

Environment in Humanitarian Action: Global Training Manual Template

Sustainable Water Resource Management in Humanitarian Action





This module was developed as part of the UNEP/OCHA Joint Environment Unit's project titled Localisation of Environment in Humanitarian Action, and is part of a template of a training manual consisting of:

- 1 Introductory Module*
- 11 Technical Modules*
- 1 ToT Module*

The template is an open source and available for any organisation or individual to use or refer to in the development and delivery of their Environment in Humanitarian Action training.

What distinguishes this training manual is its comprehensive and flexible framework. We encourage users to adjust the content to meet with the specific needs within their specific Contexts. We kindly ask that credit is given when using or adapting this resource.

MODULE OVERVIEW

This module focuses on the crucial role of water resource management in humanitarian action, emphasizing the need for sustainable practices to ensure safe and reliable access to water in emergencies. Participants will explore the importance of different water resources, including surface water, groundwater, and rainwater harvesting, while examining the environmental impacts of poor water management, such as health risks, ecosystem degradation, and the exacerbation of climate change. The module also covers techniques for sustainable water management, including safe drinking water provision, wastewater treatment, and pollution control, with a special focus on community engagement and the integration of indigenous knowledge. Through the analysis of real-world case studies and strategic solutions, participants will gain practical insights into managing water resources during humanitarian crises, including how to address challenges posed by climate change and infrastructure damage.

Learning outcomes

By the end of this module, participants will:

1. Understand the critical importance of water resource management in humanitarian contexts.
2. Identify and evaluate various water resources.
3. Analyze the environmental impacts of poor water management.
4. Apply sustainable water management techniques in emergency settings.
5. Assess challenges in water resource management.
6. Explore strategic solutions and best practices for addressing water management challenges.
7. Engage in case study analysis to identify lessons learned and best practices.

Estimated delivery time

Total time: 210 minutes

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FACILITATOR'S GUIDE

Step	Activity	Method	Duration	Materials Needed	Expected Outcomes
1	Introduce the module. Provide an overview of the module, its objectives, and the schedule.	Presentation, plenary discussion	5 mins	Slides, handouts	Understand the module's objectives and structure
2	Explain the introduction to water resource management in humanitarian settings. Overview of the importance of water resource management in emergencies.	Lecture, plenary discussion	10 mins	Slides, handouts	Understand the importance of water resource management in emergencies
3	Discuss different water resources: surface water, groundwater, rainwater harvesting.	Lecture, Q&A session	15 mins	Slides, handouts	Recognize different types of water resources and their importance
4	Analyze the environmental impact of poor water management, focusing on health risks, ecosystem degradation, and links to climate change.	Lecture, plenary discussion	15 mins	Slides, handouts	Understand the impact of poor water management on health, the environment, and climate change
5	Facilitate a group discussion: Techniques for sustainable water management. Participants discuss methods for safe drinking water provision, wastewater treatment, and water conservation techniques.	Group discussion	45 mins	Flipchart, markers	Apply sustainable water management techniques
6	Discuss the challenges in water resource management, including water scarcity, contamination, and infrastructure damage, and the impacts of climate change on water resources..	Group discussion	45 mins	Flipchart, markers	Identify key challenges and discuss potential solutions, including climate-related challenges.
7	Present strategic solutions and best practices, including pollution control measures and climate-resilient water management techniques.	Lecture, Q&A session	20 mins	Slides, handouts	Learn best practices for addressing challenges in water resource management

8	Facilitate a group discussion on the case studies provided, focusing on lessons learned from water resource management during droughts, floods, and in camps.	Group discussion	45 mins	Case study materials, slides	Analyze real-world case studies and apply lessons learned
9	Summarize and conclude the module. Review key points, reinforce main takeaways, and address any remaining questions.	Presentation, Q&A	10 mins	Slides	Reinforce key learnings and address any questions

Facilitator notes

Section 1: Introduction to water resource management in humanitarian settings

Key points

- Discuss the critical role of water in maintaining health, sanitation, and environmental stability during humanitarian crises.
- Provide an overview of surface water, groundwater, and rainwater harvesting, with emphasis on their significance and management challenges in emergencies.
- Address the health risks, ecosystem degradation, and connections to climate change that can result from inadequate water resource management.

Background information

- Water resource management is essential for ensuring the health and well-being of affected populations in humanitarian settings.
- Different water sources, such as surface water, groundwater, and rainwater, present unique challenges and opportunities in emergencies.
- Poor water management can lead to severe environmental and health impacts, including the spread of diseases, ecosystem degradation, and exacerbation of climate change effects.



Content development: Introduction to water resource management in humanitarian settings

Table 1: Importance of water resource management in emergencies

Aspect	Description	Impact	Examples/Application
Health and sanitation	Safe drinking water is essential to prevent disease outbreaks and maintain hygiene standards in emergency settings.	Reduces the risk of waterborne diseases such as cholera, dysentery, and typhoid; prevents the spread of other hygiene-related diseases.	Immediate provision of clean water sources and sanitation facilities in a cholera-prone area prevents disease spread and maintains public health.
Environmental stability	Proper water management ensures that ecosystems are protected and preserved even in crisis situations.	Prevents degradation of ecosystems, protects biodiversity, and maintains the balance of natural resources.	Strategic management of water resources during flood response reduces soil erosion and preserves wetland areas crucial for local wildlife.
Sustainability of interventions	Water management practices integrated into humanitarian interventions ensure long-term access to resources and reduce dependency on emergency supplies.	Supports long-term recovery, enhances resilience against future crises, and promotes sustainable resource use.	Installing solar-powered water pumping systems in drought-affected areas ensures sustainable water access for communities, reducing reliance on emergency water deliveries.
Protection of livelihoods	Access to water is crucial for maintaining agricultural and livestock activities, which are often key livelihoods in affected areas.	Ensures food security, sustains livelihoods, and prevents displacement due to resource scarcity.	Providing irrigation solutions and protecting water sources in rural areas helps maintain agricultural activities and prevent displacement during prolonged droughts.
Social cohesion and conflict prevention	Equitable water distribution can reduce tensions between displaced populations and host communities, fostering peace and stability.	Reduces the risk of conflict over scarce resources, promotes cooperation, and ensures equitable access to water for all groups.	Establishing joint water management committees in areas with both displaced populations and host communities to mediate resource allocation and reduce tensions.
Support for wash programs	Effective water management underpins successful Water, Sanitation, and Hygiene (WASH) interventions, essential for maintaining health and dignity.	Improves overall public health outcomes, supports hygiene education, and reduces the need for medical interventions.	Ensuring reliable access to water for handwashing stations in a camp setting significantly reduces the incidence of communicable diseases.

<p>Adaptation to climate change</p>	<p>Resilient water management strategies can help communities adapt to the impacts of climate change, such as altered rainfall patterns and increased frequency of extreme weather events.</p>	<p>Increases resilience to droughts, floods, and other climate-related challenges; ensures continuous access to safe water.</p>	<p>Implementing rainwater harvesting systems in areas experiencing unpredictable rainfall ensures water availability during dry spells.</p>
<p>Economic impact</p>	<p>Proper management of water resources can reduce the financial burden on humanitarian operations by lowering the cost of water provision and mitigating the impact of water-related health issues.</p>	<p>Decreases operational costs, reduces the need for emergency water shipments, and improves the efficiency of aid distribution.</p>	<p>Investing in sustainable water infrastructure in camps reduces ongoing costs associated with water trucking and emergency supply missions.</p>

Understanding different water resources



Surface water

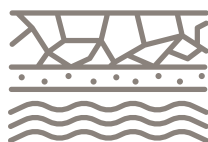
Water found on the surface of the earth, such as rivers, lakes, and reservoirs.

Importance

Crucial for immediate access in emergencies, often serves as the primary source for large populations.

Examples/Application:

Utilizing rivers and lakes as primary sources of water during an emergency provides immediate relief to affected populations.



Groundwater

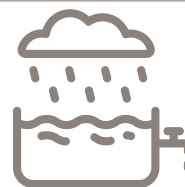
Water stored underground in aquifers, which can be accessed through wells or boreholes.

Importance

Provides a reliable water source, especially in arid regions or when surface water is contaminated or unavailable.

Examples/Application:

Extracting groundwater through boreholes in drought-affected regions ensures a continuous supply of safe drinking water.



Rainwater harvesting

Collection and storage of rainwater for later use, often in areas with seasonal rainfall.

Importance

Offers an alternative water source, reduces dependency on other sources, and helps manage water scarcity.

Examples/Application:

Implementing rainwater harvesting systems in areas with seasonal rainfall ensures water availability during dry seasons.



Desalinated water

Water obtained from the process of removing salts and minerals from seawater.

Importance

Provides a reliable water source, especially in arid regions or when surface water is contaminated or unavailable.

Examples/Application:

Extracting groundwater through boreholes in drought-affected regions ensures a continuous supply of safe drinking water.

Table 3: Environmental impact of poor water management

Impact Area	Description	Consequences	Examples/Application
Health risks	Contaminated water sources can lead to the spread of waterborne diseases and other health issues in humanitarian settings.	Increased morbidity and mortality due to diseases such as cholera, dysentery, and typhoid; strain on healthcare resources.	Inadequate sanitation in crowded refugee camps leads to a rapid spread of diarrheal diseases, exacerbated by the lack of clean water for drinking and washing.
Ecosystem degradation	Over-extraction or pollution of water sources can severely damage local ecosystems, reducing biodiversity and harming livelihoods.	Long-term environmental damage that can lead to desertification, loss of wildlife habitats, and reduced agricultural productivity.	Over-extraction of water from rivers for emergency use leads to a decline in fish populations and disrupts local food chains.
Exacerbation of climate change effects	Improper water management can worsen the impacts of climate change, such as droughts and floods, by reducing resilience and adaptability.	Increased vulnerability to climate-related disasters; disruption of local water cycles, leading to more frequent and severe weather events.	Poor water management in drought-prone areas leads to soil degradation and increases the frequency of dust storms, further exacerbating harsh living conditions.
Conflict and social tensions	Competition over scarce water resources can lead to conflict between communities, especially in fragile or conflict-affected regions.	Escalation of violence, displacement, and further strain on humanitarian operations; hindered access to water for vulnerable groups.	Disputes over water rights and usage in areas with limited access can lead to inter-community conflicts, requiring mediation and equitable resource distribution by humanitarian agencies.
Loss of agricultural productivity	Insufficient water supply can directly impact agriculture, leading to food shortages and economic losses.	Reduces food security, leads to malnutrition, and increases reliance on external food aid.	Lack of water for irrigation in agricultural communities during droughts leads to significant crop losses, exacerbating food insecurity.
Increased reliance on emergency water supplies	Failure to manage water resources sustainably forces continued reliance on expensive and logistically challenging emergency water deliveries.	Increases operational costs, logistical burdens, and environmental impacts associated with transportation and distribution of water.	Continuous need for water trucking to refugee camps strains the budget of humanitarian organizations and limits investment in sustainable water infrastructure.
Depletion of groundwater resources	Over-extraction of groundwater during emergencies can lead to the long-term depletion of aquifers, affecting water availability for future generations.	Permanent reduction in groundwater levels, land subsidence, and increased costs for accessing deeper water reserves.	Over-reliance on boreholes for emergency water supply in arid regions leads to a significant drop in groundwater levels, necessitating deeper and more expensive drilling operations.
Degradation of water quality	Pollution from human activities, industrial waste, and poor sanitation can degrade water quality, making it unsafe for consumption and harmful to ecosystems.	Leads to health risks, loss of aquatic life, and the spread of pollutants through the food chain.	Contamination of rivers used for drinking water by upstream industrial waste forces the relocation of camps to avoid health risks and further environmental damage.

Section 2: Techniques for sustainable water management

Key points

- Emphasize the importance of sustainable water management techniques in humanitarian contexts to ensure reliable access to safe water and protect the environment.
- Highlight various methods and technologies used to provide safe drinking water, treat wastewater, and conserve water resources in emergencies.
- Discuss the role of community engagement and the integration of indigenous knowledge in implementing effective water management practices.

Background information

- Sustainable water management is critical in humanitarian settings to ensure the availability of clean water while minimizing environmental impact. Different contexts may require different techniques, depending on local conditions, resource availability, and the specific needs of the affected population.
- Techniques for sustainable water management include methods for providing safe drinking water, treating wastewater, and conserving water resources. These techniques are essential for maintaining health and hygiene, preventing waterborne diseases, and ensuring the long-term sustainability of water sources.
- Community engagement and the integration of indigenous knowledge are vital components of successful water management strategies. Local communities often possess valuable knowledge and practices that can enhance the effectiveness and sustainability of water management efforts.

Content development: Techniques for sustainable water management

Table 1: Safe drinking water provision

Technique	Description	Benefits	Examples/Application
Boiling	Heating water to a rolling boil to kill pathogens and make it safe for drinking.	Simple and effective; widely understood and accessible.	In remote rural areas, families boil water from local streams to ensure it is safe to drink. In temporary shelters, boiling is used as a primary method for water purification when other technologies are unavailable.
Filtration systems	Use of portable or community-based filtration systems to remove impurities and pathogens from water.	Provides clean water by removing physical contaminants and some pathogens; suitable for long-term use.	In a disaster-affected area, filtration systems are used to purify contaminated river water, making it safe for drinking and cooking. In a refugee camp, portable filtration units provide safe drinking water from a nearby lake.
Solar water disinfection (SODIS)	Using sunlight to purify water in transparent plastic bottles. Simple and cost-effective.	Utilizes natural resources to disinfect water; ideal for regions with high sunlight exposure.	In a drought-prone area, families use SODIS to treat rainwater collected in jars. In emergency settings, SODIS is promoted as a safe water treatment method when access to other technologies is limited.

Chlorination	Adding chlorine to water to kill bacteria, viruses, and protozoa, making it safe for consumption.	Effective at low cost; easy to implement in both small-scale and large-scale settings.	In an emergency shelter, chlorine is added to stored rainwater to ensure it is safe for drinking. In a flood-affected village, chlorination units are distributed to households to purify water from contaminated wells.
Reverse osmosis (RO)	A high-tech filtration method that uses a semi-permeable membrane to remove contaminants from water.	Removes a wide range of impurities, including salts, chemicals, and pathogens; highly effective.	In coastal regions, reverse osmosis units are used to desalinate seawater for drinking. In industrial disaster areas, these systems are employed to remove heavy metals from contaminated water sources.
Biosand filters	A slow sand filtration system that removes pathogens and suspended solids from water, making it safe for drinking. This system is cost-effective, long-lasting, and can be locally manufactured.	Provides an affordable and sustainable way to purify drinking water in rural and emergency settings.	In remote areas or emergency settings, biosand filters could be installed to ensure that local water sources are safe for consumption, reducing reliance on chemical disinfection methods.
Desalination	The process of removing salt and other impurities from seawater to produce potable water. This method is essential in coastal areas with limited freshwater availability, especially during emergencies.	Provides a critical source of drinking water in coastal regions, particularly in disaster-affected areas.	In coastal disaster zones, mobile desalination units could be deployed to provide immediate access to safe drinking water when traditional sources are compromised.
Gravity-fed water systems	Systems that use gravity to transport and distribute water from a higher elevation to communities below.	Requires minimal energy inputs; sustainable and low-maintenance.	Establishing gravity-fed water systems in mountainous regions affected by natural disasters to ensure a continuous supply of safe drinking water.
Water purification tablets	Tablets that disinfect water by killing pathogens	Portable, easy to use, and ideal for emergencies.	During rapid-onset disasters, water purification tablets are distributed to affected communities to ensure immediate access to safe drinking water. In conflict zones, tablets are provided to displaced populations without access to clean water infrastructure.
Constructed wetlands	Engineered systems that use natural processes involving wetland vegetation, soils, and their associated microbial communities to treat wastewater.	Environmentally friendly, sustainable, and provides habitat for wildlife.	In a large refugee camp, constructed wetlands are used to treat greywater before it is released into the environment. In semi-urban disaster recovery sites, wetlands help to purify water runoff before it reaches local rivers.

Table 2: Wastewater treatment and pollution control

Technique	Description	Benefits	Examples/Application
Septic Systems	Underground systems for treating wastewater by separating solids and liquids.	Prevents contamination of groundwater and is effective in decentralized settings.	In rural emergency shelters, septic systems are installed to manage wastewater from temporary latrines. In semi-urban recovery areas, they are used to treat domestic wastewater where central sewage
Decentralized wastewater treatment systems (DEWATS)	Small-scale, locally managed systems that treat wastewater close to the point of generation.	Cost-effective, easily scalable; reduces the need for extensive infrastructure.	Deploying DEWATS in a temporary shelter setting to manage wastewater on-site, reducing the risk of contamination and protecting local water sources.
Biosand filters	(Refer to Table 1) Primarily used for drinking water purification, biosand filters can also treat gray-water, removing pathogens and suspended solids.	Provides a secondary treatment option for graywater in low-resource settings, enhancing overall water management.	In rural emergency settings, biosand filters are used to treat gray-water for non-potable purposes, ensuring environmental safety and reducing health risks. For more details, see Table 1.
Chemical coagulation	Adding chemicals to water to remove suspended solids and contaminants, improving water quality.	Effective in treating highly polluted water; quick and scalable for large volumes.	Implementing chemical coagulation in areas affected by industrial spills to rapidly restore water quality and prevent public health crises.
Anaerobic digesters	Systems that break down organic waste and wastewater in the absence of oxygen, producing biogas and nutrient-rich sludge.	Reduces environmental impact; produces renewable energy; effective in both urban and rural settings.	In large displacement camps, anaerobic digesters treat organic waste and generate biogas for cooking. In disaster recovery projects, these systems are used to manage organic waste from food distribution sites.
Bioremediation/ Phytoremediation	The use of microorganisms or plants to break down pollutants in wastewater.	Environmentally friendly; can be applied to a wide range of pollutants; promotes ecosystem restoration.	Applying bioremediation techniques in areas contaminated by oil spills to clean up water sources and restore local ecosystems. In post-conflict recovery zones, phytoremediation is used to treat polluted water from damaged industrial sites. In rural refugee camps, this technique helps in treating wastewater before it is released into local water sources.
Ultraviolet (UV) disinfection	Using UV light to kill or inactivate microorganisms in wastewater.	Effective at neutralizing pathogens without the need for chemicals; easy to scale.	Incorporating UV disinfection in hospital wastewater treatment systems in conflict zones to prevent the spread of waterborne diseases.
Aerated lagoons	Large, shallow ponds that treat wastewater through natural aeration and microbial activity.	Cost-effective and relatively easy to operate; suitable for large volumes of wastewater.	Using aerated lagoons to treat municipal wastewater in a post-disaster urban area, reducing the risk of contamination and promoting water reuse.

Wetland Filtration	Using natural or artificial wetlands to filter wastewater through vegetation and soil.	Low-cost, sustainable, and improves water quality while creating wildlife habitats.	In post-disaster reconstruction areas, wetland filtration systems are set up to treat greywater from temporary housing. In conflict-affected regions, they help filter contaminated water before it enters local water bodies.
Mobile wastewater treatment plants	Portable units that treat wastewater on-site, particularly in emergencies.	Flexible, quick to deploy, and ensures immediate wastewater management.	In conflict zones, mobile treatment units are used to treat wastewater from temporary healthcare facilities. In flood-affected areas, these units provide rapid wastewater treatment to prevent disease outbreaks.
Greywater recycling	Reusing water from sinks, showers, and washing machines for non-potable purposes.	Reduces demand on freshwater sources and minimizes wastewater generation.	In drought-affected areas, greywater recycling systems are installed in temporary shelters for irrigation. In refugee camps, greywater is reused for flushing toilets and cleaning, reducing the demand for fresh water.
Advanced oxidation processes	Chemical treatment processes that break down complex pollutants in wastewater.	Highly effective in treating industrial pollutants and organic contaminants.	In urban disaster sites, advanced oxidation is used to treat wastewater contaminated with industrial chemicals. In conflict-affected areas, it helps in managing wastewater from makeshift industrial facilities.
Floating treatment wetlands	Artificial floating platforms with vegetation that treat wastewater in ponds or lakes	Effective in areas with limited land, enhances water quality, and supports aquatic life.	In flooded areas, floating treatment wetlands are used to purify water in stagnant ponds. In large refugee camps, they help manage wastewater in temporary water bodies created by heavy rainfall.
Waterless sanitation systems	Sanitation solutions that treat human waste without the need for water.	Ideal for water-scarce environments, reduces the risk of water contamination.	In drought-stricken areas, waterless toilets are installed in temporary settlements. In conflict zones, these systems are used where water infrastructure is destroyed.

Table 3: Techniques for conserving and managing water resources

Technique	Description	Benefits	Examples/Application
Rainwater harvesting	Collecting and storing rainwater for various uses, reducing reliance on external sources.	Provides an independent water supply, especially in arid regions.	In drought-prone areas, rainwater harvesting systems are installed on temporary shelters to collect and store water for daily use. In urban refugee camps, these systems reduce the demand on municipal water supplies.
Groundwater recharge	Techniques to enhance the natural replenishment of groundwater by directing rainwater into the soil.	Maintains water tables, especially in areas with depleted groundwater levels.	In rural recovery zones, groundwater recharge pits are dug to replenish local wells. In post-disaster areas, recharge systems help restore groundwater levels affected by extensive water extraction.
Water reuse	Reusing treated wastewater for non-potable purposes like irrigation and industrial use.	Reduces demand on freshwater resources, conserves water, and lowers the environmental footprint.	In large agricultural projects within camps, treated wastewater is used for irrigation, conserving freshwater. In disaster recovery areas, reused water helps in reducing the pressure on limited water resources.

<i>Drip irrigation</i>	Efficient irrigation technique that delivers water directly to the plant roots, minimizing waste.	Reduces water use, promotes efficient growth, and is adaptable to various environments.	In camp-based agriculture projects, drip irrigation systems are implemented to maximize water efficiency. In urban gardening initiatives within refugee camps, these systems help conserve water while ensuring plant growth.
<i>Desalination</i>	A water resource management strategy that converts seawater into freshwater, supporting long-term water supply in arid coastal regions. Refer to Table 1	Ensures a reliable supply of freshwater in areas where natural water sources are scarce or saline.	In arid coastal regions, large-scale desalination plants are constructed to provide a continuous supply of fresh water, supporting both community needs and agricultural activities. This contributes to long-term water sustainability.
<i>Water-saving fixtures</i>	Installing low-flow taps, showers, and toilets to reduce water use in daily activities.	Reduces overall water consumption, especially in large-scale settings.	In refugee camps, water-saving fixtures are installed in communal washrooms to conserve water. In temporary urban shelters, these fixtures help manage limited water supplies efficiently.
<i>Watershed management</i>	Holistic approach to managing the water resources of a watershed, including land use, conservation, and water quality.	Protects water sources, maintains ecosystem health, and ensures water availability for all users.	In flood-prone regions, watershed management plans are developed to control water flow and reduce flood risks. In conflict-affected areas, integrated watershed management helps in sustaining water resources for local communities.
<i>Leak detection and repair programs</i>	Regularly identifying and fixing leaks in water distribution systems to prevent water loss.	Reduces water waste, ensures more reliable supply, and conserves resources.	In urban refugee camps, leak detection programs help minimize water loss from the distribution system. In rural settlements, regular maintenance of water supply networks ensures consistent water availability.
<i>Climate-resilient water infrastructure</i>	Designing and constructing water infrastructure that can withstand extreme weather events such as floods, droughts, and storms.	Ensures reliable water supply during and after disasters, reduces repair costs, and enhances community resilience.	In cyclone-prone areas, elevated water tanks are built to prevent flood contamination. In drought-affected regions, resilient pipelines and storage systems are designed to withstand prolonged dry periods.
<i>Nature-based solutions (NBS)</i>	Utilizing natural processes and ecosystems to manage water resources, such as restoring wetlands and planting vegetation along waterways.	Enhances water quality, controls floods, and supports biodiversity while providing sustainable water management solutions.	In flood-prone areas, restoring wetlands helps absorb excess water, reducing the impact of floods. In conflict-affected regions, planting vegetation along rivers reduces erosion and improves water quality.
<i>Rotational grazing</i>	Managing livestock grazing patterns to prevent overgrazing and soil degradation, thereby protecting water resources.	Improves soil health, maintains water quality, and supports sustainable land use.	In semi-arid regions, rotational grazing practices are implemented to prevent land degradation and protect nearby water sources. In pastoralist communities affected by conflict, these practices help preserve water quality and land productivity.

Water banking	A system where surplus water is stored underground or in reservoirs during wet periods for use during droughts or dry seasons.	Provides a reliable water supply during dry periods, supports drought management, and stabilizes water availability.	In arid regions, water is banked during the rainy season in underground aquifers to be used during droughts. In urban disaster recovery areas, excess water from floods is stored in reservoirs to support future needs.
Integrated water resource management (IWRM)	A process that promotes the coordinated development and management of water, land, and related resources.	Ensures sustainable water use, balances social, economic, and environmental needs, and supports long-term water security.	In conflict-affected regions, IWRM plans are developed to coordinate water use between agriculture, domestic needs, and industry. In drought-prone areas, these plans help allocate water resources efficiently across sectors.
Fog harvesting	Collecting water from fog using specialized nets or structures, typically in areas with limited rainfall but frequent fog.	Provides an alternative water source in arid or semi-arid regions, supports water security, and is environmentally friendly.	In mountainous or coastal regions with high fog density, fog harvesting systems are used to collect water for drinking and irrigation. In remote desert areas, these systems provide a vital water source for communities and livestock.

Section 3: Challenges and strategic solutions in water resource management

Key points

- Identify and discuss the primary challenges encountered in water resource management during humanitarian interventions.
- Discuss how climate change exacerbates existing water management challenges, including increased frequency and severity of extreme weather events like floods and droughts.
- Highlight practical solutions and strategies that have been successfully implemented to overcome these challenges.
- Provide real-world examples to illustrate how these challenges have been addressed in various humanitarian contexts.

Background information

- Water resource management in humanitarian settings often faces numerous challenges, including water scarcity, contamination, infrastructure damage, and the impact of climate change. These challenges can significantly affect the availability and quality of water, leading to health risks, environmental degradation, and increased vulnerability of affected populations.
- The effects of climate change, including increased temperatures, altered precipitation patterns, and rising sea levels, are leading to more frequent and severe droughts, floods, and storms. These changes exacerbate water scarcity and the degradation of water quality in humanitarian settings.
- Addressing these challenges requires innovative approaches, strong coordination among stakeholders, and the integration of sustainable practices into humanitarian planning and operations. By understanding these challenges and exploring successful case studies, humanitarian actors can improve water management outcomes in future interventions.

Table 1: Key challenges in water resource management

Challenge	Description	Impacts	Examples/Application
Water scarcity	Limited availability of water resources, particularly in arid and drought-prone regions.	Leads to competition for water, increased vulnerability, and challenges in maintaining hygiene.	In drought-stricken areas, limited water resources force humanitarian agencies to implement strict water rationing, affecting daily activities and leading to conflicts over water access among local communities and displaced populations.
Water contamination	Pollution of water sources due to industrial activities, agriculture runoff, or poor sanitation.	Increases the risk of waterborne diseases, affects ecosystem health, and reduces water usability.	In conflict zones, damaged infrastructure leads to the contamination of water supplies, requiring emergency interventions like chlorination and the distribution of water purification tablets to prevent disease outbreaks among displaced persons.
Infrastructure damage	Destruction of water supply systems and treatment facilities due to natural disasters or conflict.	Disrupts water distribution, leading to shortages and increased health risks.	Following an earthquake, the main water treatment plant in an urban area is severely damaged, leading to a critical shortage of safe drinking water and necessitating the use of mobile treatment units and the rapid repair of water pipelines.
Climate change impact	Altered precipitation patterns, increased frequency of extreme weather events, and rising temperatures.	Exacerbates existing water management challenges and increases unpredictability in water availability.	In coastal regions, rising sea levels and saltwater intrusion into freshwater aquifers disrupt local water supplies, requiring the implementation of desalination technologies and the protection of natural water catchment areas.
Community resistance	Resistance from local communities to adopt new water management practices due to cultural beliefs or lack of awareness.	Slows the implementation of effective water management strategies and exacerbates existing challenges.	In rural areas, efforts to introduce rainwater harvesting systems face resistance from local communities, requiring extensive engagement and education efforts to demonstrate the benefits and ensure the successful adoption of the new practices.
Poor coordination among stakeholders	Fragmented efforts and lack of collaboration among different humanitarian actors, local authorities, and communities.	Leads to inefficiencies, duplication of efforts, and gaps in water service delivery.	In a post-disaster urban area, multiple agencies attempt to restore water services independently, resulting in overlapping initiatives and resource wastage, highlighting the need for better coordination and centralized management.
Financial constraints	Limited funding for water resource management projects, particularly in protracted crises.	Affects the sustainability and scale of water management interventions.	In prolonged conflict zones, insufficient funding hampers the construction of resilient water infrastructure, forcing agencies to rely on temporary solutions that are unsustainable in the long term.
Inadequate data and monitoring	Lack of reliable data on water resources, usage patterns, and contamination levels.	Hinders the planning and implementation of effective water management strategies.	In remote rural areas, the absence of accurate data on groundwater levels and contamination hampers the ability to design appropriate water supply systems, necessitating the use of advanced monitoring technologies to gather real-time data.

Table 2: Climate change exacerbations on water resource challenges in humanitarian action

Impact	Description	Climate Change Exacerbation	Humanitarian Implications	Examples/Application
Altered precipitation patterns	Changes in rainfall distribution, intensity, and seasonality.	Increased frequency and intensity of rainfall events, leading to more severe flooding and droughts.	Flooding heightens the risk of water contamination, while droughts increase competition for limited water resources, complicating water management efforts.	Flooding in South Asia leads to widespread water contamination, necessitating the rapid deployment of water purification systems in affected areas. Droughts in the Horn of Africa force humanitarian agencies to increase water trucking operations.
Increased frequency of extreme weather events	More frequent and intense storms, hurricanes, and cyclones.	Greater likelihood of infrastructure damage, water source contamination, and disruptions to water supply.	Frequent destruction of water infrastructure necessitates repeated rebuilding efforts, while contamination of water sources heightens the risk of waterborne diseases in camps and shelters.	Hurricanes in the Caribbean repeatedly damage water supply systems, requiring the construction of resilient infrastructure and the use of mobile treatment units.
Rising sea levels	Rising sea levels due to melting polar ice and thermal expansion of seawater.	Increased saltwater intrusion into coastal freshwater aquifers, further reducing available drinking water.	Coastal populations face greater challenges in accessing potable water, leading to reliance on alternative water supply methods such as desalination or rainwater harvesting.	In Bangladesh, salinization of groundwater due to rising sea levels forces humanitarian organizations to implement desalination plants and distribute rainwater harvesting systems to provide clean water to affected communities.
Reduced groundwater recharge	Decreased infiltration of rainfall into the ground, leading to lower groundwater levels.	Prolonged droughts and changes in land use further diminish groundwater recharge rates.	Reduced groundwater availability exacerbates water scarcity, forcing humanitarian actors to explore alternative water sources and invest in sustainable water management practices.	In the Middle East, humanitarian agencies develop groundwater recharge projects and utilize treated wastewater to compensate for reduced natural groundwater replenishment, ensuring a stable water supply for displaced populations.
Increased evaporation rates	Higher temperatures lead to greater evaporation from water bodies and soil.	Increased evaporation due to rising temperatures further reduces surface water availability.	Evaporation reduces the volume of water in reservoirs and rivers, leading to acute water shortages and heightened competition for water resources in both refugee camps and host communities.	In the Sahel, increased evaporation rates drastically lower water levels in reservoirs, prompting the implementation of water-saving technologies and infrastructure improvements to secure water availability for displaced populations.
Changes in water quality	Alteration in water temperature, pH, and contamination levels.	Climate change-induced pollution, such as runoff from increased rainfall, degrades water quality.	Contaminated water sources become more prevalent, necessitating advanced water treatment and regular monitoring to prevent disease outbreaks in emergency settings.	Rising temperatures and runoff from agricultural fields in the Sahel worsen water quality in refugee camps, leading humanitarian agencies to invest in advanced treatment systems to ensure safe drinking water for affected populations.

Shifts in water demand and use patterns	Changing agricultural practices, energy production, and domestic water use.	Increased stress on water resources as communities adapt to climate change impacts, such as droughts.	Greater competition for water resources can lead to conflicts between displaced populations and host communities, making coordinated water management strategies essential for maintaining stability.	In the Lake Chad Basin, shifts in water demand due to prolonged droughts and reduced water availability lead to tensions between refugees and local communities, necessitating the development of integrated water resource management strategies.
Increased flood risk and pollution	Flooding caused by extreme weather events leads to widespread pollution and water contamination.	More frequent and severe flooding events heighten the risk of pollution and waterborne diseases.	The increased prevalence of polluted floodwaters requires comprehensive water treatment and pollution control measures to safeguard public health in humanitarian settings.	Floods in South Asia result in the widespread contamination of drinking water sources, forcing humanitarian agencies to deploy large-scale water purification systems and distribute hygiene kits to prevent disease outbreaks in flood-affected areas.

Table 3: Strategic solutions and best practices

Solution	Description	Benefits	Examples/Application
Integrated water resource management (IWRM)	A coordinated approach to managing water, land, and related resources to maximize social and environmental welfare.	Promotes sustainable water use, ensures equitable distribution, and supports long-term water security.	In flood-prone regions, IWRM plans are developed to manage water flow and reduce flood risks while ensuring the sustainability of water resources for agricultural and domestic use, integrating local and regional water management efforts.
Nature-based Solutions (NbS)	Utilizing natural processes and ecosystems to manage water resources and address environmental challenges.	Enhances water quality, controls floods, and supports biodiversity while providing sustainable solutions.	Restoring wetlands in post-disaster areas helps absorb excess water, reducing the impact of floods and improving water quality, while also supporting the regeneration of local ecosystems and biodiversity.
Climate-resilient infrastructure	Designing and constructing water infrastructure that can withstand extreme weather events and climate change impacts.	Ensures reliable water supply during and after disasters, reduces repair costs, and enhances community resilience.	In cyclone-prone areas, elevated water storage tanks and resilient pipelines are built to prevent flood contamination and ensure a continuous water supply even during extreme weather events.
Community engagement and education	Actively involving and consulting with local communities in water management decisions and educating them on sustainable practices.	Ensures community buy-in, enhances the sustainability of interventions, and leverages local knowledge.	In rural areas, community-led water management committees are established to oversee the maintenance of water systems, ensuring that local practices and indigenous knowledge are integrated into water conservation efforts.
Advanced water treatment technologies	Implementing high-tech solutions like reverse osmosis, UV disinfection, and advanced oxidation processes to ensure water quality.	Provides effective treatment of contaminated water sources, particularly in areas with industrial pollution.	In urban areas affected by industrial spills, advanced water treatment technologies are deployed to remove heavy metals and chemical contaminants from water supplies, ensuring that the water is safe for consumption and other uses.

Decentralized water management systems	Establishing small-scale, locally managed water systems that operate independently of centralized infrastructure.	Reduces reliance on large-scale infrastructure, improves resilience, and ensures quicker response times in emergencies.	In conflict-affected regions, decentralized water systems are implemented in remote villages to ensure continuous access to safe water even when centralized infrastructure is damaged or inaccessible.
Financial mobilization and resource allocation	Securing funding and efficiently allocating resources for water management projects in humanitarian contexts.	Ensures the sustainability and scalability of water management interventions.	Humanitarian agencies collaborate with international donors to secure long-term funding for water resource management projects in protracted crises, ensuring that essential infrastructure and services are maintained over time.
Data-driven decision making	Using real-time data and advanced monitoring technologies to inform water management strategies.	Enhances the accuracy of planning, improves resource allocation, and ensures timely interventions.	In drought-affected regions, satellite data and remote sensing technologies are used to monitor water levels, predict shortages, and inform the distribution of water resources to the most vulnerable areas.

Section 4: Case studies and practical exercises

Key points

- Highlight the practical application of water management techniques through real-world case studies in diverse humanitarian contexts.
- Examine challenges and successful strategies employed in these case studies to derive actionable lessons for future interventions.
- Showcase innovative approaches to water management that have proven effective in mitigating environmental and humanitarian crises.

Background information

- Case studies are a powerful tool to understand the complexities of water resource management in humanitarian settings. They provide concrete examples of how different strategies and techniques are implemented on the ground, offering valuable insights into their effectiveness and areas for improvement.
- By studying these cases, participants can gain a deeper understanding of the challenges and opportunities in managing water resources during emergencies, particularly in the context of environmental sustainability.



Content development: Case studies and best practices

<i>Case Study</i>	<i>Context</i>	<i>Environmental Challenge</i>	<i>Humanitarian Response</i>	<i>Lessons Learned</i>
<i>Water Management in Afghanistan</i>	Afghanistan facing prolonged droughts and conflict leading to water shortages.	Severe water depletion affecting access to safe water for drinking, sanitation, and hygiene; dried up springs and lower groundwater levels in hand-dug wells and shallow wells.	WASH Cluster 2024 priority includes safe water supply for domestic use, risk reduction, water surveillance, household water treatments, water network reinforcements, line chlorination, reverse osmosis plants; hygiene promotion focusing on handwashing, personal hygiene, and NFIs; construction and repair of hand-pumps; emergency latrines and improved access to safe sanitation.	Small-scale, climate-resilient water solutions are effective; community involvement and management of water resources are crucial; integrated WASH services mitigate the impacts of water scarcity and improve health outcomes; addressing GBV and ensuring disability-friendly infrastructure is vital.
<i>Water and Sanitation in Post-Earthquake Haiti</i>	Post-earthquake recovery efforts in Port-au-Prince, Haiti.	The 2010 earthquake caused severe infrastructural damage, leading to significant challenges in water delivery, waste management, and sanitation. The existing vulnerabilities such as poor infrastructure, governance issues, and lack of disaster preparedness exacerbated the crisis.	Various NGOs and international agencies, including the Global Water Partnership and the Haitian Water and Sanitation National Directorate (DINEPA), coordinated efforts to restore water supply, manage solid and hazardous waste, and address sanitation needs. Actions included water trucking, bladder tanks installation, chlorination, waste recycling, and the use of composting toilets.	The importance of coordinated efforts, stakeholder collaboration, and integrating local knowledge in disaster response was highlighted. The case emphasized the need for robust infrastructure and disaster preparedness to mitigate the impacts of such events. Effective waste management and sanitation practices, such as composting toilets and community engagement, proved crucial in improving conditions and preventing disease outbreaks.
<i>Rainmaker Enterprise in South Sudan</i>	Prolonged droughts and climate-induced water scarcity in South Sudan, exacerbated by ongoing conflict and displacement.	Severe water shortages leading to competition over limited resources, affecting agriculture and increasing community conflicts.	Rainmaker Enterprise implemented solar-powered drip irrigation systems, combining clean technology with traditional knowledge to provide a sustainable water supply year-round, reducing dependence on erratic rainfall and alleviating conflicts over water resources.	Innovative, community-driven water management solutions can provide long-term resilience in conflict-affected areas. Integrating technology with local knowledge enhances sustainability and community acceptance.
<i>Water desalination in Gaza</i>	Chronic water scarcity and contamination in Gaza, exacerbated by the ongoing conflict and blockades.	Over 90% of water from Gaza's sole aquifer is unsafe for human consumption, with high levels of salinity and contamination.	UNICEF, with support from international partners, installed small desalination plants across Gaza, providing clean water to tens of thousands of residents through public taps and storage tanks. These initiatives significantly reduced dependence on contaminated water sources and the high costs associated with private water vendors.	Small-scale, decentralized desalination systems can provide immediate relief in conflict zones with severe water scarcity. Ensuring reliable access to power for these systems is essential for their success.

ACTIVITIES

1. Interactive exercise: Identifying water resources, and wastewater types

- Participants will work in small groups to identify and classify different water resources, such as surface water, groundwater, and rainwater harvesting, using provided scenarios, and the different wastewater types.
- **Discussion points:** *What are the key characteristics of each water resource? How can each resource be effectively utilized in humanitarian contexts? What are the characteristics of each wastewater type? How can each wastewater type be treated and used?*

2. Brainstorming session: Sustainable water management techniques

- Participants will brainstorm and share sustainable water management techniques, focusing on safe drinking water provision, wastewater treatment, and water conservation.
- **Discussion points:** *What are the most effective techniques for water management in humanitarian settings? How can these techniques be adapted to different contexts?*

3. Case study analysis: Water management during disasters

- Participants will analyze a provided case study on water resource management during a disaster, such as the Rainmaker Enterprise in South Sudan.
- **Discussion Points:** *What were the key environmental challenges? How did the humanitarian response address these challenges? What lessons can be learned from this case study?*

4. Interactive exercise: Identifying challenges in water resource management

- Participants will work in small groups to identify challenges such as water scarcity, contamination, and infrastructure damage, and suggest solutions for each.
- **Discussion points:** *What are the common challenges in water resource management during humanitarian interventions? What strategies can be employed to overcome these challenges?*

5. Discussion: Strategic solutions and best practices

- Facilitated discussion on best practices and strategic solutions, including pollution control measures and climate-resilient water management techniques.
- **Discussion points:** *How can best practices be adapted to different humanitarian contexts? What are the benefits and potential challenges of these strategies?*

6. Case study analysis: Water resource management in conflict zones

- Participants will analyze a provided case study, such as water desalination in Gaza, and discuss lessons learned and best practices.
- **Discussion Points:** *How did the humanitarian response address water resource challenges in a conflict zone? What lessons can be drawn for future interventions?*

RESOURCES

Materials

- **Slides:** for presenting key points, definitions, and case study details.
- **Handouts:** summarizing key concepts and techniques for sustainable water management.
- **Flipchart and markers:** for group discussions and brainstorming sessions.
- **Case study materials:** detailed examples of water resource management in various humanitarian contexts.
- **Water resource scenarios:** examples for participants to classify different water resources.

References

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Delivery method

- **Lectures:** to provide foundational knowledge on water resource management, covering topics like the importance of water resources, techniques for sustainable management, and challenges faced in humanitarian contexts.
- **Group discussions:** encourage participant interaction and deeper exploration of sustainable water management techniques and strategic solutions.
- **Interactive exercises:** engage participants in identifying and applying water management concepts through practical scenarios.
- **Case study analysis:** facilitate critical thinking by examining real-world examples and discussing lessons learned.

Assessment tools

- **Q&A sessions:** used after lectures to assess participants' understanding of key concepts.
- **Group presentations:** participants will present their findings from group discussions and case study analyses.
- **Feedback sessions:** facilitator will provide feedback on group work and discussions to reinforce key learning points.
- **Written reflections:** participants will complete a short reflection on what they learned about water resource management and its challenges.

Reflection and review questions

Section 1: Introduction to water resource management in humanitarian settings

- What are the primary water resources available in humanitarian settings, and how can they be effectively managed?
- What are the different types of wastewater in humanitarian settings, and what are their potential impacts?
- How does poor water management impact health, the environment, and climate change in humanitarian contexts?

Section 2: Techniques for sustainable water management

- What are some sustainable water management techniques that can be applied in emergency situations?
- How can community engagement and indigenous knowledge enhance water management practices in humanitarian contexts?

Section 3: Challenges and strategic solutions in water resource management

- What are the key challenges faced in water resource management during humanitarian interventions?
- How does climate change exacerbate water resource management challenges, and what strategies can mitigate these effects?

Section 4: Case studies and practical exercises

- What lessons can be learned from the case studies on water resource management during disasters?
- How can best practices from real-world examples be adapted to different humanitarian contexts?

Overall module review

- How has your understanding of water resource management in humanitarian action evolved throughout this module?
- What key takeaways from this module will you apply in your future work or studies?

KEY TAKEAWAYS

1. Importance of water resource management in humanitarian contexts:

Effective water resource management is vital for maintaining health, sanitation, and environmental stability during humanitarian crises. Managing water resources sustainably ensures safe access to drinking water, supports WASH interventions, and protects ecosystems even under challenging conditions.

2. Understanding water resources:

Key water resources include surface water, groundwater, rainwater harvesting, and desalinated water. Each resource offers unique benefits and challenges in emergencies, necessitating tailored approaches to maximize their use while minimizing environmental impacts.

3. Techniques for sustainable water management:

Sustainable techniques such as safe drinking water provision (e.g., filtration systems, chlorination), wastewater treatment (e.g., septic systems, bioremediation), and conservation practices (e.g., rainwater harvesting, groundwater recharge) are essential for protecting public health and ensuring the resilience of water systems in emergencies.

4. Community engagement and indigenous knowledge:

Engaging communities and incorporating indigenous knowledge into water management practices enhances the sustainability and effectiveness of interventions. Local populations often have valuable insights into managing water resources that can improve humanitarian outcomes.

5. Challenges in water resource management:

Humanitarian contexts face significant challenges, including water scarcity, contamination, infrastructure damage, and the impacts of climate change. These challenges can compromise water availability and quality, posing health risks and exacerbating the vulnerability of affected populations.

6. Climate change and water resource management:

Climate change exacerbates water management challenges through altered precipitation patterns, increased frequency of extreme weather events, and rising sea levels. Adaptation strategies such as climate-resilient infrastructure and nature-based solutions are crucial for mitigating these impacts.

7. Strategic solutions and best practices:

Solutions such as integrated water resource management (IWRM), advanced water treatment technologies, and nature-based approaches can address water management challenges effectively. Coordination among stakeholders, financial mobilization, and data-driven decision-making are essential for implementing sustainable water management strategies.

8. Case studies and lessons learned:

Case studies provide practical insights into successful water management strategies in diverse humanitarian contexts, from conflict zones to drought-affected regions. Key lessons include the importance of innovative, community-driven solutions, the integration of technology and local knowledge, and the need for resilient and adaptable water systems.

9. Integration into humanitarian planning:

Water management should be integrated into broader humanitarian planning, ensuring that water resource considerations are aligned with other interventions such as health, WASH, and environmental protection. This holistic approach supports long-term sustainability and resilience.



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