standard 5.2: Household and personal actions to safely manage solid waste**

People can safely collect and potentially treat solid waste in their households

- **Standard 5.3: Solid waste management system at the community level**

Designated public collection points do not overflow with waste, and final treatment or disposal of waste is safe and secure

Based on the 3 SWM standards in Sphere, the IFRC summarised the main sector-specific guidelines for SWM (IFRC, 2020), which are shown in the **Table 2** below.

Table 2: Main recommendations for the WASH sector based on SPHERE standards (IFRC, 2020)

Standard reference	Main recommendations
5.1 Environment free from solid waste	• Design the solid waste disposal programme based on public health risks, assessment of waste generated by households and institutions, and existing practice. • Assess capacities for local reuse, re-purposing, recycling or composting, and encourage these practices within the community. • Work with local or municipal authorities and service providers to make sure existing systems and infrastructure are not overloaded, particularly in urban areas. • Communal collection points: Initially, provide a 100-litre container for every 40 households. In the longer term, aim for one container per 10 households. As a guide, a 2.5-person maintenance team should be available per 1,000 persons. • Protection for waste handlers: Provide personal protective equipment (PPE), soap and water for washing, and training on waste handling and risks. Work with the community to avoid stigmatisation. • Use any safe and appropriate treatment and disposal methods, including burying, managed landfill and incineration. Disposal of solid waste at the household level may be possible, and even preferred, in areas with lower population densities (rural areas). • Minimise packing material and reduce the solid waste burden by working with organisations that are responsible for food and household item distribution.
5.2 Household and personal actions to safely manage solid waste	• Provide households with convenient, adequately sized and covered storage for household waste, or containers for small clusters of households. Consider preferences for the number and size of containers for reuse and recycling. • Provide clearly marked and fenced public neighbourhood collection points where households can deposit waste daily. • Organise a system to remove waste from designated public collection points regularly. • Waste generation: Assume a generation rate of 0.5 kg/person/day, equivalent to 1–3 litres/person/day, based on a typical solid waste density of 200 to 400kg/m³ (can vary depending on how food is obtained and cooked, and activities within or near the household, including seasonal variation).
5.3 Solid waste management systems at the community level	• Ensure that institutions such as schools and learning spaces, child friendly spaces and administrative offices have clearly marked, appropriate and adequate covered on-site storage for waste generated at that location. • Provide clearly marked and fenced storage for waste generated in communal areas, especially formal or informal marketplaces, transit centres and registration centres.

C) Integrated Solid Waste Management

SWM systems can be described through the Integrated Sustainable Waste Management (ISWM) framework. This provides a comprehensive approach to understanding and addressing the key elements necessary for sustainable and integrated SWM.

As illustrated in Figure 1, the ISWM framework consists of two main components:

1. **Physical components:** These refer to the waste system elements, including waste storage, collection and transport, treatment and recycling, and disposal, as well as the 3Rs—Reduce, Reuse, and Recycle—focusing on what happens to waste throughout its lifecycle.
2. **Governance aspects:** These encompass the “software” elements of waste management, such as stakeholder inclusivity, financial sustainability, institutional frameworks, and policy development, which determine how the system is managed and governed.

Addressing both the physical and governance aspects is crucial for building a sustainable and effective waste management system, reducing public health and environmental risks. For more information, consult the [Compendium Introduction \(pp. 20-21\): What is solid waste management?](#)



Figure 1: Integrated Sustainable Waste Management Framework (Ewers et al., 2025)

Understanding the performance of each element within the ISWM framework is the first step towards data-driven decision-making. Such evidence-based improvements rely on using data to inform and guide actions effectively. Adopting a structured, step-by-step approach helps assess the current situation, generate critical data and insights, and develop well-informed plans for improvement. Baseline data form the foundation of the HAWAI guidelines, ensuring they are practical, effective, and grounded in real needs.

D) Engagement of stakeholders

Different stakeholders play essential roles in a SWM system, and meaningful engagement of all relevant actors is key to ensuring that services meet community needs. Effective stakeholder participation enables efficient use of resources, supports the achievement of service objectives, and helps design solutions that are culturally appropriate, environmentally sound, and socially equitable. It also strengthens local capacities, ensuring that solid waste management can be sustained once humanitarian actors withdraw. For detailed guidance on stakeholder engagement, refer to the [Compendium](#):

- [Roles and Responsibilities of SWM Actors \(p. 26\)](#)
- [X.1 Institutional and Regulatory Environment \(pp. 130-131\)](#)
- [X.2 Inclusive Planning and Participation \(p. 132\)](#)

Key stakeholders are summarised below:

Local authorities: Municipal and district authorities usually hold the primary responsibility for SWM under national law and policy frameworks. In humanitarian contexts, their role is often challenged by sudden population increases, resource constraints, and competing priorities. Strengthening and supporting local authorities is critical to ensure that SWM interventions are aligned with existing systems, legally compliant, and sustainable beyond the humanitarian phase. Humanitarian actors and implementing partners should therefore work in close coordination with, and in support of, local authorities rather than in substitution for them.

Host communities include residents, community leaders, local authorities, service providers, civil society groups, businesses, and regional branches of government. Host communities often share resources and services with displaced populations, playing a crucial role in promoting social cohesion, protecting refugees, and facilitating durable solutions.

Implementing partners: Local or international organisations directly involved in operational activities. These actors typically provide technical expertise, logistics, and operational management, which are crucial for establishing and maintaining solid waste management infrastructure and delivering adequate service provision. Their role hereby focuses primarily on implementation and service delivery.

Humanitarian actors: This comprises organisations structured under humanitarian coordination frameworks such as the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) system, including the cluster approach that organises response by sector (e.g., WASH, shelter, health, logistics, livelihoods), providing emergency support, resources, and coordination. Their role in coordinating with implementing partners and host communities is crucial to leveraging local insights.

Affected population: These are the primary beneficiaries of SWM. They interact daily with waste management service providers and, through their actions and behaviours, actively contribute to the success of the service. Through their participation, the service provided can tap into local customs, knowledge, and expertise, ensuring that solutions are culturally relevant and accepted by the community. Involving the affected populations in planning, design, and operation fosters a sense of ownership and responsibility.

Service providers: This group encompasses a diverse range of actors involved in waste collection, recycling, and disposal, including formal private companies, municipal service providers, informal workers, and community-based initiatives. Their involvement is central to ensuring that SWM systems are effective, scalable, and sustainable. Informal waste pickers often play a critical role in recycling and resource recovery, though they may lack recognition and protection within formal systems.

Part 2 – Step-by-step guide to assessing, improving and designing SWM systems

Step 1: Hotspot identification and prioritisation

1.1 Hotspot identification

Hotspots are locations where poor solid waste management practices, such as dumping, accumulation in drains or burning (**hazards**), pose a critical threat to human health and/or the environment. Identifying potential hotspots is the first step in assessing risks, which are evaluated based on **hazard, exposure, and vulnerability**:

- **Hazard** – What poor practices occur, where, and how frequently?
- **Exposure** – Who or what is exposed to these hazards, in which way, and how often?
- **Vulnerability** – How susceptible are the exposed people or environments to harm from the hazard?

This approach ensures that interventions are prioritised in areas where hazards, exposure, and vulnerability combine to create the highest risk, supporting effective risk reduction in SWM. This also allows identifying what urgent and immediate measures should be taken.

Some people are more **vulnerable** than others to the risks of mismanaged waste, including:

- **Children, the elderly, and people who are sick or have disabilities** are more susceptible to the effects of the hazards.
- **Informal waste pickers and waste workers**, who may lack the means or opportunity to avoid exposure and are in direct contact with waste or harmful gases and pollutants.

Vulnerable environments and infrastructure in a humanitarian setting include:

- Living areas of the affected population or host communities
- Public spaces where the affected population or host communities spend time and/or interact (e.g. markets, distribution points, community centres)
- Locations where people spend time (e.g. education centres, health centres)
- Locations where infrastructure is critical to ensure basic services, hygiene and safe health conditions (e.g. water supply system, stormwater and wastewater drains, riverbanks, roads, health care services, energy supply, food production, supply and distribution services, etc.)
- Key environmental resources and their respective ecosystem services (surface and subsurface water bodies, soil for food production and air quality)

Inadequate practices from local populations and the SWM services leading to hotspots are typically:

- **Waste dumping**, also referred to as “open dumping”, often occurs due to:
 - Waste dumping, used as an inadequate practice of disposal
 - Lack or deficiency of waste storage and collection service
 - Carelessness and/or lack of public awareness (deliberate or undeliberate discarding of small amounts of waste in public spaces)

For more information, refer to the [Compendium – U.10 Open Dumping \(pp. 120-121\)](#).

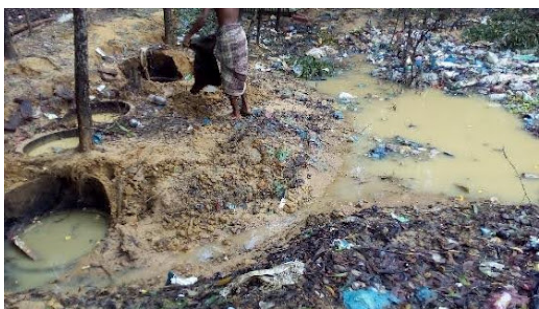
- Special attention should be given to situations where **waste accumulates in drains**, as this may lead to clogging and increase the risk of flooding, as well as the proliferation of disease vectors in stagnant water. Refer to the [Compendium – W.6 Management of Solid Waste from Sanitation Facilities and Drains \(pp. 164-165\)](#).

- **Waste burning**, also referred to as “open burning”, often occurs due to:
 - An inadequate practice which is perceived as a quick solution to reduce waste amounts
 - A method to eliminate waste and more easily obtain access to non-combustible, high-value recyclables such as glass and metals
 - Its perceived value as an energy source for heating or cooking (e.g. waste as fuel)

For more information, refer to the [Compendium – U.11 Open Burning \(pp. 122-123\)](#).

These inadequate practices and their related hazards and impacts are summarised in **Table 3**.

Table 3: Inadequate waste management practices and impacts

Inadequate practice – potential hotspots	Main recommendations
Waste dumping 	Waste accumulation increases the likelihood of contact with waste and potential physical harm. Waste accumulation enhances the proliferation of disease vectors and increases the likelihood of disease transmission. Waste accumulation and its subsequent contact with water and soil increase the likelihood of pollution in soil, surface water, and groundwater. Deterioration of living conditions. Attraction of more waste dumping.
Accumulation & clogging of drains 	Special case of waste dumping or a consequence of dumping. Acute risk of flooding. Disruption of basic services in case of flood (drains, roads, water supply, wastewater discharge ...). Direct risk to physical integrity (e.g. incl. injuries) or damage to essential infrastructure in case of flood. Proliferation of disease vectors. Contamination of the environment (soil & water).
Waste burning 	The release of harmful gases and pollutants poses serious health risks to humans, including respiratory problems, cancers, and other chronic diseases. Greenhouse gases (GHG), dioxins and black carbon (BC) emissions. Deposition of dioxins on soil/crops, which are highly toxic to humans (ingestion or inhalation). Fire risks, particularly in camp settings.

Key information for hotspot identification is summarised in tool **T 1 – Hotspot identification**, which allows:

- Find potential hotspots (where hazards occur: dumping, drain accumulation, burning).
- Evaluate associated risks based on exposure and vulnerability.

With **T1 – Hotspot identification**, a preliminary assessment can also be obtained of the reason for the hotspot, why it exists, and how it may provide direction for prioritising longer-term actions (see 1.3 Long-term actions and systemic change).

Based on the risk assessment, two courses of action can be envisaged (also see Figure 2):

- **Short-term and immediate actions** – aiming at removing the direct hazard in the case of critical immediate risks
- **Long-term action and systemic changes** – aiming at making changes to the SWM system to prevent unsafe waste management practices and related impacts.

Short-term and immediate actions only temporarily alleviate the problem and aim to mitigate immediate risks. They should always be combined with a system change and long-term actions to reduce harmful practices from happening in the first place.

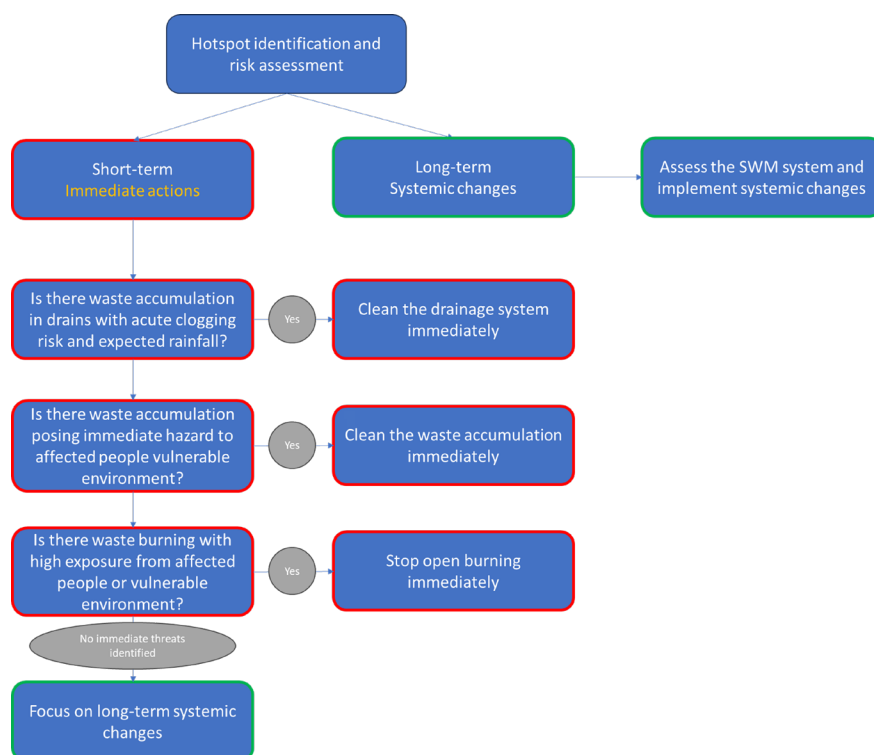


Figure 2: Prioritisation decision tree

1.2 Short-term and immediate actions

Short-term actions aim to remove hazards at high-risk hotspots. They typically include machinery and equipment such as excavation, loading, lifting and hauling vehicles. The priority should be on the locations highlighted by the hotspot mapping as crucial ones. Immediate action to remove the hazard can then be taken:

- 1) If there are hotspots involving waste accumulation in drains AND acute risk of clogging AND rainfall is to be expected → **Clean the drainage system**
- 2) If hotspots show a high risk to people and vulnerable environments → **Clean illegal open dumps in the direct vicinity of affected people and vulnerable environments**
- 3) If burning waste occurs in a location with high exposure to people → **Stop burning the waste in the direct vicinity of affected people and vulnerable environments**

As these short-term actions involve a displacement of waste, care should be taken to identify an appropriate means of transport and a location for controlled disposal whenever possible (see 3.2 Disposal). Also note that all actions mentioned here aim at removing the hazards but do not prevent them from happening again in the future. Longer-term actions and systemic changes are required to avoid future potential hazards.

1.3 Long-term actions and systemic change

Long-term actions aim at making a significant change in the SWM system to prevent inadequate practices. Most situations benefit from analysing and improving SWM in the long run.

For that, it is suggested to:

1. Define the cause of the inadequate SWM practice (who and why)
2. Identify which component of the SWM chain needs attention
3. Assess this SWM component in detail
4. Follow the recommendations for improvement

It is essential to understand who is involved in the inadequate waste management practices that create potential hotspots and the reasons behind these practices.

Typically, three groups of stakeholders can be associated with inadequate practices resulting in hotspots:

- Individuals
- Formal or informal waste collectors or service providers
- Formal and informal waste recyclers

Other stakeholders, such as institutions (e.g., schools, hospitals), can also be associated with inadequate practices resulting in hotspots; however, the responsibility usually lies with one or several individuals within these institutions.

Inadequate practices are typically a result of technical or social aspects. The most common situations linked to inadequate waste management practices are summarised in Table 4 below, along with the respective possible actions that could alleviate the issue:

Table 4: Most common scenarios for inadequate waste management practices and respective possible actions

Scenario		What to do
Individuals – Use of the collection service		
Waste storage and collection issue		
<i>Technical aspect</i>		
Absence of storage and collection service/ infrastructure	No adequate storage solutions or collection services are available in the entire area.	Plan for adequate waste storage, collection and transport service (Step 3.1) or, in dispersed and low-density settlements, engage with individuals to foster improved self-management of their waste (Step 3.5)
	Without any collection service, individuals often turn to open dumping or burning as a waste management practice.	
	A collection service exists, but some individuals lack access to it, resulting in open dumping or burning.	Check the performance of the existing collection service to see if it can be improved and extended (Step 2.1), or if a new collection system should be designed and planned (Step 3.1)
Inefficient/inadequate service	Storage, collection, and transport of waste are available, but the service is irregular, has an inadequate collection schedule, or is inconvenient for individuals. As a consequence, dumping or burning is often preferred over using the existing service.	Evaluate the storage, collection and transport (Step 2.1) to see how it can be improved or if a new storage, collection and transport service is needed (Step 3.1)
<i>Social and regulatory aspects</i>		
Behaviour	Individuals often lack awareness of the collection service schedule, are reluctant to use and/or pay for the service, or are accustomed to not using it for some other socio-economic reason.	Evaluate the storage, collection and transport service (Step 2.1)
Regulation	Existing regulations regarding the use of collection services are not enforced. Although services in a humanitarian context are most often free of charge, in cases where existing tariffs apply, it may also be that these payment duties are not enforced, resulting in inadequate payments.	

Formal and informal waste collectors or service providers - Operation of waste collection service and/or waste disposal		
Waste storage and collection issue		
Technical aspect		
Inefficient/inadequate service	Waste accumulates at collection or transfer points due to inadequate storage options, a lack of equipment and consumables (e.g., collection vehicles or fuel), insufficient staff (including collection workers, drivers, sweepers, etc.), or inadequate planning of daily operations. Therefore, waste cannot be loaded and transported to the disposal or treatment site.	Assess the storage, collection and transport service (Step 2.1)
Social and regulatory aspects		
Behaviour	Waste workers often lack the skills and training necessary for efficient disposal practices, or they are under-supervised and lack clear responsibilities and tasks. Therefore, waste is not disposed of adequately.	Assess the disposal site (Step 2.2)
	Informal waste collectors often lack knowledge of where the designated disposal site is located and/or face behavioural barriers that prevent them from using it.	
Regulation	Regulations are not enforced to ensure correct waste disposal practices.	
	Waste collectors are not allowed to access and use the disposal site for waste disposal.	
Informal waste recyclers – Collection of recyclables		
Waste collection issue		
Technical/social aspect	Waste collection is disrupted due to waste picking activities (for instance: emptying bins and opening bags to look for valuable materials)	Evaluate the storage, collection and transport service (Step 2.1)
	Waste is burned at waste accumulation points by waste-picking activities to extract valuable materials.	
Waste disposal issue		
Technical/social aspect	Waste is burned at the waste disposal site by waste-picking activities to extract valuable materials	Evaluate the disposal site (Step 2.2)

Step 2: Assessment and improvement of existing SWM systems

This chapter focuses on service delivery and is intended for areas that currently receive some level of SWM service. Hereafter, an evaluation approach is proposed to assess and improve the various service stages, including waste storage, collection and transport, disposal, and management of organics and recyclable waste. Each chapter can be used individually if it was identified as a critical aspect to be evaluated and improved as a priority. Nonetheless, suppose no specific aspect of the service is identified as a priority. In that case, it is recommended that the system be assessed in an integrated manner, reviewing all existing elements of the service. The chapters were divided according to the following structure and based on the priorities to protect public health described in **Part 1 – Key principles: A) Protection of public health**.

Highest priority to remove and contain mixed waste:

- 2.1 Storage, collection and transport
- 2.2 Disposal

Whenever possible, separate management of specific fractions with treatment and recycling:

- 2.3 Organic waste management
- 2.4 Recyclable waste management

Special case for sparsely populated areas, usually remote and rural:

- 2.5 Self-management

Prior to starting the assessment and improvements of existing SWM systems, HAWAI guidelines users should be familiarised with the contents of the [Compendium](#). This is to ensure that users have a basic understanding of SWM and comprehend how the different elements of the system interconnect and interact. The following chapters are most relevant:

- **Introduction (pp. 20-31)**
- [Preparing for SWM \(pp. 32-41\)](#)
- [Introduction to Storage \(pp. 42-47\)](#)
- [Introduction to Collection and Transport \(pp. 54-61\)](#)
- [Introduction to Treatment and Recycling \(pp. 72-79\)](#)
- [Introduction to Use and Disposal \(pp. 96-101\)](#)
- [Cross-Cutting Issues \(pp. 128-151\)](#)

2.1 Storage, collection and transport

Providing collection and transport services is an essential priority for SWM. Especially in urban areas where space is limited and the impacts of the unmanaged waste directly affect the communities. The minimum requirements of a basic level of service are the following:

Safe storage:

- A designated area with a container (bag or solid) is used to store waste. Both at the household level and at community/shared collection points.
- Waste is not accessible to animals that might spread the waste.

Door-to-door, summoned or roadside collection service:

- Collection follows a planned schedule
- Collection frequency is appropriate for the amount of waste generated
- Reliability of frequency is ensured
- Workers are protected by personal protective equipment (PPE)

Collection point service:

- Collection points are easily accessible
- Collection points are located closer than 200 m from waste generators
- Frequency of collection point emptying is sufficient
- Capacity is sufficient to contain the waste
- Littering around can be frequent, but regular cleaning is ensured
- No burning in and around collection points
- Workers are protected by personal protective equipment (PPE)

The assessment and improvement of storage, collection and transport directly link to the following chapters of the Compendium:

- [Storage \(pp. 42-53\)](#)
- [Collection and Transport \(pp. 54-71\)](#)

Evaluating waste storage, collection, and transportation is crucial for assessing service quality and identifying areas for potential improvement. Often, most available municipal financial resources for SWM are spent on collection. Evaluating and then improving the collection service can support financial sustainability and free up resources for the expansion of the service, or allocate these resources to improving treatment and/or controlled disposal.

When assessing the collection service, efficiency—how effectively resources are utilised—is a key consideration. This involves examining each stage of the chain, from waste generation to its final treatment or disposal, and evaluating how well these stages are interconnected. Equally important is effectiveness, which measures the extent to which the system or program achieves its intended waste management goals. The **Tool 2 – Storage, Collection, and Transport – Assessment and Improvement** provides a structured framework for this evaluation. To enhance the efficiency of the collection service—and thereby optimise time and resources while boosting overall effectiveness—the following priorities should be addressed:

- Optimise time and effort required at each task
 - Make loading/unloading the waste easy
 - Ensure good waste containment (loose waste is strenuous to handle and requires additional cleaning)
 - Avoid idle time of staff and vehicles (traffic jams, manoeuvres, waiting for inhabitants to give their waste)
- Ensure adequate planning and monitoring
 - Ensure efficient routes and load maximisation during transport
 - Optimise storage capacity (collection points, containers, transfer station)
 - Ensure staff availability and occupational health and safety
 - Ensure vehicle availability, including preventive and corrective maintenance

To perform a detailed assessment and evaluate possible improvements for storage, collection and transport, use Tool 2, which includes the following two main parts:

- **Tool 2.1 – Overview of Storage, Collection and Transport**
 - ➔ to understand and have an overview of the current collection system
- **Tool 2.2 – Evaluation and improvement of Storage, Collection and Transport**
 - ➔ to assess the efficiency, effectiveness and possible improvements for the collection system

2.2 Disposal

Safe and controlled waste disposal is an important element of public health and environmental protection. Disposal sites should be designed and operated to contain and control the impacts of waste, thereby minimising risks. Minimum requirements include:

- Waste disposal is organised through a filling plan, including a waste placement plan
- Disposal of waste at a designated location called the tipping face
- Waste should be compacted and covered with inert material periodically
- The site should be fenced and the access supervised by staff
- Staff and equipment are required for handling the waste, cover material and other operations
- No smoke nor fire should be present at the site
- Rainwater is carefully managed to prevent it from entering the site
- Workers are protected by personal protective equipment (PPE)

Additional protection measures going beyond minimum requirements include:

- Containment of leachate in ponds and leachate recirculation to the disposal site
- Gas evacuation through exhaust chimneys constructed in the disposal site.

Waste disposal benefits significantly from economies of scale, making the shared use of controlled disposal facilities desirable. Host communities often lack safe disposal methods, so they too can benefit from improved facilities. It is important to ensure equitable treatment and resource distribution between host communities and displaced populations, addressing disparities in access to essential services and support to prevent inequalities or social tensions.

Note that the recommendations and tools provided here regarding waste disposal rely on the publication [Guidelines for the Safe Disposal of Solid Waste in Humanitarian Contexts \(Tosi Robinson et al., 2024\)](#), referred to as Geneva Technical Hub (GTH) disposal guidelines in the present document. The GTH disposal guidelines should be used in conjunction with the provided resources. Additionally, refer to the [Compendium – U.9 Controlled Disposal Site/Landfill \(pp. 118-119\)](#).

To perform a detailed assessment and evaluate possible improvements for waste disposal, use the **Tool 3 – Disposal – Assessment and Improvement**, which includes the following two parts:

- **Tool 3.1 – Overview of Disposal**
 - ➔ to gain an overview of the current waste disposal sites
- **Tool 3.2 – Evaluation and Improvement of Disposal**
 - ➔ to evaluate the disposal sites and identify improvement options through mitigation measures

2.3 Organic waste management

Organic waste often represents a significant proportion of the total amount of solid waste produced in low- to middle-income settings (often more than 50%). While organics should at least be collected through mixed waste collection systems and safely disposed of at controlled sites, diverting them from disposal can:

- Support livelihoods through value and job creation
- Generate valuable products that benefit communities
- Reduce disease vectors, such as flies, mosquitoes, and rats
- Reduce odour nuisance
- Reduce disposal needs and increase disposal site lifetime
- Lessen environmental impacts (leachate and greenhouse gas emissions - methane (CH₄), carbon dioxide (CO₂), nitrous oxide (N₂O))
- Increases material circularity

Separate management of organics is thus a key component of an integrated and sustainable waste management system and should be prioritised whenever possible in humanitarian contexts. In some cases, organics are already segregated by users—for example, for animal feed or home composting. Generally, an organic waste management system should not compete with or undermine existing reuse and recovery practices, but rather focus on the fraction of organics currently mixed with general waste and requiring disposal.

A key element for separate organic waste management is source segregation of the waste. Refer to the [Compendium – Waste Separation \(pp. 34-37\)](#) for more information on source segregation and understand its importance.

The assessment and improvement of organic waste management considers the entire SWM service chain and connects to the following most relevant chapters of the Compendium:

- [Storage \(pp. 42-51\)](#)
- [Collection and Transport \(pp. 54-71\)](#)
- [Treatment and Recycling \(pp. 72-89\)](#)
 - [T.1 Composting \(pp. 80-81\)](#)
 - [T.2 Vermicomposting \(pp. 82-83\)](#)
 - [T.3 Anaerobic Digestion \(pp. 84-85\)](#)
 - [T.4 Black Soldier Fly \(BSF\) Waste Processing \(pp. 86-87\)](#)
 - [T.5 Making Fuel from Biomass \(pp. 88-89\)](#)
- [Use and Disposal \(pp. 96-119\)](#)

To perform a detailed assessment and evaluate possible improvements of the current organic waste management system, use the **Tool 4 – Organic Waste Management – Assessment and Improvement**, which includes the following three elements:

- **Tool 4.1 – Overview of Organic Waste Management**
 - ➔ to gain an overview of the current organic waste management
- **Tool 4.2 – Evaluation and Improvement of Organic Waste Management**
 - ➔ to evaluate the organic waste management system and identify improvement options
- **Tool 4.3 – Technology Evaluation Tool (TET)**
 - ➔ Excel tool to evaluate the suitability of organic waste for different treatment options, as well as potential amounts of output products

2.4 Recyclable waste management

Recyclable waste management is the process of separating, storing, collecting, and reprocessing dry recyclable materials, such as metals, paper, cardboard, glass, and plastics, for reuse in the manufacturing of new products, thereby reducing waste and conserving resources. The specific assessment of recyclable waste focuses on understanding current practices for the recovery of recyclable materials and identifying the potential for further material recovery. This is an important step of an integrated and sustainable waste management system, as diverting recyclable materials from disposal has multiple benefits, including:

- Supporting livelihoods through value and job creation
- Contributing to the circular economy
- Reduce need for disposal
- Increase the lifetime of disposal sites

Recyclable recovery can occur through the SWM service in a formal manner or through the informal sector. The informal sector typically plays a crucial role in the value chain, ranging from gathering and collecting recyclable materials to selling them to the recycling system. Typically, some fractions might be separated regularly by waste generators and given to the active informal sector. The informal sector may also recover recyclables through waste-picking activities at various stages of the SWM system. These recyclables are then sold to the recycling market.

Including the informal sector and supporting it is recommended, as these individuals are often the most vulnerable and rely on it for their subsistence. For the recovery of recyclables, it is recommended to connect with existing recycling markets whenever possible as the first option. If no recycling markets are available for specific recyclable waste fractions, small-scale treatment and transformation could be implemented.

A key element for recyclable waste management is source segregation. Refer to the [Compendium – Waste Separation \(pp. 34-37\)](#) for more information on source segregation and understand its importance.

The assessment and improvement of recyclable waste management considers the entire SWM service chain and connects to the following most relevant chapters of the Compendium:

- [Storage \(pp. 42-53\)](#)
- [Collection and Transport \(pp. 54-71\)](#)
- [Treatment and Recycling \(pp. 72-79\)](#)
 - [T.6 Plastic Recycling \(pp. 90-91\)](#)
 - [T.7 Plastic Upcycling \(pp. 92-93\)](#)
 - [T.6 Plastic Downcycling \(pp. 94-95\)](#)
- [U.1 Sale of Recyclable Materials \(pp. 102-103\)](#)

To perform a detailed assessment and evaluate possible improvements of the current recyclables waste management system, use the **Tool 5 – Recyclable Waste Management – Assessment and Improvement**, which includes the following two parts:

- **Tool 5.1 – Overview of Recyclable Waste Management**
 - ➔ to gain an overview of the current recyclable waste management
- **Tool 5.2 – Evaluation and Improvement of Recyclable Waste Management**
 - ➔ to evaluate the recyclables waste management system in place and identify improvement options

2.5 Self-management

Self-management should be considered only for sparsely populated areas, especially in rural settings, where it may not be feasible to provide a conventional waste management service that includes waste collection, further disposal, or treatment. To prevent uncontrolled open dumping and open burning, safe self-management practices should be promoted, allowing waste to be managed individually by each household or waste generator with limited means. In this case, continuous support and supervision can be provided to implement and maintain the best possible practices. Safe self-management relies heavily on waste segregation and differentiated management of different fractions through the treatment of organic waste and the disposal of only the residual fraction of waste. Efforts to reduce and reuse before generating waste are also crucial in minimising the amounts, especially the residual fraction of waste that needs to be disposed of. Refer to the compendium:

- [Waste Prevention \(pp. 32-33\)](#)
- [Waste Separation \(pp. 34-37\)](#)

To protect public health, the following minimum requirements for self-management of waste are recommended:

- No open burning
- Waste must be disposed of using controlled waste pits, which should be regularly covered with inert material.
- Organics and recyclables should be separated from general waste and either managed on-site

The assessment and improvement of self-management connect to the following technology chapters of the Compendium:

For organics:

- [T.1 Composting \(pp. 80-81\)](#)
- [T.2 Vermicomposting \(pp. 82-83\)](#)
- [T.3 Anaerobic Digestion \(pp. 84-85\)](#)
- [T.4 Black Soldier Fly \(BSF\) Waste Processing \(pp. 86-87\)](#)
- [T.5 Making Fuel From Biomass \(pp. 114-115\)](#)

For plastics:

- [T.7 Plastic Upcycling \(pp. 92-93\)](#)
- [T.6 Plastic Downcycling \(pp. 94-95\)](#)

For recyclables:

- [U.1 Sale of Recyclable Materials \(pp. 102-103\)](#)

For residual waste

- [U.8 Controlled Waste Pit \(pp. 116-117\)](#)

To perform a detailed assessment and evaluate possible improvements of the current self-management system, use the **Tool 6 – Self-management – Assessment and Improvement**, which includes the following two parts:

- **Tool 6.1 – Overview of Self-management**
 - ➔ to gain an overview of the current self-management practices
- **Tool 6.2 – Evaluation and Improvement of Self-management**
 - ➔ to evaluate self- management improvements options

Step 3: Design and plan new SWM systems

This chapter focuses on the provision of new solid waste services. Hereafter, a step-by-step approach is proposed to design and plan new services throughout all stages of solid waste management: waste storage, collection and transport, disposal, and recovery of recyclables or organics. The specific case of sparsely populated areas is also considered in the last sub-chapter, along with safe self-management options. The chapters were divided according to the following structure and based on the priorities to protect public health described in **Part 1 – Key principles: A) Protection of public health**.

Highest priority to remove and contain mixed waste:

- 3.1 Storage, collection and transport
- 3.2 Disposal

Whenever possible, separate management of specific fractions with treatment and recycling:

- 3.3 Organic waste management
- 3.4 Recyclable waste management

Special case for sparsely populated areas, usually remote and rural:

- 3.5 Self-management

Although the following chapters are organised in a siloed manner, it is highly recommended to design and plan a new SWM system with an integrated approach, considering the entire SWM service chain: storage, collection and transport, disposal and treatment, and recycling (of both organics and recyclables).

Prior to starting the design and plan of new SWM systems, HAWAI users should be familiarised with the contents of the Compendium. This is to ensure that users have a basic understanding of SWM and comprehend how the different elements of the system interconnect and interact. The following chapters are most relevant:

- **Introduction (pp. 20-31)**
- [Preparing for SWM \(pp. 32-41\)](#)
- [Introduction to Storage \(pp. 42-47\)](#)
- [Introduction to Collection and Transport \(pp. 54-61\)](#)
- [Introduction to Treatment and Recycling \(pp. 72-79\)](#)
- [Introduction to Use and Disposal \(pp. 96-101\)](#)
- [Cross-Cutting Issues \(pp. 128-151\)](#)

3.1 Storage, collection and transport

In urban or high-density population settings, it is essential that waste is first safely stored and then collected and transported to a location for safe treatment, recycling, or disposal. Without a functioning collection system, waste will quickly accumulate or be burnt close to persons, creating direct health and environmental risks. In rural, sparsely populated areas, providing a collection service may not be feasible; instead, promoting and implementing self-management of waste should be encouraged (see **Chapter 3.5** further below). As a first step, it is necessary to assess and evaluate whether a collection system is reasonable, desirable, and sustainable in the long term.

Most situations will require the storage, collection, and transportation of waste. For more information about the relevant technologies, refer to the Compendium:

- [Storage \(pp. 42-53\)](#)
- [Collection and Transport \(pp. 54-71\)](#)

Hereafter, the main tasks and considerations are outlined to assist in designing and planning a new collection system. Humanitarian actors are encouraged to follow these suggested steps while also coordinating and engaging closely with all other relevant stakeholders, including the local government, service providers, host communities, implementing partners, and affected populations. For more information, see [Compendium – X.2 Inclusive Planning and Participation \(p. 132\)](#).

Task 1: Waste quantification and composition

First, the types and quantities of waste to be collected should be assessed. The more precise the information obtained and analysed, the more accurate the design and planning can be, with fewer adjustments and changes to the plan and design required during implementation.

A precise assessment of the type and quantity of waste can be conducted through a waste audit (see **Tool 7 – Waste Generation and Composition Study**). A waste audit can be time-consuming; therefore, it is recommended for humanitarian situations that show more stability and are less suited for rapid response or acute emergency phases.

If a waste audit is not considered feasible or if a quick and rough estimation is required, the Sphere standards recommend using 0.5 kg/capita/day as a quantity of waste generated, without any information about its composition.

Surveys can be a less resource-intensive alternative for a rapid estimation of the composition. Both audits and surveys are covered in **Tool 7 – Waste Generation and Composition Study**.

Note that to assess the potential of waste segregation and separate treatment for waste fractions (e.g., organic or recyclables), it is necessary to have information about the waste composition.

Besides waste generation, waste density is an important design parameter. Understanding the “bulkiness” of the waste helps estimate and design storage, transport, and recovery/transfer/disposal facilities. Waste density can be measured by filling containers of a given volume with waste and measuring the net weight of the waste contained within this volume. Density is expressed as weight per unit of volume (for instance, per m³, which is equivalent to 1,000 litres). The typical range for densities of non-compacted mixed waste in low- and middle-income contexts ranges from 200 to 400 kg/m³, depending on the waste composition. The higher the organic waste content is, the higher the density will be. Measuring the density is recommended to use a precise and context-specific value for the design. As a first approximation, the lower value of 200 kg/m³ can be used to calculate a conservative design value.

Density is also important, as both quantity (weight) and volume of waste generated should be known to compute the capacity of the equipment required to collect all the waste generated. In practice, either the volume or the weight limit of a container or vehicle will be reached first, and the one that is reached first becomes the limiting factor. This is why understanding the density of the waste is essential. For example:

- Low-density waste (like plastics or garden waste) may fill up a vehicle’s volume before reaching its weight capacity. This means the vehicle appears ‘full’ without being fully loaded by weight.
- High-density waste (like wet food waste or metals) may reach the weight limit of a vehicle or container quickly, even if there is unused volume remaining.

Special waste fractions may require special attention at this point, as it is essential to avoid mixing them with household and non-household (commercial, institutional, public) solid waste, which can create an overall hazard and increase difficulties in managing this mixed fraction. Hazardous healthcare waste, industrial waste, construction and demolition waste, or disaster waste are typical examples of these “special fractions” that require special consideration. For more information, refer to the [Compendium – Management of Special Waste Types \(pp. 152-168\)](#).

Example: You estimated the waste generation of a refugee camp with 10,000 persons to be 0.5 kg/capita/day – including household and non-household waste – and to have a density of 250 kg/m³ when non-compacted. You based these estimations on data from similar camps in the region. You have decided to postpone the waste audit for later, once the situation is more stabilised. This means your design estimate for collection is:

Generation (weight) = people * generation rate = 10,000 * 0.5 = 5,000 kg/day

Generation (volume) = quantity / density = 5,000 / 250 = 20 m³/day

To collect and manage 5,000 kg of waste per day, which amounts to approximately 20 m³ of waste volume.

Tools and further resources summary:

Waste quantities & composition



Tool 7 – Waste Generation and Composition Study



SPHERE standards*

* SPHERE rough estimate: 0.5kg/person/day (use only if a waste audit is impossible)

Task 2: Options analysis

The book **Collection of Municipal Solid Waste in Developing Countries (Manus Coffey & Adrian Coad, 2010)** is a more detailed resource and a go-to reference for planning new services.

When planning new storage, collection, and transportation services for waste, it is essential to consider the various available options, evaluate them, and select the most suitable solution. This decision will shape the subsequent stages of waste collection, as well as influence treatment, recycling and disposal choices.

At this stage of the evaluation and planning process, no detailed calculations are required. Instead, the primary goal is to identify one or more technological options for the entire collection service chain, including the method for collecting waste.

The assessment should encompass the entire pathway, from waste generation to treatment, recycling, or final disposal. Key elements to be examined include:

- **Collection methods** (e.g., door-to-door, roadside, community bins/containers).
- **Collection points** (locations and accessibility).
- **Containers and individual storage** (types, sizes, and design).
- **Collection vehicles** (whether primary or secondary).
- **Transfer stations** (if used).
- **Transfer vehicles** (long-haul or specialised transport, if used).

The priority option is to consider existing infrastructure and vehicles, as they enable a quick start to the collection and transportation service. Nevertheless, the efficiency of the existing system must be carefully evaluated.

It is essential to consider the design of an integrated collection chain, where each element is connected to the others in the most efficient manner possible to minimise the effort, time, and resources required for waste collection. Containers that are compatible with collection vehicles reduce handling time, prevent spillage, and limit exposure to pests and odours. When storage and collection systems are not aligned, it can lead to operational inefficiencies, increased labour demands, and environmental health risks. Integrating these components ensures a smooth waste flow and enhances the overall performance of the solid waste management system.

Another element to consider is the need for behaviour change campaigns to accompany the affected population in the new system. The system should be simple enough to encourage people to use it, utilising locally available equipment and infrastructure whenever possible.

Example: You are tasked with assessing the storage and collection options for a newly established refugee camp in Southeast Asia, which will serve 10,000 people. Several collection methods were assessed, including communal containers, door-to-door collection, and public litter storage. Factors such as accessibility, cost, ease of use for residents, and operational efficiency were taken into consideration. Given the warm and humid climate, which accelerates the decomposition of organic waste, the frequency and containment method were also key considerations.

You selected community containers as the most appropriate storage method, combined with distributing plastic bags to households to contain waste and facilitate easy loading into collection trucks. All collection points are accessible by truck, and a temporary disposal site has been designated outside the camp. To minimise health risks and odour, waste will be collected twice a week, which is appropriate given the climate and the high proportion of organic waste.

Tools and further resources summary:

Collection system technology and type options



[Compendium – Storage \(pp. 42-53\)](#)



[Compendium – Collection and transport \(pp. 54-71\)](#)



[Collection of Municipal Solid Waste in Developing Countries \(Manus Coffey & Adrian Coad, 2010\)](#)

Task 3: System design

In the previous step, a first draft of the waste collection system was prepared. Now, an estimate of the infrastructure, vehicles and staff requirements to set up and operate such a system can be made. The starting point is the amount of waste generated, which needs to be collected.

First, the capacity of waste storage prior to collection can be estimated. This includes individual storage and/or community and shared storage. Storage capacity should be sufficient to store the waste until the next collection, and therefore directly depends on the amount of waste generated and the frequency of collection. Storage should never overflow; a reserve of 20% volume can be added to the storage capacity to account for variability in waste generation and ensure that no overfilling occurs. For community and shared storage, the estimation follows the same procedure; however, each point will be used by a defined number of waste generators, thereby increasing the storage volume needed.

At the desired frequency of collection, the collection vehicles will need to collect all the waste assigned to those collection days. Depending on the system, the number of collection rounds the vehicles can fulfil during one working day can be calculated. The number of rounds times the vehicle's capacity must match the amount of waste that needs to be collected. Aiming for a filling rate of 80% for the vehicle is a good starting point to also account for variability in waste generation and maintain some reserves.

Once the infrastructure and vehicle requirements have been estimated, the number of staff required to operate the system can be calculated. Besides waste collectors, there will be a need for drivers, maintenance technicians, supervisors, managers, and administrative staff, especially for large systems. Consider involving workers who already have experience in waste management. In situations where formal employment may not be feasible, consider alternative options for allowing the involvement and contribution of labour.

At this point, various options for designing the collection system have been drafted, and they can now be compared and evaluated. At this point, a rough cost estimation (see **Tool 8 – Cost Evaluation**) can be prepared.

Example: You already have a 10 m³ open truck readily available that you can use for waste collection. At each of the community collection points, about 50 people will provide their waste for collection. You plan to collect waste twice a week, once after 3 days and then after 4 days of accumulation at the household level.

For designing the required storage volume at each collection point, you can base your calculation on the 4-day accumulation period. With a daily waste generation rate of 0.5 kg/person, this results in:

100 kg of waste per collection point over 4 days (50 persons × 0.5 kg × 4 days).

Given the waste density, this equals approximately 0.4 m³ per collection point.

The truck is available for collection 6 days a week, with 1 day reserved for maintenance. Considering a 20% operational buffer, the truck can effectively carry about 8 m³ or 2,000 kg of waste per trip. This means:

- One trip can service 20 collection points
- One collection point = 0.4 m³ = 100 kg, so 20 points = 8 m³ = 2,000 kg

If the truck completes 3 to 4 rounds per day, a rough weekly schedule might look like this:

Mondays & Thursdays: routes 1, 2, 3 (covering 60 collection points, which is 3,000 persons)

Tuesdays & Fridays: routes 4, 5, 6 (covering 60 collection points, which is 3,000 persons)

Wednesday & Saturdays: routes 7, 8, 9 and 10 (covering 80 collection points, which are 4,000 persons)

On Mondays, Tuesdays, and Wednesdays, only three days of waste accumulation will be collected. On Thursdays, Fridays, and Saturdays, the truck should be approximately 80% full after each route.

The staff required for the collection is one supervisor, two drivers, and eight waste collectors, based on an initial estimate that considers the need for different shifts throughout the week and potential absences, such as sick leaves or holidays. Furthermore, staff are required for education and awareness-raising, especially during the initial phase of the system.

Tools and further resources summary:

Cost evaluation tool



Tool 8 – Cost Evaluation

Task 4: Define schedule and routes

Now that the initial estimate of infrastructure, vehicles, and staff is ready, a precise schedule and routes can be established. This precise planning will further utilise the calculations performed in the previous step. Here, ensure that each vehicle and team has sufficient time to prepare the vehicles, collect waste, and transport it to treatment or disposal during a daily shift. Note that vehicles may perform multiple shifts in a single day, particularly in specific cases involving multiple staff teams.

The design of the route should consider minimising distances and fuel usage to be as efficient as possible. Avoid multiple passes on the same route, reduce the need for manoeuvres such as U-turns or reversing, and minimise stopping next to collection points to minimise the effort required to load waste. Routes should also minimise waiting time, and avoid congested traffic hours or take this into account.

Example: you prepare 10 routes on a map along with all the collection points along the routes. For each route, an estimate of 20 collection points (1,000 persons) are served by a waste collection service. You optimised the routes to minimise manoeuvres and passes on the same roads. The first service route will start at 7 am, allowing residents to deposit their waste at the collection points from the same morning or the night before. The team will need 10 minutes to prepare the truck and drive to the start of the first collection route. Furthermore, the travel time from the end of the route to the disposal site is approximately 10 minutes. The team will need an additional 20 minutes for unloading the truck and 20 minutes to travel to the following collection route. Waste will be contained in bags for easy loading and unloading. To collect the waste of 1 route, the estimated time is 90 minutes. Including time to arrive at the route start and to deliver and unload at the disposal site, in total, one route would take 150 minutes (10+90+10+20+20), thus approximately 2.5 hours to complete. A first shift can cover two routes in the morning, and a second shift can cover 1-2 other routes in the afternoon. After the day, 30 minutes are needed to drive to the parking and clean the truck. This estimate seems excessive in terms of working hours for only one team, including breaks and lunch. Two teams are likely to be required, each with one driver and four collectors.

Task 5: Communicating change

When initiating a new waste collection service, a communication campaign will be necessary to inform waste generators on how to use the service effectively. Engaging and collaborating with key stakeholders is also essential, and they should have been included from the beginning of the design and planning process for this new service. Communication should include information about collection schedules, sorting requirements and indications on how, where and when to provide waste. Tools best suited to the context should be used, such as flyers, public announcements, community meetings, religious gatherings, door-to-door information, and others. For more information on behaviour change, refer to the [Compendium – X.6 Hygiene Promotion and Behaviour Change \(pp. 139-141\)](#).

During the first piloting period, testing and adapting the collection system will be important. Encouraging residents to report any concerns or file complaints can support improving the collection service.

Example: As you prepare to launch a new household waste collection service, you organise a communication campaign two weeks before the rollout. Flyers are distributed in the local language, detailing the collection days, waste separation instructions, and how to place waste in the provided bags at designated points. You also hold community meetings in coordination with local leaders and announce the service through Friday Mosque gatherings and a mobile loudspeaker.

Key stakeholders, including community representatives and local health workers, were engaged early in the planning phase to ensure the service fits local habits and concerns. During the first month of piloting, a feedback mechanism is established via a simple phone line and a complaints box located at the local administration office. This helps you adjust collection times in one area where school hours created a conflict, and to reinforce sorting instructions where confusion arose.

Task 6: Rollout, monitor, adapt, adjust

Depending on the size of the area and the number of people requiring collection service, opting for a step-by-step approach can be important, piloting the system in a few areas first before expanding it. In the first phase, feedback from residents and staff, as well as monitoring data, will allow us to adjust the operations. Estimations used for the design can then be confirmed, allowing adjustments to routes, frequency, collection points, or any other element of the collection service chain if necessary. Based on these improvements, the service can be expanded to cover the entire area.

If there is no time to pilot the system, adjustments and adaptations can be made based on initial experiences for the entire coverage area. Similarly, a prerequisite for such adjustments is monitoring and evaluation. When starting the new collection system, cleaning of previously dumped and burned waste is important, as it is likely to have accumulated in critical hotspots in the past. Clean-up, combined with information and a request to the community to stop disposing of waste in such areas, is key.

Step 2 of the HAWAI guidelines can be used to assess further and improve an existing service: **2.1 Storage, collection and transport.**

Below are a few key performance indicators that should be monitored and evaluated as a basis for deciding what adjustments are needed:

- Time needed for each collection route and transport of waste to the disposal site
- Time needed for emptying the truck at the disposal site
- Distance travelled and fuel consumption
- Downtime of vehicles
- Storage capacity of collection points and the level of filling when collected
- Level of filling of vehicles at the end of each trip
- Community satisfaction

Based on service quality and reliability, indirect indicators such as the prevalence of unsafe practices (e.g., dumping and burning of waste) can be monitored.

Finally, it is also crucial to monitor the operational costs of the service. This includes labour costs, vehicle repair costs, fuel costs, equipment replacement costs, and other related expenses.

Ultimately, the goal is to have a highly effective collection service. The effectiveness is measured by how well it ensures reliable, accessible, and efficient removal of waste while protecting public health and the environment.

Small incremental changes to all aspects of the service can be made as needed, while observing how these changes affect indicators and performance improves. This can involve adjusting the collection frequency, adding new collection points, or modifying how waste generators provide their waste for collection.

Example: During the first three months of operating the new waste collection service, your team tracks key performance indicators such as route duration, truck filling levels, and fuel consumption. You notice that trucks are returning only 60% full from specific areas, while other routes regularly exceed storage point capacity before pickup. Based on this, you adjust the collection frequency, increasing pickups in high-density areas and reducing them in areas with lower waste volumes.

You also track vehicle downtime and maintenance costs, which helps identify that one truck requires more frequent repairs—leading to the decision to schedule preventive maintenance earlier. Meanwhile, a simple community feedback form distributed through local leaders shows increasing satisfaction and a visible reduction in illegal dumping sites.

3.2 Disposal

A safe disposal site is always necessary, and options should be identified early to avoid uncontrolled waste dumping or open burning. Priority should be given to upgrading existing uncontrolled sites before investigating new ones (refer to Chapter **2.2 Disposal** for existing sites). A new disposal site might be necessary when:

- There is no disposal site, or existing disposal sites are too far away
- The current disposal sites are reaching full capacity
- The current disposal sites are not adequate and cannot be upgraded
- An urgent new waste disposal is required due to the recent arrival of many displaced persons seeking shelter and protection in a designated camp setting, and where the existing disposal site of the host community is not able to accept this new amount of waste.

This chapter outlines the key steps and considerations for designing and planning a new disposal site. Humanitarian actors are encouraged to follow these steps and engage closely with all relevant stakeholders, including local authorities, service providers, the host community, affected populations, other humanitarian actors and sectors, NGOs, and CBOs.

This section relies on the existing publication [Guidelines for the Safe Disposal of Solid Waste in Humanitarian Contexts \(Tosi Robinson et al., 2024\)](#). Hereafter shortened as the “GTH disposal guidelines”. **Annexe 3 of the GTH disposal guidelines** provides a template for planning steps and a respective timeline. The main steps are described again in the following chapters, including references to key tools and additional resources.

For more information about controlled disposal, consult the [Compendium – U.9 Controlled Disposal Site/Landfill \(pp. 119-120\)](#).

Task 1: Waste quantification and composition

Knowing the type and quantity of waste to be disposed of is essential for planning sufficient capacity at the disposal site. Ideally, the disposal site should allow for at least 10 years of waste to be disposed of. The better the information on the type and quantity of waste, the better the design and planning of the disposal site can be. A standard method for assessing the type and quantity of waste is to conduct a waste generation and composition study (see **Tool 7 – Waste Generation and Composition Study**). Conducting a waste audit, however, can be time-consuming; therefore, it is recommended during the stabilisation and recovery phase. As an alternative to a waste audit, the Sphere standards recommend a standard value of 0.5 kg/capita/day, without considering the composition of the waste. Waste composition is, however, important as it allows for planning for the resource recovery of a certain fraction (organics and recyclables). Recovering and recycling specific fractions of waste will result in less waste that needs to be disposed of, thereby helping to save space at the disposal site and increase its lifespan.

The size of a disposal site is calculated based on the total waste produced during its lifetime. The planned lifetime of a disposal site can vary depending on the context, but long lifetimes (above 10 years) are generally preferred. The volume of waste that can be disposed of at the site also depends on how the site will be operated, in other words, how the vertical space can be used (upwards or downwards). As waste is continuously added, the site must remain stable throughout its lifetime, preventing any material slippage. A stable site is achieved by compacting and covering the waste and constructing stable slopes. To estimate the size of a disposal site, **Annexe 4 of the GTH disposal guidelines** can be used in conjunction with the [GTH Excel calculation tool](#).

Tools and further resources summary:	
Waste quantities & composition	 Tool 7 – Waste Generation and Composition Study  SPHERE standards* (Sphere, 2018) * SPHERE rough estimate: 0.5kg/person/day (use only if a waste audit is impossible)
Disposal site size	 GTH Excel Landfill area estimation tool  Annexe 4 of the GTH disposal guidelines
Controlled disposal technology	 Compendium – U.9 Controlled Disposal Site/Landfill (pp. 119-120) .

Task 2: Site selection

A suitable location for a disposal site fulfils several criteria to reduce health and environmental risks. **Annexe 5 of the GTH disposal guidelines** provides a list of key criteria to be considered. Identifying a suitable location requires consultation and engagement with local stakeholders, as formal approval from local authorities will be necessary. These stakeholders can provide valuable local insights and suggest alternative locations. If local authorities are supportive of a new disposal site, investigating publicly owned land would help accelerate the process of setting it up and reduce potential land ownership issues.

As disposal sites pose a considerable risk to water resources, consulting with a hydrogeologist is crucial to validate that a site is suitable and will not pose a risk to water resources that are currently used or could be used for drinking water or agriculture in the future.

Tools and further resources summary:	
Criteria for site location	 Annexe 5 of the GTH disposal guidelines

Task 3: Evaluate and prioritise the mitigation measures

At a designated disposal site, measures should be implemented to mitigate public health and environmental risks. Some minimum requirements should be ensured. To select which mitigation measures can be prioritised and implemented, consult **Chapter 2.3 and Table 3 of the GTH disposal guidelines**. The feasibility of each mitigation measure should be evaluated based on the resources available for the construction and operation phase of the disposal site. To ensure proper operation at a disposal site, staff are required for various tasks, including supervision, waste handling, compaction, and covering. The staff requirements should also be estimated and will vary depending on the site size and whether mechanical equipment will be available for handling waste, compaction, covering and other operations at the site.

At this step, it is essential to estimate costs, prepare budgets, and evaluate the feasibility of implementing the prioritised mitigation measures (use **Tool 8 – Cost Evaluation**). As the disposal site is planned to operate for many years, long-term financial sustainability should be considered early on by computing operational costs and ensuring that the owner and operator (often the municipality) can bear these costs in the long run when humanitarian actors hand over the operations. For more information about hand-over strategies, see **Compendium – X.1 Institutional and Regulatory Environment (pp. 130-131)**.

Tools and further resources summary:	
Criteria for site location	 Table 3 of the GTH disposal guidelines
	 Chapter 2.3 of GTH disposal guidelines
Controlled disposal technology	 Tool 8 – Cost Evaluation

Task 4: Secure political endorsement

From the onset of the design and planning process, key local stakeholders must be engaged. Prior to the site receiving waste, governmental approval is required. Check country-specific legislation to determine the procedures required to open new disposal facilities. It may be necessary to prepare approval documents, such as a feasibility study or an environmental impact assessment, among others. Refer to each country-specific legislation and requirements.

Once formal approval is granted, local authorities can allocate land for disposal operations if they are the owners, or it can be purchased from private owners.

Task 5: Site preparation

Preparation of the site prior to operation must follow the site design and the selected mitigation measures. The site should be cleared of trees and other vegetation, except for the area surrounding the site, where vegetation acts as a green buffer. The ground surface needs to be prepared to receive the waste. This involves either ground levelling, excavation and compaction, or even the installation of bottom liners. It is recommended and often legally required (depending on the country, type of landfill, and the classification of the waste being disposed of) to have a liner for disposal sites. However, in low-income countries or during emergency and displacement settings, liner systems may not be feasible due to cost, lack of materials, technical complexity, or urgency. Access roads to the site need to be constructed if they do not already exist. Internal access roads, leachate drainage, containment and treatment and rainwater drainage must be constructed. Finally, auxiliary constructions such as the perimeter fence, control building and gate, as well as sanitary facilities for workers, also need to be constructed. For more information on the disposal site design and mitigation measures, refer to **Chapters 2.2, 3, and 4 of the GTH disposal guidelines**.

Tools and further resources summary:	
Site preparation & construction of initial infrastructure	 Chapter 2.2 of GTH disposal guidelines (disposal site design)
	 Chapter 3 of GTH disposal guidelines (how to operate a disposal site)
	 Chapter 4 of the GTH disposal guidelines (how to further reduce impact)

Task 6: Site planning

An operational plan directs the operations at the disposal site and is therefore an important guidance document. This includes site planning, which describes how and which areas of the site will be organised over time, defining the main waste disposal areas, routes, and facilities, such as the entrance gate. A waste placement plan provides directives on where the waste should be deposited at the disposal site in the short term and how the disposal site will be constructed, cell by cell. For more information on operations at a disposal site, refer to **Chapter 3 of the GTH disposal guidelines**.

Tools and further resources summary:	
Disposal site operation	 Chapter 3 of the GTH disposal guidelines

Task 7: Launch operations

Waste is deposited in accordance with the filling and waste placement plan. To ensure a basic level of control at the disposal site, it is essential to handle waste appropriately from the start of operations. See **Chapter 3 of the GTH disposal guidelines: How to operate a disposal site**.

Tools and further resources summary:	
Disposal site operation	 Chapter 3 of the GTH disposal guidelines

Task 8: Monitoring and evaluation

To ensure a basic level of control at the site, it is essential to regularly assess whether the mitigation measures in place are adequate and whether adjustments are needed. Particular attention should be paid to the waste being spread, compacted, and regularly covered with inert materials.

A disposal site should never have any fires or burning waste. Regular surveillance and prompt intervention in the event of a fire are crucial. Compacting and covering waste mitigates the risks of fires.

Groundwater and surface water contamination can be monitored with regular water testing. Results can indicate whether the leachate from waste disposal is responsible for contaminating water bodies. Such an impact is likely to occur if the disposal site is not adequately controlled and lacks a bottom liner and effective leachate management. Monitoring of water quality can provide an early warning of the magnitude of such contamination, allowing informed decisions regarding the downstream uses of these water resources to be evaluated and possibly avoided.

Impacts of the disposal site on nearby communities should be regularly monitored. Consider the impacts of factors such as the presence of pests and animals, odours, smoke, contamination of water, land, and windblown waste.

To assess the disposal site, the **Chapter 2.2 Disposal** can be used.

Tools and further resources summary:	
Disposal site operation	 Chapter 2.2 Disposal

Task 9: Site closure

A disposal site has a defined lifetime and can be closed for several reasons, including when it is full, is non-compliant with regulations, suffers from community pressures, or poses a public health risk. A closure plan should be established, with resources reserved for both the closure period and post-closure monitoring. See **Chapter 5 from the GTH guidelines: how to close a disposal site**.

Tools and further resources summary:	
Closing a disposal site	 Chapter 5 of the GTH disposal guidelines

3.3 Organic waste management

Organic waste often represents a significant proportion of the total amount of solid waste produced in low- to middle-income settings (more than 50%). When not adequately managed, organic waste can heavily affect the environment and human health by leading to:

- (Ground)water pollution through leachate
- Greenhouse gas emissions (mainly methane (CH₄), carbon dioxide (CO₂), nitrous oxide (N₂O))
- Proliferation of disease vectors, such as flies, mosquitoes, and rats
- Odour nuisance
- Depletion of nutrient resources

Diverting organic waste from disposal can extend the lifetime of disposal sites, reduce their negative impacts, and generate valuable products, livelihoods, and further benefits for the community. As such, organic waste management is a key component of an integrated and sustainable waste management system. To efficiently recover organics, however, it is crucial to separate them from other waste streams. Even in the absence of formal recovery services, many waste generators may already be reusing organics for their own purposes, such as feeding animals or home composting. When designing a new organic waste management system, it is therefore important not to disrupt or compete with these existing practices. Instead, the system should target the portion of organic waste that is currently unused, mixed with other waste, and ultimately sent for disposal.

Hereafter, the main steps and considerations for designing and planning a new organic waste management system are described. Humanitarian actors are encouraged to follow these steps and coordinate closely with all relevant stakeholders, including local authorities, the community, other humanitarian actors and sectors, NGOs, and CBOs.

Task 1: Organic waste quantification

First, the amounts and types of organic waste that can potentially be treated separately should be assessed. This can be achieved through a waste generation and composition study (see **Tool 7 – Waste Generation and Composition Study**), which will provide information on the daily volume generated. Here, it is possible to distinguish multiple fractions of organic waste, such as kitchen waste, garden waste, or green waste, which is important to know when selecting treatment technology. Typically, organic waste is the largest fraction in municipal solid waste, accounting for 50 to 80% of the total weight. This value may vary, and therefore, it should be measured more precisely. Secondary data no older than 5 years can be considered as a first approximation. Using such data may serve its purpose when piloting a smaller-scale system. However, secondary data should be evaluated with care, especially when planning for the design and operation of an organic waste management system involving one or many large organic waste treatment plants (>5 tons/day).

Organic waste management and treatment can benefit from co-treatment with other waste streams, such as agricultural waste, animal manure, or sanitation wastes, including faecal sludge. Assessing the quantities and availability of potential co-treatment feedstocks may be a relevant consideration. Co-treatment can pose higher risks due to the presence of pathogens in other waste streams. Additional risks should be accounted for and considered if co-treatment is envisaged.

At this point, it is essential to consider how to capture organic waste at the source. Is there any competitive use for direct animal feed? How much of the organic waste will the waste generators likely separate, and how much can I expect to collect for organic waste treatment? It is essential to consider the quantity, quality, availability, and accessibility of the organic waste streams.

Tools and further resources summary:

Waste quantities & composition



Tool 7 – Waste Generation and Composition Study

Task 2: Options analysis

When evaluating options for organic waste treatment, it is essential to consider the primary purpose. Is it to divert waste from disposal? Is it to help co-treat other waste, such as animal manure and faecal sludge? Is your primary interest to recover energy from organic waste, or to capture the nutrients in organic waste for soil amendment and fertiliser? Or are the main reasons instead of socio-economic nature to provide livelihood opportunities and facilitate empowerment? With one or several purposes in mind, multiple elements should then be considered in terms of technical, economic, social, environmental, and legal aspects to select a suitable technology.

The Compendium proposes five potential organic waste treatment technologies:

- [T.1 Composting \(pp. 80-81\)](#)
- [T.2 Vermicomposting \(pp. 82-83\)](#)
- [T.3 Anaerobic Digestion \(pp. 84-85\)](#)
- [T.4 Black Soldier Fly \(BSF\) Waste Processing \(pp. 86-87\)](#)
- [T.5 Making Fuel From Biomass \(pp. 114-115\)](#)

Additionally, the publication [Selecting Organic Waste Treatment Technologies SOWATT \(Zabaleta et al., 2020\)](#) provides detailed guidance on how to evaluate and compare different technologies. Hereafter is a simplified list of the key elements to consider for the evaluation.

Technical aspects

- Are the waste characteristics and amounts suitable for the considered treatment option? Use the **Tool 4.3 – Technology Evaluation Tool (TET)**.
- Is it likely that the waste generators will separate organics, and is it then possible to collect and transport the organics to the treatment facility?
- Can the collection and transport system be adapted to allow for segregated collection?
- Where will the facility be located, and how large would it be? Will it be a centralised or decentralised treatment facility?
- Is there access to experts who can design and build a treatment facility?
- Is there a sufficient level of knowledge in-house to operate and maintain the facility? If not, is it possible to train staff on that?

Governance aspects

- Who will be operating the treatment facility?
- Who will own the treatment facility?
- What is the operator model envisaged for the facility?
- Is there an enabling legal and policy framework?
- What institutional coordination is required?

Economic aspects

- Is there a market demand for the end-product?
- What is the potential market value of the product?
- Is there a budget to cover the capital cost (CAPEX) and operational cost (OPEX)?
- How will long-term financial sustainability be ensured?
- Is there a handover strategy in place?

Social and environmental aspects

- Is waste segregation a common/accepted practice?
- Is it socially appropriate and accepted in the given context to use the end-product? (e.g. cook with biogas from waste source or use compost made from waste, etc.)
- Have there been past bad/good experiences with such a treatment option in the local context, which could discourage/favour the use of such an option?
- Are there any expected positive or negative impacts on nearby communities due to the implementation of a new organic waste treatment facility?
- Who is expected to benefit from the products generated at the treatment facility?

Legal aspects

- Is there any legislation/policy preventing the use of such a treatment option?
- Is there any legislation/policy preventing the use of the end-product?
- Are there any legislation/policy setting standards for process or end-product quality?

Once these aspects have been thoroughly evaluated, there will be better clarity on the suitability of the selected technology, and the next design and planning steps can be pursued.

Tools and further resources summary:	
Organic waste technology options	 Compendium - Treatment and Recycling (pp. 72-89)  Selecting Organic Waste Treatment Technologies SOWATT (Zabaleta et al., 2020)
Technology evaluation	 Tool 4.3 – Technology Evaluation Tool (TET)

Task 3: Collection system

Organic waste treatment greatly benefits from separation as early as possible, as organic waste is of higher quality when separated early compared to being sorted from waste in later stages of the solid waste management system. Priority should therefore be given to systems that integrate waste segregation at the source. For more information on source segregation, refer to the [Compendium – Waste Separation \(pp. 34-37\)](#). Once segregated, multiple systems can be considered for the separate collection of organic waste. It can be collected using dedicated containers at collection points. However, this alternative can pose the challenge of limited control over what people deposit in the organic waste container. Instead, door-to-door collection with a separate organic waste bin provides easier control and possibilities to train and inform users about correct waste segregation practice.

Incentive systems are also possible, where waste generators can use community drop-off systems at centralised locations and then receive a reward for this practice, for instance, in the form of a recycled organic waste product (such as compost or biogas). Organic waste that is not segregated correctly will require further strenuous sorting to remove undesired materials, such as plastics or other impurities, before undergoing organic waste treatment. Impurities can negatively affect the process, the quality and the value of the end products.

When defining how organics will be collected, consider past experiences in the area and previous practices that users are commonly familiar with. Engagement with local authorities, service providers, and the communities directly will be important in designing a system that is suitable for all.

For more information on the design and planning of the collection system, refer to the **Chapter 3.1 Storage, collection and transport**.

Tools and further resources summary:	
Design and planning of the collection system	 Chapter 3.1 Storage, collection and transport  Compendium – Storage (pp. 42-53)  Compendium – Collection and Transport (pp. 54-71)  Compendium – Waste Separation (pp. 34-37)

Task 4: Behaviour change

Behaviour change is a critical element for the success of organic recovery projects. A behaviour change campaign should be prepared and implemented in conjunction with the introduction of the new system for organic waste collection and treatment. The goal is to inform all waste generators about the new modalities and provide them with the necessary tools to use the system effectively and properly segregate their waste. It should be considered that waste segregation might be a completely new practice, requiring users to learn how to do it correctly and to develop a new habit, which is often not straightforward. Community engagement and participatory planning will be essential to create ownership for organic waste management practices and waste segregation.

To plan and design a behaviour campaign, several approaches exist. One of them is the Risks, Attitudes, Norms, Abilities and Self-regulation (RANAS) approach. This approach considers factors influencing a specific behaviour in a specific population and then proposes multiple interventions to trigger behaviour change.

For more information on behaviour change, refer to the [Compendium – X.6 Hygiene Promotion and Behaviour Change \(pp. 139-141\)](#) and to the [Compendium of Hygiene Promotion in Emergencies \(Gensch et al., 2022\) – Social and Behaviour Change](#).

A behaviour change campaign is a long-lasting intervention that lasts months and years following the implementation of an organics management project. For any campaign, the key is to ensure that it targets a specific location and audience (e.g., markets, households, schools, etc.), bringing focus to the specific issues and challenges faced by the local community. Intense efforts will be required at the launch of the new system. Then a regular program must be maintained in the long run to stabilise the behaviour and turn it into a habit.

Tools and further resources summary:

Behaviour change	 Compendium – X.6 Hygiene Promotion and Behaviour Change (pp. 139-141)
	 Webpage of RANAS: https://ranas.ch
	 Compendium of Hygiene Promotion in Emergencies (Gensch et al., 2022) – Social and Behaviour Change

Task 5: Piloting

It is essential to consider piloting solutions before scaling them up. By implementing a pilot, it is then possible to recognise challenges and test improvements to learn and adapt for the scale-up phase at a later stage. Piloting is important for both the separate storage, collection and transport as well as for the treatment itself. Piloting will help evaluate the real costs and resources required to implement the new system at scale more effectively. Piloting can also help compare different types of systems for separate organic waste collection when there is uncertainty about which system to implement. Piloting may also play a crucial role in bringing the community or affected population on board. The extent of the pilot area can vary, but it should not be too small and should be able to capture a representative situation of the future scale-up stage. Piloting with at least 100 households is suitable, although this may vary depending on the size and complexity of the entire project area, as well as the existing SWM system.

A pilot project can also focus on a large organic waste generator, such as a market, or a group of restaurants or shops, to facilitate easier access to organic waste and conduct a pilot of separate collection as well as treatment.

This initial pilot phase provides the first experience and adjustments with organic waste treatment, which will be invaluable once the amount of organic waste to manage increases during scaling up.

Task 6: Evaluate costs and financial sustainability

If various system options are considered and the infrastructure, vehicles, and staff needs for each option are estimated, it becomes possible to compare them and make informed decisions on the feasibility of each system. Pilot testing of the options may also provide a clearer understanding of the resources required for large-scale implementation. At this point, a complete cost estimation (see **Tool 8 – Cost Evaluation**) is crucial to have a plan for how the system will be financed in both the short and long term. Using the data collected in task 1, it is possible to estimate the potential income from the products of organic waste treatment, which can partly cover the costs. Nonetheless, this will likely contribute only a small fraction of the total costs. Organic waste management results in new costs but reduces costs in other stages of the waste management system, for instance, at disposal sites – reducing the amounts to be managed and increasing the lifetime of the disposal site.

Tools and further resources summary:

Cost evaluation tool



Tool 8 – Cost Evaluation

Task 7: Rollout, monitor, adapt, adjust

Depending on the size of the area and the number of people being served, service providers may choose to acquire materials, equipment, and vehicles and to build the required infrastructure using a step-by-step approach. In the first phase, feedback from residents and staff, along with monitoring data, can guide necessary adjustments. These may include modifications to routes, frequency, collection points, or other elements of the organics collection service chain.

For organic waste management to be efficient, the most important parameter is the quality of waste segregation. Well-segregated waste is easier to handle and produces higher-quality, value-added products without undesired impurities, such as plastics.

Another important parameter is the share of organics that are recovered compared to the amount of organic waste generated. In an ideal scenario, all the organic waste generated is segregated and collected separately. This scenario is often not achievable, and some organics will ultimately still end up in the mixed waste. Nonetheless, measuring the amounts of organics collected and aiming to increase the organic segregation and recovery rates is important. Regular data collection is thus necessary and can inform decisions on improvements to the system, adapting the behaviour change campaign to increase rates of recovery as well as the quality of organic segregation. Evaluating the overall system efficiency is also relevant for planning the future and informing whether changes are desired or required. Adjustments can take place at any time if regular evaluation of the organic waste management system is ensured (see **Chapter 2.3 Organic waste management**).

Tools and further resources summary:

Organic waste management assessment and improvement



Chapter 2.3 Organic waste management

3.4 Recyclable waste management

Recyclables waste management is the process of collecting, sorting, and reprocessing non-biodegradable recyclable materials such as metal, paper, cardboard, glass, and plastics to be reused in manufacturing new products, thus reducing waste and conserving resources. This is an important step of an integrated and sustainable waste management system that has multiple benefits, including:

- Value and job creation
- Contributing to the circular economy
- Reduce need for disposal
- Increase the lifetime of disposal sites

Recyclables recovery can happen as part of the SWM service through a formal or informal sector.

Hereafter, the main steps and considerations for designing and planning a new recyclable waste management system are described. Humanitarian actors are encouraged to follow these steps and coordinate closely with all relevant stakeholders identified, including other humanitarian actors and sectors, NGOs, CBOs, local authorities, and the community.

Task 1: Recyclables quantification

First, the amount of recyclable waste should be assessed. It is essential to remember that, depending on the specific context, different types of materials may be recoverable. Therefore, you must evaluate the waste materials currently in demand in an existing recycling market, who accepts these materials and how the value chain of recyclables is set up. Together with local authorities and service providers, recyclable businesses should be investigated and identified to provide more information on the materials they buy and sell, as well as the reasons behind these choices.

It is then important to assess the amounts of recyclables generated in the area of concern, specifically for each type of recyclable waste material. This can be achieved through a waste generation and composition study (see **Tool 7 – Waste Generation and Composition Study**), which will provide information on the daily quantities of each material generated, potentially identifying materials that can be recycled. Having precise data is important for planning, as your initial design will be based on this information.

As the amounts and types of recyclable materials can vary significantly depending on the local context, it is not possible to provide a rough general estimate. Some secondary information might, however, exist. This can be useful, but only as a very tentative first approximation. In any case, it is essential to gather reliable data for the design and planning of the new system.

Tools and further resources summary:

Waste quantities & composition



Tool 7 – Waste Generation and Composition Study

Task 2: Entering the market for recyclables or evaluating options for on-site recycling

As previously mentioned, for many recyclable materials, the simplest solution is to tap into existing markets and hand over (or sell) recyclable materials to already established actors in the sector. The **Compendium** can be consulted regarding handing over to the existing market:

- [U.1 Sale of Recyclable Materials \(pp. 102-103\)](#)

Another alternative is to implement small-scale recycling facilities. Any on-site option you might consider must be **carefully evaluated** in terms of its **technical, economic, social, environmental, financial, and legal aspects**. The Compendium proposes three technologies for on-site recycling:

- [T.6 Plastic Recycling \(pp. 90-91\)](#)
- [T.7 Plastic Upcycling \(pp. 92-93\)](#)
- [T.8 Plastic Downcycling \(pp. 94-95\)](#)

If there are already existing recyclable recovery systems in place, they can be assessed, improved if needed and expanded also to cover new service areas or to include more recyclable types (see **Chapter 2.4 Recyclable waste management**). This can serve as the starting point for designing and planning new services.

Informal sector activities should be carefully evaluated and understood. It is crucial not to create unfair competition and negatively affect the existing informal sector activities, as these typically involve the most vulnerable individuals and should not be threatened in their livelihood activities. The informal sector may already recover a significant amount of recyclables without being prominent or visible. Whenever possible, supporting the informal sector and integrating it into the recyclables recovery system should be pursued as a priority.

The following tasks outline the process of designing and planning a formal system for the recovery of recyclables. Throughout the various tasks, always consider and include informal sector actors in the planning process. **An alternative approach to direct service delivery is to focus solely on supporting the informal sector and empowering them to take complete responsibility for recyclable recovery.** This approach should be prioritised whenever the informal sector already plays a major role and is very active in recovering recyclables. For more information on integrating the informal sector into waste management, consult the publication: [Recovering resources, creating opportunities – Integrating the informal sector into solid waste management \(GIZ, 2011\)](#).

Tools and further resources summary:	
Assessment & improvement of the existing recycling market	 Tool 5: Recyclable Waste Management – Assessment and Improvement  Compendium – U.1 Sale of Recyclable Materials (pp. 102-103)
On-site recycling of plastic	 Compendium – T.6 Plastic Recycling (pp. 90-91)  Compendium – T.7 Plastic Upcycling (pp. 92-93)  Compendium – T.6 Plastic Downcycling (pp. 94-95)
Informal sector integration	 Recovering resources, creating opportunities. Integrating the informal sector into solid waste management (GIZ, 2011)

Task 3: Collection system

Recyclable recovery greatly benefits when these materials are separated from other waste fractions as early as possible from the waste. Priority should be given to systems involving waste segregation at the source, as the materials obtained through segregation will be of higher quality compared to those separated from mixed waste in later stages of the SWM service chain. For more information on waste segregation, refer to the [Compendium – Waste Separation \(pp. 34-37\)](#).

Multiple systems can be considered for collecting separated recyclables. Recyclables can be collected through the formal collection service using dedicated containers or designated locations for recyclables. Although these community collection points can pose a challenge in that they lack direct control over which materials are deposited. Door-to-door collection using a dedicated bin or bags, on the other hand, can provide much more control and direct possibilities to train and inform users about correct waste segregation. Community drop-off points, which include an incentive or reward for users to bring their recyclables, may be another alternative. Recyclables can be received or collected for each type of material separately, or they may be collected together as a single “recyclable fraction.” It is, however, important to ensure knowledge and awareness of what materials are acceptable as part of this “mixed” recyclable fraction. Mixed recyclables collection might be easier to implement, but it will require further sorting into individual material types.

When defining how recyclables will be gathered and managed, consider past experiences in the area and previous practices that users may have already employed. Engaging with local authorities, service providers, and the community will be important in designing a system that is suitable for all.

For more information on the design and planning of the collection system, refer to the **Chapter 3.1 Storage, collection and transport**.

Tools and further resources summary:	
Design and planning of the collection system	 Chapter 3.1 Storage, collection and transport  Compendium – Storage (pp. 42-53)  Compendium – Collection and Transport (pp. 54-71)  Compendium – Waste Separation (pp. 34-37)

Task 4: Behaviour change

Behaviour change is a critical element for the success of recycling recovery projects. A behaviour change campaign should be prepared and implemented in conjunction with the introduction of the new system for recyclable recovery. The goal is to inform all waste generators about the new modalities and provide them with the necessary tools to use the system effectively and properly segregate their waste. It should be considered that waste segregation might be a completely new practice, requiring users to learn how to do it correctly and to develop a new habit, which is often not straightforward.

To plan and design a behaviour campaign, several approaches exist. One of them is the Risks, Attitudes, Norms, Abilities and Self-regulation (RANAS) approach. This approach considers factors influencing a specific behaviour in a specific population and then proposes multiple interventions to trigger behaviour change.

For more information on behaviour change, refer to the [Compendium – X.6 Hygiene Promotion and Behaviour Change \(pp. 139-141\)](#) and to the [Compendium of Hygiene Promotion in Emergencies \(Gensch et al., 2022\) – Social and Behaviour Change](#).

A behaviour change campaign is a long-lasting intervention that lasts weeks, months, and years following the implementation of a recyclables management project. Intense efforts will be required at the launch of the new system. Then a regular program must be maintained in the long run to stabilise the behaviour and turn it into a habit.

Tools and further resources summary:	
Behaviour change	 Compendium – X.6 Hygiene Promotion and Behaviour Change (pp. 139-141)  Webpage of RANAS: https://ranas.ch  Compendium of Hygiene Promotion in Emergencies (Gensch et al., 2022) – Social and Behaviour Change

Task 5: Piloting

It is essential to consider piloting solutions before scaling them up. By implementing a pilot, it is then possible to recognise challenges and test improvements to learn and adapt for the scale-up phase at a later stage. Piloting is important for both storage, collection, and transport, as well as for the treatment itself (if any) or the handover to existing markets. By implementing a pilot, it is then possible to recognise challenges and test improvements in order to learn and adapt for the scale-up phase at a later stage. Piloting will help evaluate the real costs and resources required to implement the new system at scale more effectively. Piloting recyclable recovery can also help compare different types of systems when there is uncertainty about which system to implement. The extent of the pilot area can vary, but it should not be too small and should be able to capture a representative situation of the future scale-up stage. Piloting with at least 100 households is suitable. However, this may vary depending on the size and complexity of the entire project area, as well as the existing solid waste management system in place. When multiple waste collection systems exist, it may be helpful to pilot recyclable recovery in each of these systems to assess their performance in combination (for example, door-to-door collection, roadside collection, summoned collection, self-delivery, etc.). A pilot project can also focus on a large waste generator which generates high amounts of recyclables.

This initial pilot phase provides the first experience and adjustments with recyclable waste management, which will be invaluable once the volume of recyclables to manage increases during scaling up.

Task 6: Evaluate costs and financial sustainability

If various system options are considered and the infrastructure, vehicles, and staff needs for each option are estimated, it becomes possible to compare them and make informed decisions on the feasibility of each system. Pilot testing of the options may also provide a clearer understanding of the resources required for large-scale implementation. At this point, a cost estimation (see **Tool 8 – Cost Evaluation**) is crucial to have a plan for how the system will be financed in both the short and long term. Using the data collected in Task 1, it is possible to estimate the potential income from recyclable sales, which can partly cover the costs. Nonetheless, this will likely contribute only a small fraction of the total costs to implement a recyclable recovery system. Recyclable recovery creates new costs but reduces costs in other stages of the waste management system, for instance, at disposal sites – reducing the amounts to be managed and increasing the lifetime of the disposal site.

Tools and further resources summary:

Cost evaluation tool



Tool 8 – Cost Evaluation

Task 7: Rollout, monitor, adapt, adjust

Depending on the size of the area and the number of people being served, service providers may choose to acquire materials, equipment, and vehicles and to build the required infrastructure using a step-by-step approach. In the first phase, feedback from residents and staff, along with monitoring data, can guide necessary adjustments. These may include modifications to routes, frequency, collection points, or other elements of the recyclables collection service chain.

For recyclables recovery to be efficient, the most important parameter is the quality of waste segregation. Well-segregated waste will be easier to handle and produce higher-quality, value-added products without undesired impurities. Another important parameter is the share of recyclables that are being recovered compared to the total amount of recyclables generated. In an ideal scenario, all recyclables that are generated are segregated and collected separately. This scenario is extremely hard to achieve (even in developed economies), and some recyclables will ultimately still end up in the mixed waste. Nonetheless, measuring the amounts of recyclables collected and aiming to increase recyclable segregation and recovery rates is important. Regular data collection is thus needed and can inform decisions on improvements to the system, adapting the behaviour change campaign to increase rates of recovery as well as quality of recyclable segregation.

Evaluating the overall system efficiency is also relevant for planning the future and informing whether changes are desired or required. Adjustments can take place at any time if regular evaluation of the recyclable recovery system is in place (refer to **Chapter 2.4 Recyclable waste management**).

Tools and further resources summary:

Recyclable waste management assessment and improvement



Chapter 2.4 Recyclable waste management

3.5 Self-management

This chapter proposes a step-by-step approach to designing and planning for the safe self-management of waste. Self-management of waste is suitable for very sparsely populated areas where a waste collection service is not feasible. Remote and rural areas with very low population density may be situations where self-management is more appropriate. Providing collection services for small amounts of waste, however, would be very costly if requiring a long transport distance. Instead, promoting and supporting safe self-management to limit the impacts of waste would be a much more cost-effective approach. Self-management is not an ideal solution, but it can improve waste management.

Task 1: Waste quantification and composition

A first step is to understand better how much waste is generated and of what type. A standard method for assessing the type and quantity of waste is to conduct a waste generation and composition study (see **Tool 7 – Waste Generation and Composition Study**). Without a waste generation and composition study, you can use the Sphere standards as a rough starting estimate. Sphere standards recommend using 0.5 kg/capita/day as a quantity of waste generated, without any information on its composition. In the case of self-management, it is essential to gather information about waste composition because it will heavily rely on treating different fractions separately (organics, recyclables, residual waste).

Tools and further resources summary:	
Waste quantities & composition	 Tool 7 – Waste generation and composition study

Task 2: Community involvement

Self-management requires individuals to take responsibility and actively manage their own waste. Early involvement and engagement of the community is therefore essential for the success of any initiative aiming to improve waste safe self-management practices. The goal is to empower individuals to self-manage their waste in the most effective way possible, set priorities, implement targeted interventions, and develop resilient yet straightforward solutions at the local level. It is crucial to raise awareness about the risks associated with poor waste management practices and to engage communities in adopting alternatives for improved management.

Task 3: Explore synergies

Despite focusing on self-management of waste at a local level, there may still be opportunities to find synergies with external actors, such as recyclers or nearby municipalities, that could support waste management activities. Collection of recyclable waste, for instance, could be organised with the private sector or the informal sector. This might even generate possible income from the sale of these recyclable materials. Note that recyclers will only be interested in obtaining these materials if there is a positive economic value to offset the cost of their engagement. This will most likely be achieved by collecting larger volumes of recyclables at one time. Planning and organising the collection of recyclables at regular intervals, such as once a month or on demand, should be assessed and discussed with the relevant parties.

The role of humanitarian actors would be to facilitate contact between parties and provide support to ensure a beneficial arrangement for both parties. Another potential actor might be nearby municipalities, which might be interested in inter-municipal arrangements to leverage economies of scale. For instance, for the disposal of waste, although waste is initially collected and then disposed of at a controlled disposal site, this no longer constitutes a self-management situation but instead shifts to a service provision scheme (**Chapters 3.1-3.4**).

Task 4: Develop a SWM strategy

As self-managed waste is managed locally by individuals, prevention (reducing waste generation) should be a priority for the strategy. Besides prevention, separating waste at the source into different fractions should be the backbone of safe self-management. For more information about prevention and separation, the Compendium should be consulted:

- [Waste prevention \(pp. 32-33\)](#)
- [Waste Separation \(pp. 34-37\)](#)

This is especially important for organic waste, which is typically the largest fraction of waste, particularly in rural contexts. These should be completely diverted from disposal and treated separately. Another fraction that can be valorised is the recyclables, for which partnerships with nearby municipalities or recyclers can be established. Even with these strategic priorities in place, some residual waste will still need to be disposed of safely.

You may consider different treatment strategies for self-managed waste. Organic waste, for instance, can be treated by each household separately (e.g., with home composting bins or as direct animal feed) or jointly managed among nearby households. Such decisions should be made through a participatory planning process that involves the community.

Tools and further resources summary:

Waste prevention and separation strategies



[Compendium – Waste Prevention \(pp. 32-33\)](#)



[Compendium – Waste Separation \(pp. 34-37\)](#)

Task 5: Evaluate treatment and disposal technologies

To evaluate treatment and disposal technologies, the Compendium of SWM in humanitarian contexts can be used. Three main waste fractions must be considered: organics, recyclables, and residual waste.

For organics, the **Compendium** proposes five possible options: composting, vermicomposting, anaerobic digestion, utilising black soldier fly, and converting biomass into fuel (including dry organics). Direct use of organic waste as animal feed is also an option to consider.

- [T.1 Composting \(pp. 80-81\)](#)
- [T.2 Vermicomposting \(pp. 82-83\)](#)
- [T.3 Anaerobic Digestion \(pp. 84-85\)](#)
- [T.4 Black Soldier Fly \(BSF\) Waste Processing \(pp. 86-87\)](#)
- [T.5 Making Fuel From Biomass \(pp. 114-115\)](#)

The **Tool 4.3 Technology Evaluation Tool** can help evaluate options in this regard. The following reference document, [Selecting Organic Waste Treatment Technologies SOWATT \(Zabaleta et al., 2020\)](#), provides more in-depth information.

For recyclables, the most straightforward option is to connect with existing value chains and markets to sell or hand over these recyclable materials. For plastics, especially those of low value and of no interest to recyclers, plastic treatment may be worthwhile. For instance, simple methods for plastic upcycling or downcycling, such as Ecobricks production, exist for use as a construction material. On the level of self-management and treatment of plastics, heating and melting should be avoided, as maintaining the correct temperature is very challenging, with the consequence of generating harmful gaseous emissions for those operating the technology. The **Compendium** can be consulted for adequate technologies:

- [T.7 Plastic Upcycling \(pp. 92-93\)](#)
- [T.6 Plastic Downcycling \(pp. 94-95\)](#)

Residual waste can be disposed of in individually controlled waste pits. Waste disposal pits have been and remain contaminated locations for many years. Therefore, it is essential to minimise the amount of residual waste requiring disposal. Otherwise, waste disposal pits will fill up quickly, and new pits will be required much more often. Residual waste should only consist of waste that is neither biodegradable, reusable, nor recyclable. The **Compendium** can be consulted:

- [U.8 Controlled Waste Pit \(pp. 116-117\)](#)

Any treatment alternative considered for self-management must be carefully evaluated in terms of its technical, economic, social, environmental, financial, and legal aspects. For each technology, communities should be well-informed about the implications in terms of operations and potential impacts. Ultimately, it will be the individuals who are directly involved in managing their own waste. Therefore, they must be well-informed before making a decision and must be willing and empowered to take on this responsibility.

Tools and further resources summary:	
Organic waste management options	 T 4.3 Technology Evaluation Tool  Compendium – Treatment and Recycling (pp. 72-89)  Selecting Organic Waste Treatment Technologies SOWATT (Zabaleta et al., 2020)
On-site recycling of plastic	 Compendium – T.7 Plastic Upcycling (pp. 92-93)  Compendium – T.6 Plastic Downcycling (pp. 94-95)  Planning for Zero-Waste at Schools – A Toolkit – P.1 Ecobricks (Mertenat et al., 2023)
Controlled disposal pit	 Compendium U.8 Controlled Waste Pit (pp. 116-117)

Task 6: Training communities and raising awareness

Safe self-management requires individuals to change their behaviour and actively manage their waste safely. This requires communities to be convinced of the benefits of managing their waste in better ways and to stop dumping or burning, which are highly damaging to their health and the environment. Besides awareness and willingness to change, individual must know how to best self-manage their waste safely. This includes aspects of waste reduction, proper waste segregation and the correct use of the technologies used to treat waste. Guidance should be provided regularly, and follow-up support must be planned and implemented to ensure that waste handling practices are adequate and fit for purpose, thereby reducing health risks for individuals and communities. Also consider strong community involvement and engagement, see [Compendium – X.2 Inclusive Planning and Participation \(pp. 132-133\)](#).

For more information on behaviour change, refer to the [Compendium – X.6 Hygiene Promotion and Behaviour Change \(pp. 139-141\)](#) and to the [Compendium of Hygiene Promotion in Emergencies \(Gensch et al., 2022\) – Social and Behaviour Change](#).

Tools and further resources summary:	
Behaviour change and engagement	 Compendium – X.2 Inclusive Planning and Participation (pp. 132-133)
	 Compendium – X.6 Hygiene Promotion and Behaviour Change (pp. 139-142)
	 Webpage of RANAS: https://ranas.ch
	 Compendium of hygiene promotion in emergencies (Gensch et al., 2022) – components E, C, B

Task 7: Initiate self-management of waste

Depending on the chosen self-management strategy, implementation activities can start in sequence, step by step. For instance, start with a pilot project to gain valuable insights and demonstrate to others how waste can be safely self-managed. Such a demonstration can help convince other individuals and the community to do the same and improve their practices. At a later stage, an evaluation of the waste self-management practice can follow using the **Chapter 2.5 Self-management**.

Tools and further resources summary:	
Assessment and improvement of existing SWM systems: self-management	 Chapter 2.5 Self-management

Part 3 – Tools

Tool 1 – Hotspot Identification

Inappropriate SWM practices such as waste dumping and burning might pose a public health threat. By combining the hazards, exposures, and vulnerabilities associated with waste dumping and burning, the hotspot identification and evaluation tool helps define where the major risks occur. Coupled with indications of who is behind unsafe practices, it also helps to understand why this inadequate practice occurs, thereby setting the ground to define key immediate and long-term actions.

- [Tool 1 – Summary](#)
- [Tool 1.1 – Hotspot Identification](#)

Tool 2 – Storage, Collection and Transport – Assessment and Improvement

Waste storage, collection and transport are essential elements of the SWM service chain. Often, most available resources are spent on it. Evaluating and improving the collection service can enhance financial sustainability, freeing resources to expand the collection service or allocate these resources to safer treatment and disposal.

- [Tool 2 – Summary](#)
- [Tool 2.1 – Overview of Storage, Collection and Transport](#)
- [Tool 2.2 – Evaluation and Improvement of Storage, Collection and Transport](#)

Tool 3 – Disposal – Assessment and Improvement

The safe and controlled disposal of waste is essential to ensure public health and environmental protection. The evaluation of disposal sites enables the assessment of their level of control and the identification of potential improvements through mitigation measures to contain the impacts of waste and reduce associated risks. This tool heavily relies on the publication Guidelines for the Safe Disposal of Solid Waste in Humanitarian Contexts (Tosi Robinson et al., 2024), which should be used in conjunction with the provided resources.

- [Tool 3 – Summary](#)
- [Tool 3.1 – Overview of Disposal](#)
- [Tool 3.2 – Evaluation and Improvement of Disposal](#)

Tool 4 – Organic Waste Management – Assessment and Improvement

Organic waste management is an important component of SWM systems. Organics often account for more than half of the waste generation. Whenever possible, organics should be collected and treated separately to support a sustainable waste management system. However, it is typically not the initial priority in humanitarian contexts, which likely focus on ensuring the storage, collection, and disposal of mixed waste. Once this initial need is, however, covered, separate organic waste management can be initiated to limit the need for disposal. Organic waste management can also promote livelihoods by creating jobs, generating income, and producing valuable products for communities.

- [Tool 4 – Summary](#)
- [Tool 4.1 – Overview of Organic Waste Management](#)
- [Tool 4.2 – Evaluation and Improvement of Organic Waste Management](#)
- [Tool 4.3 – Technology Evaluation Tool \(TET\)](#)

Tool 5 – Recyclable Waste Management – Assessment and Improvement

Recyclable waste management is an important component of SWM systems. Whenever possible and for sustainable waste management systems, recyclables should be managed separately. Whenever possible, it is essential to recover as many materials as possible from waste, thereby limiting the need for disposal and increasing material circularity. Recovering recyclables can also promote livelihoods by creating jobs and generating income.

- **Tool 5 – Summary**
- **Tool 5.1 – Overview of Recyclable Waste Management**
- **Tool 5.2 – Evaluation and Improvement of Recyclable Waste Management**

Tool 6 – Self-management – Assessment and Improvement

Self-management of waste refers to situations where waste collection services cannot be provided due to resource constraints, particularly in sparsely populated areas. In such cases, the focus shifts to supporting households and communities in managing their waste independently. This approach emphasises individual solutions, encouraging practices such as waste reduction, reuse, and resource recovery, especially for organic waste management.

- **Tool 6 – Summary**
- **Tool 6.1 – Overview of Self-management**
- **Tool 6.2 – Evaluation and Improvement of Self-management**

Tool 7 – Waste Generation and Composition Study

Studies on waste generation and composition are essential for understanding, planning, and monitoring waste management services. Conducting such studies enables the collection of data to inform decisions. The amounts of waste generated and its composition can be measured via a waste audit or estimated through waste surveys. These two methods differ in their goals, precision, and the efforts required to implement them. This tool guides in doing a waste audit or survey at household and/or non-household waste generators.

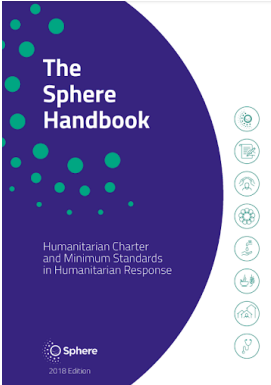
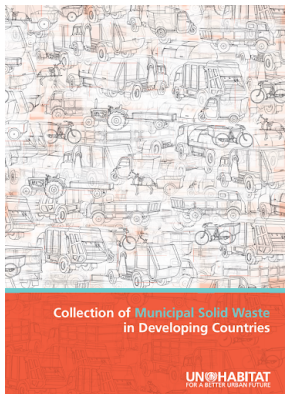
- **Tool 7 – Summary**
- **Tool 7.1 – Waste Survey**
- **Tool 7.2 – Waste Audit**

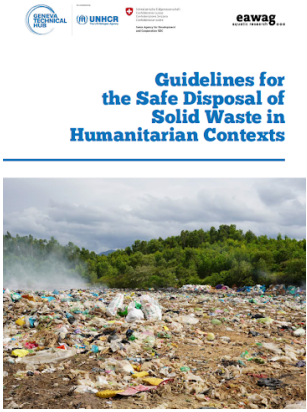
Tool 8 – Cost Evaluation

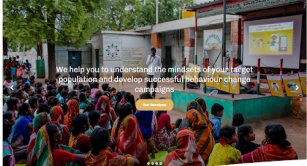
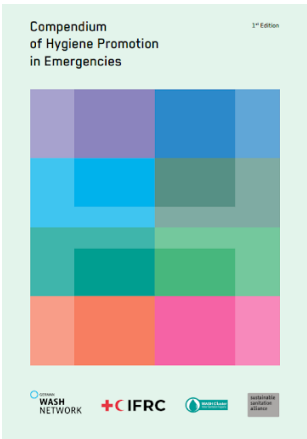
Understanding and accounting for all the costs of the SWM system is a crucial step in evaluating and ensuring the financial sustainability of the service. This simple evaluation tool helps practitioners account for all costs associated with managing waste, including both capital and operational expenses.

- **Tool 8 – Summary**
- **Tool 8.1 – Cost Evaluation Tool**

Part 4 – Resources and references

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Glossary

3Rs

A key SWM principle promoting waste minimisation: reducing waste generation, reusing products, and recycling materials.

Affected population

People directly impacted by a crisis or displacement are the primary beneficiaries of SWM systems. Their engagement is essential to ensure culturally appropriate and accepted solutions.

Controlled disposal

Waste disposal in designated and managed sites with measures such as compaction, covering, fencing, and staff supervision to reduce risks.

Controlled disposal pits

A small-scale excavated pit used for waste burial in low-density or rural areas, regularly covered with soil or inert material to contain waste. Typically sized for individual household use, it is limited to disposing of residual waste.

Efficiency

How well resources (time, labour, money, equipment) are used in a SWM system, e.g., optimising routes and reducing idle time.

Effectiveness

The extent to which a SWM system achieves its goals, such as protecting public health, reducing environmental risks, or increasing resource recovery.

Exposure

The people, communities, or environments that come into contact with waste-related hazards — and how often or in what way they are affected.

Financial sustainability

The ability of SWM systems to cover long-term capital and operational costs (labour, vehicles, equipment, maintenance) through efficient use of resources and, where possible, cost recovery.

Host communities

Residents, community leaders, authorities, service providers, and local groups in areas where displaced populations settle. They often share resources and services with affected populations, playing a key role in promoting social cohesion, refugee protection, and supporting durable solutions.

Hotspots

Locations where poor waste management practices (e.g., dumping, burning, or accumulation in drains) pose significant risks to human health or the environment.

Integrated solid waste management

A comprehensive framework combining physical components (storage, collection, transport, treatment, recycling, disposal) with governance aspects (stakeholders, finance, regulation) to build sustainable SWM systems.

Waste diversion

Efforts to reduce the volume of waste going to disposal by promoting recovery, recycling, or treatment of organics and recyclables.

Waste Filling Plan

A plan that defines the sequence and method of filling the disposal site over its lifetime, including the integration of construction elements such as drainage systems, gas vents, surface water controls, access roads, and cover layers to ensure stability, capacity optimisation, and environmental protection.

Waste Placement Plan

A plan that specifies the operational procedures for depositing waste, including its placement, spreading, compaction, interim cover application, and traffic patterns within the site to maintain daily safety, stability, and environmental standards.

Monitoring and evaluation

The continuous process of measuring performance (e.g., route times, filling levels, costs, community satisfaction) to assess and improve SWM systems.

Municipal solid waste

Discarded materials from households, commerce, small businesses, institutions, and public spaces — excluding hazardous or industrial waste. Also sometimes referred to as domestic solid waste.

Recovery

The process of extracting value from waste, either as materials (recycling, reuse, composting, ...) or as energy (biogas, ...).

Recovery rate

The proportion of waste materials that are successfully recovered (through recycling, composting, or reuse) relative to the total waste generated.

Recycling

Reprocessing of collected waste materials (e.g., plastic, glass, paper, metal) into new products.

Risks

The potential negative impacts that arise when hazards, exposure, and vulnerability combine, leading to threats such as disease spread, pollution, flooding, or injury.

Segregation at source

Separation of different waste fractions (e.g., organic, recyclable, residual) at the point of generation to facilitate safe management, recycling, or treatment.

Service chain

The sequence of solid waste management services — from storage, collection, and transport to treatment, recycling, and disposal.

Uncontrolled disposal

Unsafe dumping of waste in open areas without protective measures leads to health and environmental hazards (e.g., pollution, disease vectors).

Value chain

The stages through which waste materials pass while being recovered, recycled and reused, creating economic and social value (e.g., recycling markets, informal sector contributions).

Vulnerability

The degree to which individuals, groups, or environments are susceptible to harm from waste-related hazards. Most vulnerable groups include children, the elderly, the sick, informal waste pickers, and fragile ecosystems.

Waste audit

A detailed study to quantify and characterise waste types and volumes, used for designing or improving SWM systems.

Waste survey

A quicker, less resource-intensive method than an audit, used to estimate waste composition and generation rates in humanitarian settings.



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