

# Dzongkhag Waste Management Strategy 2025



Towards Zero Waste Society



PemaGatshel Dzongkhag Administration

Royal Government of Bhutan



**His Majesty The 5<sup>th</sup>  
Druk Gyalpo**

*Where we live  
must be clean,  
safe, organized  
and beautiful, for  
national integrity,  
national pride, and  
for our bright  
future. This too is  
nation building.*

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**ABBREVIATION**

C&D	Construction and Demolition
CH <sub>4</sub>	Methane
CO <sub>2</sub>	Carbon Dioxide
EPR	Extended Producer Responsibility
E-waste	Electronic Waste
GHG	Greenhouse Gas
GNH	Gross National Happiness
KPI	Key Performance Indicator
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
NEC	National Environment Commission

NEPA	National Environment Protection Act 2007
NWIS	National Waste Inventory Survey
OB	Overburden
PPP	Public-private Partnership





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24 February 2025



## **INTRODUCTION**

Bhutan is facing significant waste management challenges due to rapid urbanization, increasing population and changing consumption patterns. The country's commitment to sustainable waste management aligns with the philosophy of Gross National Happiness (GNH), focusing on environmental conservation, public health and wellbeing. The National Waste Inventory Survey (NWIS) 2019 found that Bhutan produces approximately 172.16 metric tonnes of waste per day, with household waste accounting for 47.34% and commercial waste accounting 39.09%.

With minimal waste treatment and recycling initiatives, all categories of waste end up in landfills and open dumpsites. With landfills and open dumpsites across the country reaching their maximum capacity, increasing waste generation and improper waste disposal is threatening the environment and public health.

Plastic waste and hazardous materials endanger the biodiversity and wild life through ingestion and entanglement. Leachate from the landfills and open dumpsites pollutes soil and water bodies. Organic waste in the landfills and open dumpsite degrades and emits

greenhouse gas emissions (GHG), contributing to global climate change.

Poor waste management also threatens public health and wellbeing. Poor waste management favours the growth of disease-carrying vectors which increases the risk of vector-borne diseases. Open burning of waste produces toxicants which deteriorates air quality and causes respiratory diseases. Besides, improper disposal of hazardous waste from industries and medical facilities can cause food and water contamination.

Waste management is a critical component of environmental stewardship, public health, sustainable development and climate resilience. With increasing waste generation worldwide, effective waste management systems and technological innovations have become a necessity.

With the rapid development, Bhutan has seen improvements in the waste management with the adoption of new strategies and technologies, involvement of private entrepreneurs and waste workers and volunteers. To address the waste management issues, the

government has implemented policies such as the National Waste Management Strategy 2019, aiming for a Zero Waste Bhutan by 2030 through a circular economy approach. This strategy emphasizes waste segregation at source, recycling, composting and waste-to-energy initiatives to minimize dependency on landfills and open dumpsites. Bhutan also observes the Zero Waste Hour initiative, encouraging citizens to engage in community clean-ups and promote responsible waste disposal.

## **WASTE MANAGEMENT CHALLENGES IN BHUTAN**

Although Bhutan has waste management policies implemented, waste management remains a challenge for Bhutan, as in most developing countries. Improper waste disposal threatens the pristine environment, water, air and soil quality and public wellbeing. Waste management is a major challenge due to open littering, lack of source segregation and scarce land for landfills and illegal dumping of waste.

Currently, waste collection systems are in place in urban areas whereas rural areas lack proper waste management systems and infrastructures. In rural areas, open dumping and open burning of

waste are still practiced, resulting in environmental pollution and health risks. Increasing waste generation, coupled with a lack of waste recycling practices has further worsened the situation.

Bhutan banned the use of plastic bags in 1999 to minimize plastic pollution and protect the country's rich biodiversity. Despite the repeated implementation of single-use plastic in 2005, 2009 and 2019, Bhutan's goal of eradicating plastic waste remains a biggest challenge. Despite policy implementation, Bhutan faces challenges in coordination and planning across institutions for waste management.

Lack of human and financial resources further hampers its implementation and regulation enforcement. Additionally, lack of skilled personnel and technology worsens waste management in a sustainable and environmentally friendly manner. Although waste collection systems have been established in urban areas, Bhutan lacks robust landfill management and wastewater treatment systems. Untreated wastewater pollutes rivers and lakes, threatening both aquatic ecosystems and human health.



## OVERVIEW

Located in the south-eastern region, PemaGatshel Dzongkhag has a population of 25,000. PemaGatshel spans a total land area of 1023 sq. km and comprises 11 Gewogs, which are further divided into Chiwogs for effective local governance and service delivery. The Dzongkhag is known for its vibrant traditions, including the production of traditional Bhutanese music instruments and rich Buddhist cultural practices.

Denchhi is a developing town, undergoing major developmental activities including infrastructure development. The town is being developed with improved road conditions and public facilities to accommodate the growing population and economic activities. Nganglam, one of the fastest-growing towns, plays a significant role as an industrial and commercial hub due to its strategic location near the Indian border. With the economic opportunities, the town will play a crucial role in trade, manufacturing, and employment generation.

## CURRENT STATUS OF WASTE MANAGEMENT

The current municipal solid waste (MSW) generation in Denchhi Throm and Nganglam Throm under PemaGatshel Dzongkhag is estimated to be 0.74 tonnes per day. With increasing developmental activities and economic growth, the volume of waste generation is increasing. The current waste management system in the town consists of primary collection and final disposal. Waste is collected by municipal trucks and the waste is transported for final disposal. The Dzongkhag depends on an open dumpsite for waste disposal, with no engineered landfill in place. The open dumpsite is located at Chungkhar under Zobel Gewog (*Figure 1*).



**Figure 1. *Open Dumpsite at Chungkhar***

The Dzongkhag Administration in collaboration with Drungkhag, Gewogs and residents from Denchhi and Nganglam Throm also observes Zero Waste Hour monthly to maintain a clean community. However, illegal waste disposal and open littering are prominent issues due to lack of awareness and lack of infrastructures such as waste collection points.

Currently, there is no waste segregation system implemented in the Dzongkhag. However, the private waste workers play a critical role in waste recycling, who work to recover valuable recyclable waste. Recyclable wastes are then sold to waste dealers across the border. Denchhi Throm has a decentralized sewage treatment plant (*Figure 2*). Domestic wastewater in Denchhi Throm will be collected and treated prior to discharge into Marung river.



**Figure 2. Decentralized Sewage Treatment Plant**

In the Dzongkhag, community-based organizations such as Lotus Women Group (*Figure 3*) and SerLam Women Group work towards waste reduction and waste upcycling.



**Figure 3. Lotus Women Group**

## **OBJECTIVES**

The main objective of the Dzongkhag Waste Management Strategy is to develop a sustainable and efficient waste management system that minimizes pollution, safeguards public health and preserves the pristine environment. This strategy aligns with Bhutan's national vision of Zero Waste Society by 2030 through the promotion of a circular economy based on the principles of Reduce, Reuse, and Recycle (3Rs).

## **SPECIFIC OBJECTIVES**

- Minimize pollution and environmental degradation through reduced waste production and improper disposal
- Enhance public awareness and community participation in waste management through advocacy, education and behavioural change programs.
- Ensure compliance with existing waste regulations through strict monitoring, enforcement and accountability.
- Improve and enhance waste segregation, collection and disposal systems.

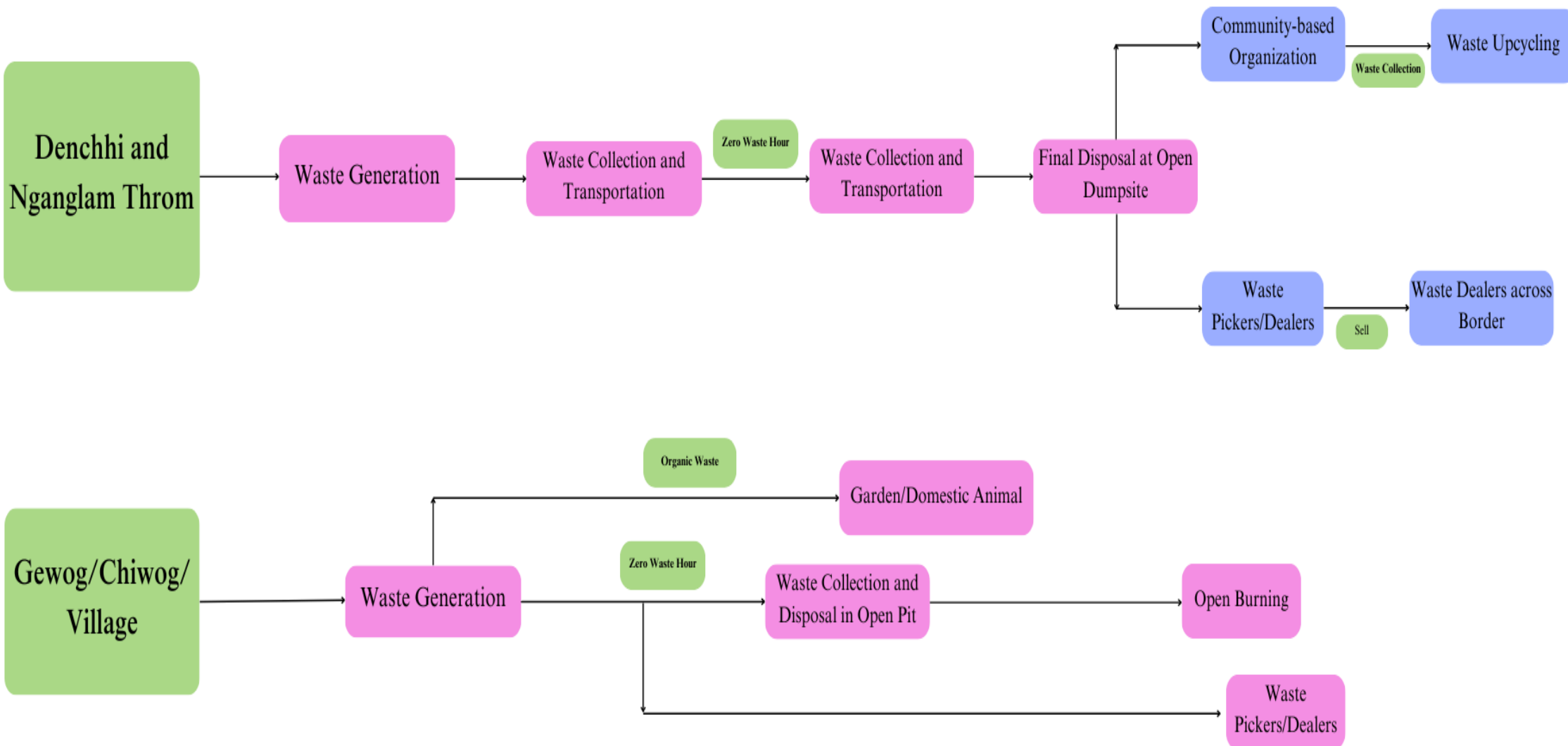
- Promote green initiatives, sustainable packaging and responsible consumerism.
- Promote circular economy through enhance waste recycling and upcycling and composting of organic waste

## **TARGET**

- Improved waste collection system in the municipality area.
- Establish waste drop-off centres at strategic locations.
- Enhance waste segregation at source.
- Promote wider use of Zero Waste App.
- Enhance awareness on sustainable waste management.
- Ensure 100% reduction of illegal disposal of waste



# Current Waste Management Practice in PemaGatshel









## CHAPTER 1: OVERARCHING POLICY



The overarching policy sets the basis for a holistic and integrated approach to waste management across all levels. This waste

management strategy is prepared in align with existing relevant environmental policies, legislations and regulations of Bhutan.



**Figure 4.** Overview of the National policy, plans/strategies and Regulations

## **THE CONSTITUTION OF KINGDOM OF BHUTAN**

The Article 5 of the Constitution of Kingdom of Bhutan (2008) mandates the Royal Government of Bhutan to maintain a minimum of sixty percent of forest cover for all time. The Constitution also requires the Government to ensure ecologically balanced sustainable development, while promoting justifiable economic, prevent pollution and ecological degradation and social development and ensure a safe and healthy environment and the right and responsibility of the government, parliament, and every Bhutanese citizen for environmental conservation as detailed below:

1. Every Bhutanese is a trustee of the Kingdom's natural resources and environment for the benefit of the present and future generations and it is the fundamental duty of every citizen to contribute to the protection of the natural environment, conservation of the rich biodiversity of Bhutan and prevention of all forms of ecological degradation including noise, visual and physical pollution through the adoption and support of environment friendly practices and policies.
2. The Royal Government shall:

- (a) Protect, conserve and improve the pristine environment and safeguard the biodiversity of the country;
- (b) Prevent pollution and ecological degradation;
- (c) Secure ecologically balanced sustainable development while promoting justifiable economic and social development; and
- (d) Ensure a safe and healthy environment.

3. The Government shall ensure that, in order to conserve the country's natural resources and to prevent degradation of the ecosystem, a minimum of sixty percent of Bhutan's total land shall be maintained under forest cover for all time.

## **NATIONAL ENVIRONMENT PROTECTION ACT OF BHUTAN 2007**

The NEPA Act outlines the roles and responsibilities of National Environment Commission (NEC) and Competent Authorities in monitoring and reporting the environmental conditions of the country. Principles in the NEPA consists of fundamental right to a safe and healthy environment with a duty to protect and promote the pristine environment of the country, intergenerational equity, middle path strategy, precautionary principle, principle of 3Rs (reducing, reusing

and recycling materials), polluter pays principle, right to information and access to justice.

### **WASTE PREVENTION AND MANAGEMENT ACT OF BHUTAN 2009**

The Waste Prevention and Management Act of Bhutan was enacted in 2009 with an aim to enhance waste management, promote 3R principle of waste management and improve final waste disposal sites. The main objective of the Act is to prevent and reduce the quantity of waste generated across the country and promote reuse and recycling of the waste. The Act outlines the roles and responsibilities of implementing agencies and the people to manage different categories of waste as per the approved standards.

### **WASTE PREVENTION AND MANAGEMENT REGULATION 2012 AND AMENDMENT 2016**

Adopted in 2012, the *Waste Prevention and Management Regulation 2012*, the Regulation aims to develop a proper waste management system through effective and efficient waste collection, segregation,

treatment, storage, transportation, reuse, recycling and safe final disposal of solid, liquid and gaseous waste. The Regulation categorizes the waste into industrial waste, municipal waste, e-waste and medical waste along with their prevention and management systems.

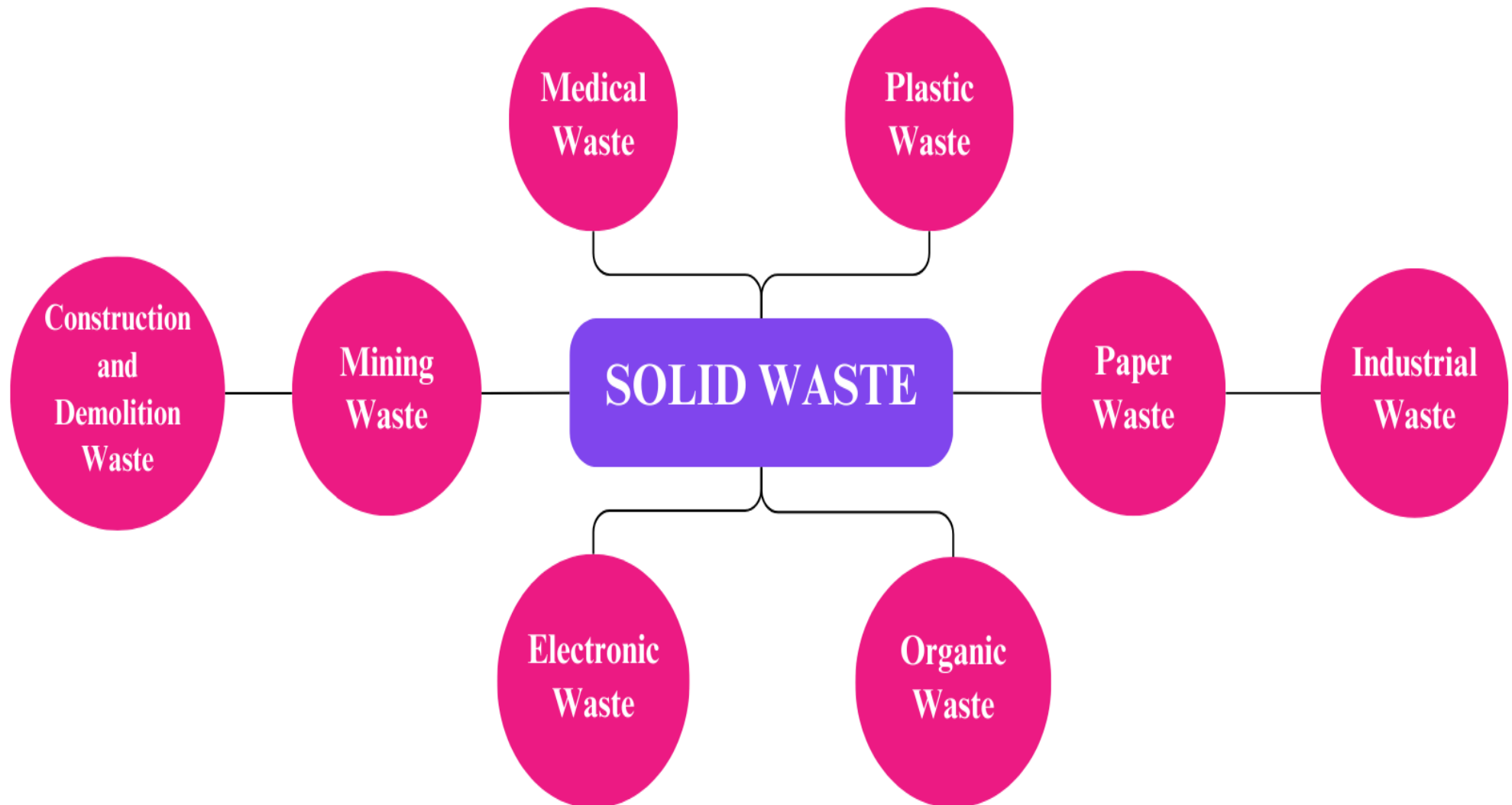
The Regulation further mandates the need for waste collection, levying fees for waste collection based on quantity of waste generated or by the degree of hazardousness, penalties for violations and to control and prohibit illegal dumping or releasing of waste into the environment. The Regulation was amended in 2016 as Waste Prevention and Management (Amendment) Regulation, 2016.

### **MINES AND MINERAL MANAGEMENT ACT 1995**

The Mines and Mineral Management Act of Bhutan 1995 is the primary legal framework which governs the mineral resource extraction. The Act aims to ensure sustainable and environmentally responsible mining operations, maintaining balanced economic development and environmental conservation through emphasis on environmental protection.



# CLASSIFICATION OF WASTE



# CHAPTER 2: MUNICIPAL WASTE





## **BACKGROUND**

Municipal solid waste (MSW) consists of organic waste, plastics, paper, metals, glass and construction and demolition (C&D) waste produced from households, commercial spaces, construction sites and institutions. With rapid urbanization and population growth, the amount of municipal waste is increasing globally, putting pressure on the waste management systems and the natural environment.

In Bhutan, the majority of the municipal solid waste generated ends up in landfills and open dumpsites due to lack of segregation, recycling and treatment practices. Lack of effective waste collection systems, limited recycling technologies and infrastructure and improper disposal practices results in landfill overflows, environmental degradation and resource wastage.

Poor waste management has a significant environmental, health, and economic impact, particularly in municipality areas where waste generation continues to increase. Improper waste disposal in open dumpsites and unregulated landfills leads to soil, water and air pollution. leachate from open dumpsites pollutes groundwater and

surface water bodies which makes it unsafe for domestic purposes. In addition, degradation of organic waste emits methane (CH<sub>4</sub>), accelerating climate change and global warming.

Poor waste management also has significant health impacts. Improper waste disposal makes it favourable for the development of disease-carrying vectors, resulting in vector-borne diseases outbreaks. Poor waste management incurs high expenditure due to the landfill and open dumpsite maintenance, waste collection cleaning programs. The combined effects of environmental, health, and economic challenges calls for the immediate need for effective waste management strategies to ensure a cleaner, healthier, and more sustainable future.

## **MANAGEMENT STRATEGY**

### **ENHANCE SOURCE SEGREGATION**

Waste segregation at the source plays a crucial role in effective waste management. The source segregation allows for the proper reuse, recycling, and recovery of waste. Currently, there is no waste segregation at source in both Denchhi and Nganglam town. The



municipal authorities should implement waste segregation at source and strictly monitor to ensure compliance.

Improved waste management and source segregation reduces the quantity of waste going into the landfill. Waste segregation at source reduces expenditures incurred for open dumpsites and landfill maintenance and waste treatment. This practice also helps in enhancing recycling practices and enhancing the circular economy, thereby creating opportunities for waste dealers to generate income through waste.

### **IMPROVE WASTE COLLECTION SYSTEMS**

Enhanced waste collection system is essential for improving waste management efficiency and ensuring proper waste disposal. Regular and systematic collection services will be provided to help prevent illegal dumping, open burning, and waste accumulation in the municipalities. Waste collection schedule for organic and inorganic waste will be implemented. This practice improves waste recovery and recycling, thereby contributing to a circular economy and reducing environmental pollution.

### **RECYCLING AND COMPOSTING**

Composting of organic waste is a sustainable and cost-effective solution for managing organic waste. A major portion of municipal solid waste in Bhutan is made up of organic waste that ends up in open dumpsites and landfills. Composting of organic waste is an alternate solution which can help minimize the emission of methane, reduce landfill dependency and enhance soil quality. In both Denchhi and Nganglam town, composting is less practiced. Awareness programs and technical support will be provided to encourage and promote composting practices.

Recycling materials plays a crucial role in managing every category of waste such as plastic, paper, glass and electronic waste. Material recovery facilities (MRFs) and waste collection centres will be constructed in the town to promote waste segregation, process for recycling and waste upcycling.

### **PUBLIC PARTICIPATION**

To achieve the goal of Zero Waste Society by 2030 and to improve the waste management systems, strong commitment and community participation is required. Private waste workers and community-based

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organizations will be strengthened. Public awareness programs and incentives for proper waste management will be enforced. Regulations will be strictly implemented to enhance community engagement. Enhanced emphasis will be made on community participation for sustainable waste disposal and management.

### **PRIVATE SECTOR PARTNERSHIP**

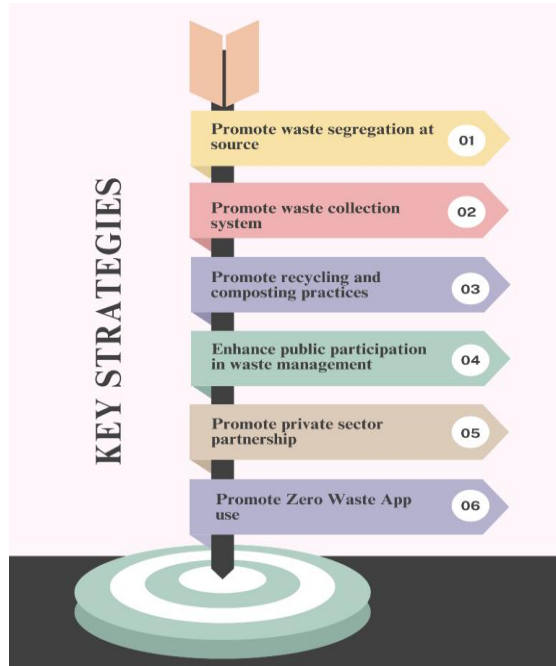
Bhutan is seeing an increasing number of private sector involvement in waste management and they have played a critical role in fighting against increasing waste pollution. Private sectors should be involved through public-private partnerships, fostering a circular economy that transforms waste into resources. The waste entrepreneurs should be supported with funding, new technologies and market linkages to increase recycling practices and strengthen the recycling industry.

### **ENHANCE ZERO WASTE APP**

The Zero Waste Bhutan App was developed by the National Environment Commission (NEC) and launched on December 13, 2022, to enhance Bhutan's waste management system. The app is an

enforcement tool which is used to track and penalize waste-related offenses.

The Zero Waste App use will be expanded as it is a cost-effective digital tool which can improve waste collection, monitoring, and encourage public participation in the waste management. The Zero Waste App will help make waste management more efficient, participatory, and transparent, contributing to a cleaner and more sustainable Dzongkhag. Open littering and illegal waste disposal can be prevented through community reporting.









## CHAPTER 3: PLASTIC WASTE



## **BACKGROUND**

Plastic waste has become a major environmental issue with its widespread use, slow decomposition rate and long-term impacts. The extensive use of single-use plastics, driven by rapid urbanization and changing consumption patterns has significantly contributed to environmental pollution and endangered ecosystems. Millions of tons of plastics are produced with a significant portion ending up in oceans, open dumpsites and landfills, and urban areas.

The decomposition rate of plastic waste is slow and varies with material composition and environmental conditions. Some plastics degrade in a few decades whereas some plastics remain in the environment for centuries, breaking down into microplastics. Studies have found that microplastics have entered the food chain, with traces found in drinking water, seafood, and the human body. Microplastics absorb harmful chemicals, disrupt hormonal balance, and pose serious health risks to humans and animals.

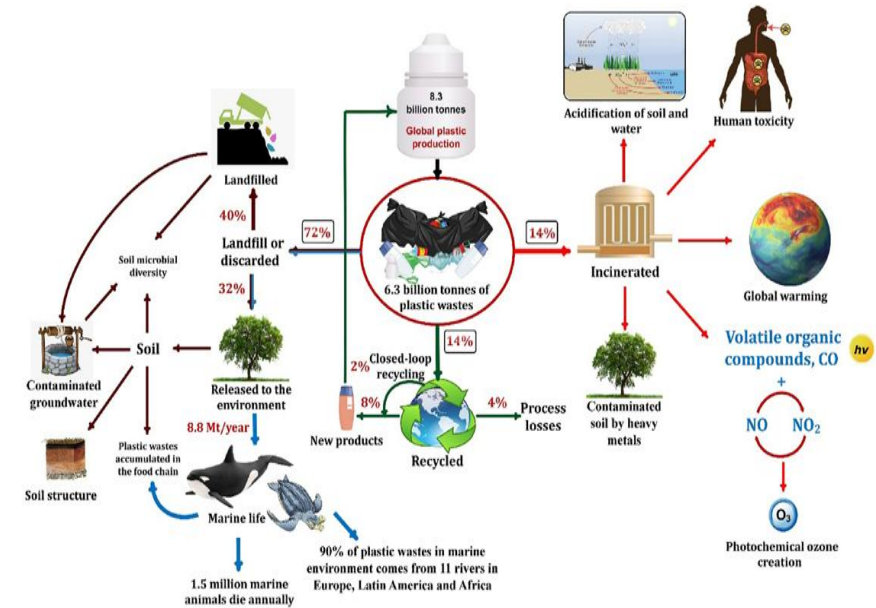
<b>Material</b>	<b>Estimated Decomposition</b>
Cigarette butts	5 years
Plastic bags	20 years
Plastic-lined coffee cups	30 years
Plastic straws	200 years
Soda can ring	400 years
Plastic bottles	450 years
Toothbrushes	500 years
Disposable diapers	500 years
Styrofoam	500 years

(Source: Chariot Energy, 2024)

The increase in plastic usage not only threatens wildlife but also poses significant health risks to humans, as microplastics pollute food and water supplies. Plastics break down into microplastic which enter the food chain. Microplastics in human bodies increase the risks of potential toxic impacts on human health. Plastic pollution also poses a severe threat to marine ecosystems.

Research shows that more than 1,500 species in marine and terrestrial environments consume plastics. The accumulation of plastic in marine ecosystems disturbs marine food chains and habitats.

Plastics contribute significantly to the greenhouse gas emissions mainly through production and disposal. According to the Organization for Economic Cooperation and Development, 90% of the greenhouse gas emissions from plastic products in 2019 came from the production and conversion of fossil fuels into new plastic products, which accounted for 3.4% of global emissions (United States Environmental Protection Agency, 2024).



(Source: Evode et al., 2021)

## MANAGEMENT STRATEGY

### WASTE PREVENTION

The waste prevention is the first stage in the waste management hierarchy and it is the most effective and sustainable approach to proper waste management. Preventing the waste at source helps in

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minimizing the environmental footprint associated with waste generation, collection, treatment, and disposal.

Sustainable production and responsible consumption should be adopted to prevent waste generation. Utilization of renewable raw materials will be promoted. Businesses in the Dzongkhag will be made to use sustainable packaging alternatives. The consumers will be educated on responsible plastic use, waste segregation, and recycling practices.

Prevention of waste generation has social and economic advantages. Energy and raw materials consumption and cost of waste management can be reduced. This can also help in climate change mitigation and sustainable resource management. Besides, a plastic free environment can improve the health and wellbeing of the community.

### **REDUCE SINGLE-USE PLASTICS**

The increased use of single-use plastics has led to increased plastic pollution. Plastics are widely used in Bhutan, despite government

efforts to ban plastic bags. It is critical to reduce and eventually eradicate the use of single-use plastics in daily life.

The Royal Government of Bhutan has implemented policies to minimize plastic use. Despite the efforts, it remains a challenge due to lack of commitment and support from the public, limited monitoring and lack of substitutes for plastic bags. *National Waste Management Strategy 2019* and the *Waste Prevention and Management Act 2009 and its Regulation 2012 & Amendment 2016* emphasize the need to minimize plastic consumption and promote sustainable alternatives.

Strict monitoring will be conducted on the use of single-use plastics. Businesses and customers using single-use plastics will be penalized as per the *Revised Waste Offence and Penalties*.

### **PROMOTE USE OF SHOPPING BAGS**

By choosing reusable or biodegradable alternatives, plastic pollution can be reduced, helping to limit the spread of microplastics and their harmful effects on the environment and human health. Alternative



materials such as cloth bags, biodegradable packaging, reusable bags and environmentally-friendly containers should be adopted.



**Figure 5.** *Waste to Bags*

### **ENHANCE RECYCLING PRACTICES**

Recycling plays a crucial role in pollution reduction, conserving resources and preserving the environment. The Dzongkhag has no infrastructure for recycling of waste which leads to most recyclable waste ending up in open dumpsites. To enhance recycling initiatives

in the Dzongkhag, emphasis will be given to waste segregation at source, infrastructure development, policy enforcement and public participation. The source segregation at the household and institutional level will be implemented.

Investing in material recovery facilities in the Dzongkhag is another key step toward improving waste management. Waste collection, segregation and recycling processes can be streamlined. Municipal Authorities and Gewog Administration should establish waste collection centres with separate bins to facilitate the public to play a role in recycling efforts.

## KEY STRATEGIES

01 Sustainable production and responsible consumption

02 Reduce single-use plastic

03 Promote use of shopping bags

04 Promote recycling practices

05 Strict monitoring to ensure compliance with regulations

06 Promote sustainable packaging alternatives



(Source: Zeroin, 2024)

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## CHAPTER 4: PAPER WASTE



## **BACKGROUND**

Paper waste has become a major issue as global consumption of paper products continues to increase. This is driven by an increase in packaging demands, office supplies, and consumer goods. Besides digital transition, paper consumption is high in businesses, educational institutions, households and government offices which results in huge volumes of discarded paper. Although paper waste is biodegradable than plastic, increasing paper waste contributes significantly to deforestation, greenhouse gas emissions, and land pollution.

Paper waste is produced from schools, offices, business and packaging industries. Minimal recycling practices and management of paper waste puts pressure on the landfills and open dumpsites. Paper degrades faster than plastics, however huge quantities of paper waste contribute to environmental pollution. Paper manufacturing results in large-scale deforestation which destroys habitats and reduces biodiversity. Besides, it also consumes huge amounts of energy and water and releases carbon dioxide (CO<sub>2</sub>) and methane (GHG).

The production, disposal, and recycling of paper waste have significant environmental and social implications. Paper production heavily depends on wood pulp, leading to deforestation and habitat destruction. This disrupts the carbon sink-a natural process that absorbs CO<sub>2</sub> from the atmosphere. The decomposition of paper waste also emits methane that is 25 times more potent than CO<sub>2</sub>.

Paper wastes accounts for nearly 26% of global landfill. The increasing usage of paper results in large volumes of paper waste which ends up in landfills and the environment. produces increased paper wastes which end up in landfills. Landfills and open dumpsites across the country have reached their maximum capacity and the paper waste further exacerbates waste management challenges. This puts more pressure on the landfill space.

## **MANAGEMENT STRATEGY**

### **DIGITAL TRANSITION**

As the world transitions towards the digital era, technology provides a powerful tool to minimize paper use and paper waste production. All the institutions should adopt digital transition to minimize demand

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for paper-based documents and enhance operational efficiency, data security and accessibility. Digital platforms should be widely used in workplaces, schools and government agencies which is a key step in reducing paper consumption.

Transitioning from manual paperwork to digital workflows will allow organizations to carry out duties electronically. Businesses in the Dzongkhag should adopt e-receipts and online record-keeping platforms. Further, hybrid models of paper-based systems and digital should be integrated where physical documentation is necessary.

### **PAPER RECYCLING**

Minimizing paper waste aligns with the principles of reduce, reuse, and recycle (3Rs), which plays a critical role for a sustainable future. Paper waste generated should be reused and upcycled into new products. Recycling is important in paper waste management. To enhance paper recycling practices, waste segregation at source should be adopted which helps to ensure that clean and dry paper waste is collected separately from other waste.

### **PROMOTING SUSTAINABLE PRACTICES**

Sustainable practices such as double-sided printing and reducing unnecessary paper consumption are essential steps in minimizing paper waste at the source. Use of double-sided printing should be adopted in every institution and work place. This practice reduces paper consumption in half and maximizes the use of both sides of the paper.

### **REUSABLE AND MINIMALIST APPROACHES**

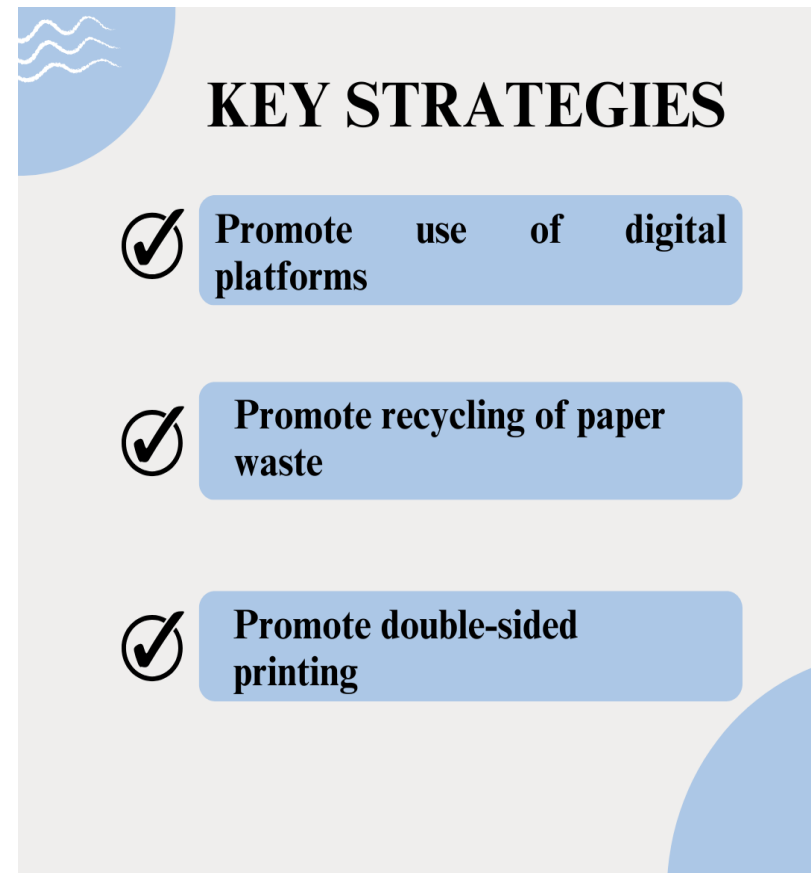
Consumers and businesses should adopt reusable solutions, such as using cloth bags, opting for minimal packaging, and purchasing products made from recycled paper, which can reduce waste and promote sustainability. Businesses should promote minimal packaging practices by reducing excessive packaging and choosing biodegradable and recyclable materials. Further, the businesses should collaborate with eco-friendly packaging suppliers.

### **EDUCATION AND AWARENESS**

Public awareness, educational programs, and corporate initiatives are key to increasing awareness about the environmental impact of paper



waste. The public should be educated on the importance of mindful consumption habits and responsible disposal practices such as proper waste segregation, recycling and composting paper waste to drive behavioural changes. Educational programs should be conducted which can help instil sustainable habits.









# CHAPTER 5: ORGANIC WASTE





## **BACKGROUND**

Organic waste, including food scraps and yard waste, constitutes a significant portion of municipal solid waste. Studies show that organic waste accounts for up to 30% of the total waste generated worldwide. As the population increases and consumption patterns continue to evolve, the quantity of organic waste generation is increasing.

Although the organic waste is biodegradable, poor management leads to environmental challenges. Disposal of organic waste into the environment, open dumpsites and landfills causes waste overflow, methane emission and foul odour.

## **MANAGEMENT STRATEGY**

### **PREVENT AND REDUCE FOOD WASTAGE AT SOURCE**

Preventing and reducing food waste at the source is one of the most effective methods to minimize organic waste and promote sustainability. Portion control and responsible consumption is encouraged which helps prevent excess food from being wasted.

### **PROMOTE COMPOSTING**

Composting is a sustainable and eco-friendly approach to organic waste management given its environmental benefits. It diverts food waste from landfills and transforms food waste into nutrient rich soil amendments that enhance soil health and promote sustainable agriculture.

Waste segregation at source also plays a crucial role to facilitate composting where organic waste can be sorted to prevent contamination with other waste. To embrace the benefits of composting and organic waste management, public awareness, policy support, and infrastructure development are crucial. Establishment of efficient composting facilities are encouraged, along with incentives and recognition for community composting initiatives.

In the rural areas, organic waste is used for animal feeding and disposed of in gardens. Farmers are encouraged to adopt compost as a natural fertilizer which will support sustainable farming practices, reduce dependence on chemical inputs, and contribute to a circular economy where waste is repurposed into valuable resources.

**PROMOTE BIOGAS PRODUCTION**

Biogas production is one of the most effective strategies to convert biodegradable waste into renewable energy. Biogas production should be promoted in the Dzongkhag. The Dzongkhag and Gewog Administration should provide technical support. This strategy supports the principles of a circular economy by turning organic waste into valuable resources.









# CHAPTER 6: ELECTRONIC WASTE





## **BACKGROUND**

Electronic waste (e-waste) consists of discarded electronic devices such as computers, mobile phones, televisions, and household appliances. With the increasing use of technology in Bhutan, the generation of e-waste has risen significantly. The rapid rate of technological advancement, coupled with shorter product lifecycles and growing consumer demand for electronics, has contributed to the accumulation of e-waste. E-waste contains hazardous materials such as lead, mercury, and cadmium, which poses significant environmental and health risks.

Hazardous components of the e-waste can leach into the soil and water, leading to groundwater contamination and ecosystem degradation. Dumping and burning of e-waste in open dumpsites and landfills emits hazardous fumes into the atmosphere which pollutes air. The lack of proper e-waste disposal facilities increases the risk of illegal dumping and informal recycling. Poor e-waste management and exposure can lead to respiratory diseases, skin infections, neurological disorders, and cancers.

## **MANAGEMENT STRATEGY**

### **REPAIR AND REUSE INITIATIVES**

Repairing and reusing of electronic devices is encouraged to improve the e-waste management in the Dzongkhag. PemaGatshel Dzongkhag lacks e-waste disposal sites. With the growing dependence on electronic devices for communication, education and business, e-waste is becoming a pressing concern.

Electronic devices are discarded without repairing. Awareness programs about repair options and advantages of reusing can change public attitudes towards e-waste. Outsourcing of e-waste management to private waste workers is encouraged.

### **ESTABLISH E-WASTE COLLECTION AND RECYCLING**

Designated collection sites should be established to ensure the safe disposal of electronic waste. This will encourage responsible disposal practices and prevent illegal disposal of e-waste into the environment, open dumpsites and landfills. Partnership with e-waste recyclers and waste dealers are crucial to ensure safe and environmentally sound recycling processes.







## CHAPTER 7: MINING WASTE

## **BACKGROUND**

Mining waste consists of various by-products generated from mineral extraction and processing such as overburden, tailings, and processing residues. Bhutan's mining sector plays a crucial role in economic growth, however, increasing mining operations has resulted in increased mining waste. The waste generated during excavation, mineral processing consists of chemicals and heavy metals which causes long-term impacts on the environment and human health if not managed properly.

Mining waste impacts soil, water and quality. Airborne pollutants from mining operations such as dust and particulate matter lead to respiratory diseases. Improper disposal practices affect soil quality which makes land unsuitable for agriculture and vegetation growth. Pollutants entering water bodies threaten aquatic ecosystems and drinking water.

## **MANAGEMENT STRATEGY**

### **WASTE REDUCTION AT SOURCE**

Implementing sustainable mining practices is crucial for minimizing waste generation at source. Mining companies such as State Mining Corporation Limited and private companies should explore and adopt efficient resource extraction techniques to maximize the recovery of valuable minerals. Advanced technologies should be adopted to optimize extraction and reduce the overburdened production. Further, a low-waste mining approach should be adopted which will help reduce environmental impacts and improve operational efficiency and cost-effectiveness.

### **MINE BACKFILLING APPROACH**

Mining companies should adopt a mine backfilling approach where overburden waste can be reintegrated into mined-out areas. This helps reduce waste volume, stabilize the land, and minimize soil erosion and habitat degradation. The *Mines and Minerals Management Regulation 2022* emphasizes the need for back-filling waste rock and overburden into the mine excavations.

**PROMOTE REUSE OF TOPSOIL**

The proper management and utilization of topsoil in mining operations play a crucial role in mining waste management, land rehabilitation and ecosystem restoration. During the extraction process, valuable topsoil layers are removed and displaced. Poor management of the topsoil leads to land degradation and loss of biodiversity and soil fertility.

Topsoil should be stored for later use for reclamation of the mined-out areas. Topsoil should be preserved separately from overburden and waste materials to minimize the loss of nutrients and microbial life. After the completion of mining activities, the reserved topsoil should be utilized for reforestation and revegetation. The *Mines and Mineral Management Regulation 2022* emphasizes the need to reuse the topsoil for reforestation and reclamation of mined out areas.

**SUSTAINABLE OVERBURDEN DUMPING**

Sustainable overburden (OB) dumping emphasizes reducing the environmental impact of mining waste while ensuring long-term land stability and ecological restoration. Overburden should be disposed of in such a way that no soil erosion, water contamination, and habitat destruction occur. Appropriate dump sites should be identified and the waste piles with terraced layers should be designed to ensure stability, along with erosion control measures. The *Mines and Mineral Management Regulation 2022* emphasizes the need for external waste dumping sites when in-pit dumping is not feasible. Overburden and waste materials should be layered with terraced edges to enhance stability, prevent erosion, and facilitate reclamation.



## KEY STRATEGIES

**1**

Promote sustainable mining practices through advanced technologies

**2**

Adopt mine backfilling approach for reintegration into mined-out areas

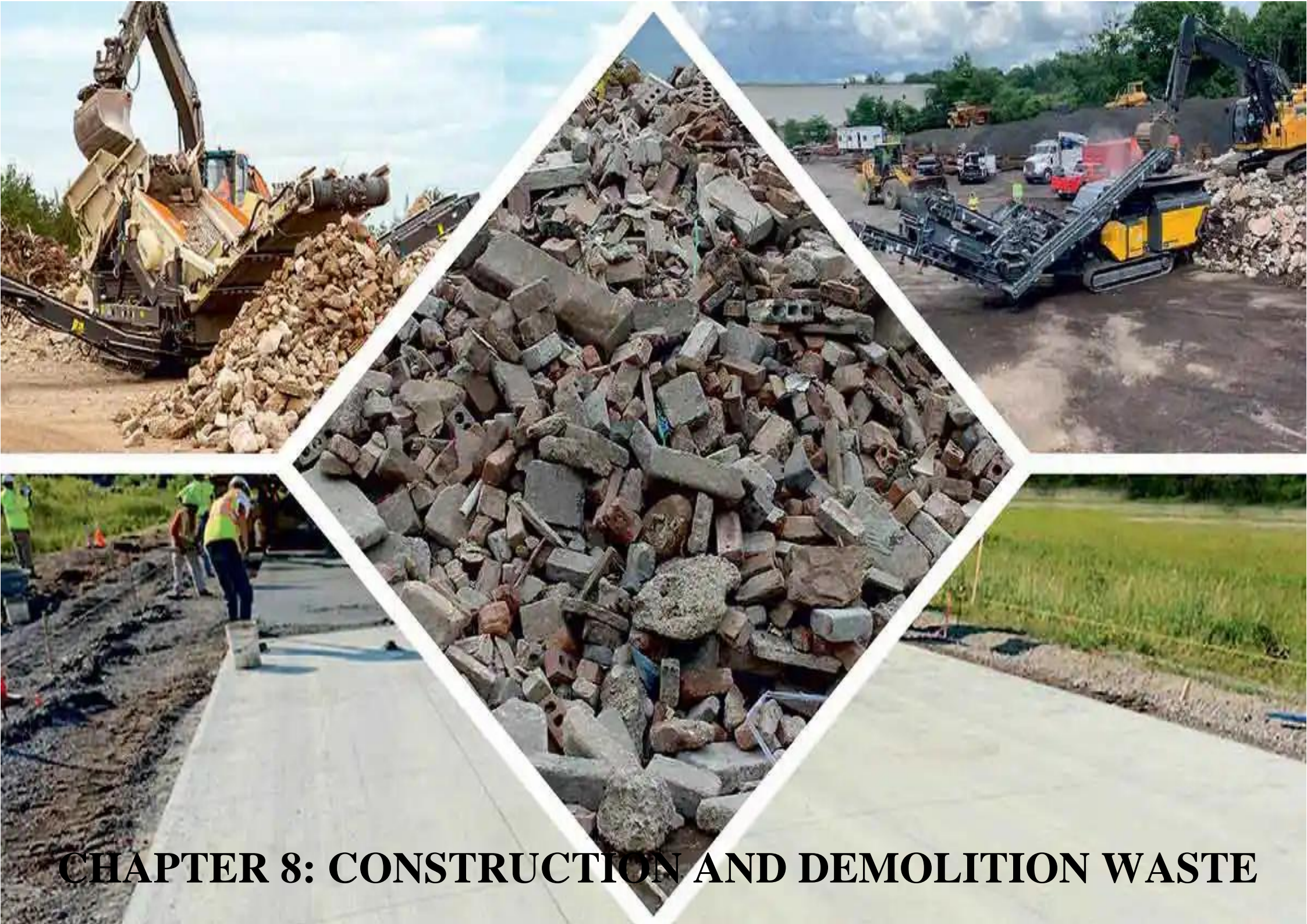
**3**

Promote reuse of topsoil for reclamation of mined-out areas

**4**

Adopt sustainable overburden dumping





## **CHAPTER 8: CONSTRUCTION AND DEMOLITION WASTE**



## **BACKGROUND**

Construction and demolition (C&D) waste consists of concrete, bricks, wood, and metal waste generated during construction and demolition activities. The amount of C&D waste is growing with increasing population and rapid infrastructure development. With increasing construction activities, illegal disposal of C&D waste is rising. Strategies for reducing construction waste through practices such as design for deconstruction, material reuse, and recycling is vital. Emphasizing the importance of planning and efficient resource use can significantly reduce the volume of waste generated during construction projects.

Improper disposal of C&D waste leads to land degradation as unregulated dumping contributes to soil erosion. Further, disposal of C&D waste in open dumpsites and landfill reduces the space and landfill/open dumpsites capacity. The improper disposal of such waste causes public health concerns, as it leads to water contamination and air pollution.

## **MANAGEMENT STRATEGY**

### **ON-SITE SEGREGATION**

On-site segregation of C&D waste is important in managing waste efficiently. Sorting compartments should be established within the construction site to enable the workers to segregate waste materials at the source. Designated bins and signage for different waste should be placed at the construction sites to ensure proper segregation. This will reduce illegal dumping and reduce the volume of waste that ends up in landfills. Waste segregation at source enables material recovery and supports enhanced recycling initiatives.

### **REUSE AND RECYCLING**

C&D waste should be reused and recycled after proper segregation. Reusing and recycling reduces the need for raw materials and reduces waste generation. C&D waste such as concrete and woods can be reused in other construction purposes and repurposed into new products. Further, construction sites should use recycled materials and materials from other construction work such as bamboo and metals.

**SUSTAINABLE C&D WASTE DUMPING**

C&D waste that cannot be reused or recycled should be disposed of in an environmentally-friendly manner. Proper dump yards should be identified and the waste should be disposed of in such a way that no soil erosion, water contamination, and habitat destruction occur. The dump yard should be designed to ensure stability, along with erosion control measures. Illegal dumping of C&D waste in places other than designated and approved sites should be monitored and regulated

## KEY STRATEGIES

Adopt on-site  
segregation  
and set up  
sorting  
compartments

Promote reuse  
and recycling  
of C&D waste

Practice  
environmental  
ly friendly  
dumping  
practices



## CHAPTER 9: INDUSTRIAL WASTE





## **BACKGROUND**

Industrial waste is generated from manufacturing and production processes of various industries. Industrial wastes are categorized into hazardous and non-hazardous depending on the risks to the environment and human health. Industrial waste varies from industry to industry. Poor management of industrial waste causes soil, water and air contamination, posing risks to environmental health and public wellbeing. With increasing industrial activity, industrial waste generation has increased.

## **MANAGEMENT STRATEGY**

### **INDUSTRIAL WASTE RECYCLING**

Industrial waste recycling is a critical approach towards reducing industrial waste, conserving resources and environment. Recycling will help to ensure that valuable materials are recovered and divert waste from reaching landfill. Industrial waste recycling is less practiced in the Dzongkhag.

Industries should study industrial waste to identify recyclable materials such as metals, plastics, paper, glass, and certain organic

waste. Dedicated recycling facilities should be set up and partnering with recycling companies is encouraged. Furthermore, employees should be educated on the importance of recycling and waste segregation at source.

Integrating a "closed-loop" recycling system can enhance sustainability. In a closed-loop system, recycled materials are reused within the same manufacturing process, creating a self-sustaining cycle.

### **TREATMENT OF CHEMICAL AND LIQUID WASTE**

Proper treatment of chemical and liquid waste from the industries will prevent soil, water and air contamination, protect environmental and human health, and ensure compliance with regulatory standards. Effective treatment approaches such as physical, chemical, biological and thermal should be adopted and implemented wherever appropriate to ensure safe reclamation, disposal.



## KEY STRATEGIES

01

**Adopt source segregation and recycling initiatives**

02

**Promote proper treatment of chemical and liquid waste**



## CHAPTER 10: MEDICAL WASTE



## **BACKGROUND**

Medical waste generation has increased with increasing health care services in Bhutan. However, effective management of medical waste remains a challenge for health care facilities. Medical waste poses environmental and public health risks due to the presence of infectious, hazardous and pharmaceutical waste. Medical wastes are generated from various healthcare centres such as hospitals, veterinary hospitals, clinics, laboratories and medical stores. Medical waste consists of infectious materials, sharps, expired pharmaceuticals, pathological and chemical waste. Improper disposal of medical waste, such as open burning or dumping in landfills, can result in the release of toxic pollutants, including dioxins and heavy metals, into the environment.

## **MANAGEMENT STRATEGY**

### **SEGREGATION OF MEDICAL WASTE**

Healthcare centres in the Dzongkhag should implement proper source segregation of medical waste along with color-coded bins for different categories of medical waste. This will help ensure that each waste is disposed of appropriately. Waste containers should be clearly

labelled to enhance waste handling and disposal processes. Healthcare workers should be trained on correct disposal techniques, educated on the importance of using protective equipment, and emergency procedures for handling hazardous materials.

## **SEGREGATION**

Color coded **bins/box/bag** for appropriate segregation and collection of waste



Food Waste

Infectious Waste

Non-Infectious Waste

Sharp Waste

**COLLECTION, STORAGE, AND TRANSPORTATION**

Designated storage areas should be established in the strategic locations within healthcare centres for segregated medical waste. This is crucial for maintaining a safe and organized waste management system. Medical waste should be collected and transported timely to designated disposal sites.

**TREATMENT AND DISPOSAL METHODS**

Medical waste treatment methods such as autoclave, incinerators and deep burial methods should be implemented to treat infectious medical waste. Autoclave is prominently used for decontaminating sharps, laboratory waste, and biohazardous waste and it is a cost-effective and environmentally friendly method. Modern incinerators are used for managing hazardous medical waste. This burns the waste at extremely high temperatures which destroys pathogens, thereby reducing the volume of medical waste. Medical waste should be disposed of and buried in deep pits which are constructed in accordance with standards. Burial pits should be constructed in such a way that it does not contaminate groundwater and soil.

**REGULATORY FRAMEWORK AND MONITORING**

Enforcement of policies that require proper waste segregation, storage, transportation and disposal practices within health centres are encouraged. Periodic monitoring needs to be conducted in the healthcare centres to ensure compliance with existing regulation and identify gaps in the waste handling practices. Moreover, healthcare facilities should establish strict monitoring and compliance mechanisms to ensure adherence to waste management guidelines. Routine inspections, audits, and feedback systems will help maintain proper waste handling practices. Strengthening these measures contributes to a safer healthcare environment while reducing the environmental impact of medical waste. Further, healthcare centres should adopt internal monitoring and compliance mechanisms to ensure compliance with existing medical waste management regulations.



## KEY STRATEGIES



Promote waste segregation at source and set up color-coded bins



Set up designated storage areas and implement timely collection and transportation



Promote medical waste treatment and safe disposal practices



Enforce policies and conduct regular monitoring on medical waste handling







# CHAPTER 11: WAY FORWARD



As we look to the future, advancing waste management practices will require a comprehensive and integrated approach that incorporates innovation, collaboration, and continuous improvement. Adoption of modern technologies, strengthening framework and collaboration between all stakeholders is required.

### **EMBRACING TECHNOLOGICAL INNOVATION**

Technological advancements play a crucial role in enhancing waste management practices. Emerging technologies, such as advanced segregation systems, waste-to-energy, and digital tracking tools, provide opportunities to improve efficiency. New waste management technologies need to be explored and adopted to address waste management challenges and promote waste recycling. Smart technologies should be adopted to improve waste tracking, and material recovery rates.

### **STRENGTHENING POLICY AND REGULATORY FRAMEWORKS**

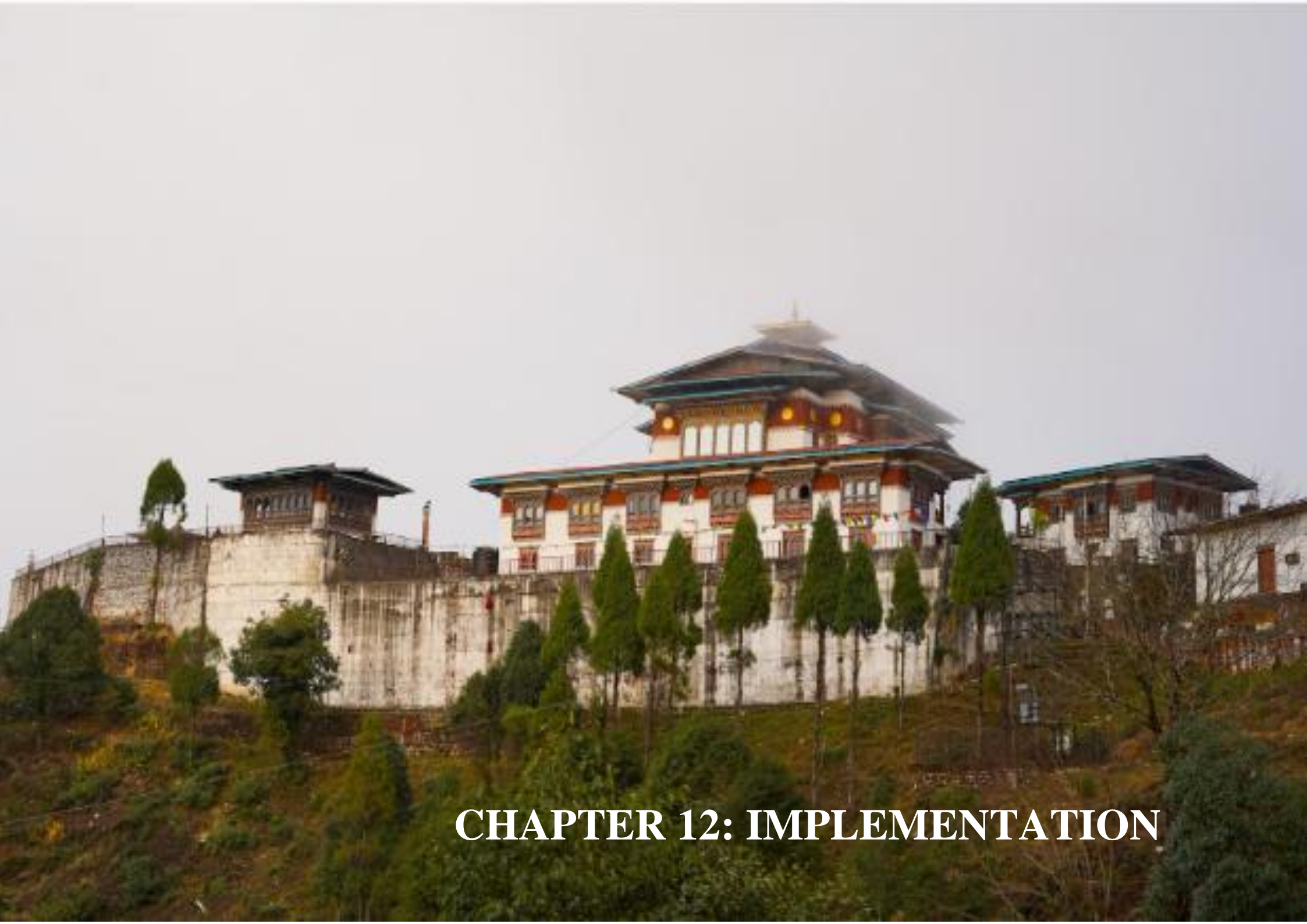
To drive meaningful progress in waste management, it is important to enforce regulations that promote waste reduction, recycling, and safe disposal practices. Further, Extended Producer Responsibility (EPR)

guidelines need to be developed to ensure that manufacturers are held responsible for.

### **PROMOTING EDUCATION AND PUBLIC ENGAGEMENT**

Public awareness and engagement are critical components to achieve successful waste management. Awareness programs can educate communities about the importance of waste reduction, proper sorting, and recycling. Engaging the public through campaigns, workshops, and community initiatives can drive behavioural changes and encourage participation in waste management programs





## CHAPTER 12: IMPLEMENTATION

### 1. Institutional Coordination and Capacity Building

The strategy will be implemented in collaboration with key stakeholders, including Drungkhag and Gewog administrations, municipal offices, private sector partners, community groups, and waste workers. The Dzongkhag Environment Sector will oversee the implementation of the strategy. Capacity-building programs will be conducted for officials and waste workers on waste segregation, recycling and upcycling techniques, and the use of the Zero Waste Bhutan App for reporting violations.

### 2. Infrastructure Development and Waste Collection Systems

To improve waste management, waste drop-off centres will be established in Denchhi and Nganglam towns. Waste collection services will be improved and made accessible.

### 3. Public Awareness and Behavioural Change Campaigns

Awareness campaigns will be conducted in schools and communities to promote waste segregation, composting, and plastic waste reduction. Community-based Organizations such as Lotus Women Group and SerLam Women Group will be strengthened to lead awareness programs, upcycling and recycling initiatives. The Zero

Waste Hour initiative will be continued, encouraging monthly clean-up drives.

### 4. Private Sector Engagement

Public-private partnerships (PPPs) will be promoted to improve recycling rates and waste processing. Waste dealers will be strengthened to increase waste recycling and upcycling initiatives and the waste management will be outsourced to private sectors.

### 5. Monitoring, Enforcement, and Policy Compliance

Waste regulations will be strictly enforced through regular inspections and penalties for waste-related offences. Digital platforms such as Zero Waste Bhutan App will be widely promoted for citizens to report waste offenses. The progress will be reviewed and tracked using key performance indicators (KPIs), such as waste segregation compliance rates, volume of waste recycled/composted, reduction in single-use plastics and adoption of shopping bags.



### **DZONGKHAG/MUNICIPAL/ GEWOG**

- Monitoring and evaluation
- Create awareness
- Provide technical support
- Infrastructure development
- Law enforcement
- Enhance public participation
- Digital platforms

### **COMMUNITY/PRIVATE SECTOR/CBO**

- Waste segregation at source
- Sustainable/renewable packaging materials.
- Reduce single-use plastics
- Use shopping bags
- Recycling practices and reusing

### **HEALTHCARE CENTRES**

- Medical waste source segregation
- Color-coded bins
- Proper treatment and disposal

### **COMPANIES/INDUSTRIES**

- Sustainable C&D and overburden dumping
- Treatment of industrial waste
- Industrial waste segregation and recycling

## CONCLUSION

The Dzongkhag Waste Management Strategy 2025 outlines approaches to transform waste management in the Dzongkhag and change the attitude towards waste, aligning with Bhutan's national objective of transitioning towards Zero Waste Society by 2030. The strategy focuses on the principles of a circular economy to turn waste into resources and reduce waste generation, thereby creating economic opportunities.

The successful implementation of the strategy depends on the coordination and collaboration between agencies, sustainable financing and public awareness. Partnerships with the key stakeholders will help build a culture of environmental stewardship. The strategy commits to preserve the country's rich environment, promote human health and uphold the principles of Gross National Happiness. With collective effort and sustained implementation, the Dzongkhag can set a benchmark for sustainable waste management, thereby promising a clean and green Dzongkhag for future generations.



## ANNEX I: IMPLEMENTATION PLAN OF THE DZONGKHAG WASTE MANAGEMENT STRATEGY

Type of Waste	Lead Agency	Collaborating Agency	Strategy	Baseline 2025	Target 2030	Target 2035	Indicator
<b>Municipal Solid Waste</b>	Dzongkhag Municipalities	Dzongkhag Environment Sector	Enhance source segregation				Number of residents practicing source segregation
			Improve waste collection system				Systemic and regular collection system
			Recycling and composting				Recycling and composting rate
		Dzongkhag Environment Sector, Gewog Administration	Public participation				Community engagement
		Dzongkhag Environment Sector, Gewog Administration	Public participation				Community engagement
			Private sector partnership				Number of private sectors in waste management

	Dzongkhag Environment Sector	Drungkhag and Gewog Administration and Regional Offices	Enhance Zero Waste App use				Number of people and incidents reported
<b>Plastic Waste</b>	Dzongkhag Environment Sector	Drungkhag and Gewog Administration and Municipal office	Waste prevention				Number of businesses adopting sustainable packaging alternatives
			Reduce single-use plastics				Number of incident reports
			Promote use of shopping bags				Number of people using shopping bags
			Enhance recycling practices				Number of recycling facilities/waste collection centres
<b>Paper Waste</b>	Dzongkhag Environment Sector	Drungkhag and Gewog Administration, Regional offices and	Digital transition				Number of institutions using digital platforms
			Paper recycling				Volume of paper waste recycled



		Dzongkhag Education Sector	Promoting sustainable practices				Number of people practicing double-sided printing
		Municipal office and Gewog Administration	Reusable and minimalist approaches				Number of businesses adopting minimal packaging
		Gewog Administration and Dzongkhag	Education and awareness				Number of education and awareness program
<b>Organic Waste</b>	Dzongkhag Environment Sector	Education Sector	Prevent and reduce food wastage at source				Volume of food waste reduced
		Gewog Administration and Dzongkhag Agriculture Sector	Promote composting				Number of household practicing composting
			Promote biogas production				Number of households producing biogas
<b>Electronic Waste</b>	Dzongkhag Environment Sector	Dzongkhag ICT Sector, Drungkhag and Gewog Administration	Repair and reuse initiatives				Number of repairing centres and reuse rate
		Drungkhag and Gewog Administration and Municipal office	Establish e-waste collection and recycling				Number of collection sites and recycling rate

<b>Mining Waste</b>	Dzongkhag Environment Sector	DGM (Dzongkhag)	Waste reduction at source				Volume of mining waste reduced
			Mine backfilling approach				Volume of mining waste backfilled
			Promote reuse of topsoil				Volume of topsoil reused
			Sustainable overburden dumping				Number of OB dump yard and management
<b>Construction and Demolition Waste</b>	Municipal and Environment Sector	Drungkhag and Gewog Administration	On-site segregation				Number of construction sites and segregation rate
			Reuse and recycling				Number of construction sites reusing and recycling
			Sustainable C&D waste dumping				Number of incident report, dump yard and management
<b>Industrial Waste</b>			Industrial waste recycling				Volume of waste recycled



	Dzongkhag Environment Sector		Treatment of chemical and liquid waste				Volume of chemical and liquid waste treated
<b>Medical Waste</b>	Dzongkhag Environment Sector	Dzongkhag Health Sector, Drungkhag and Gewog Administration	Segregation of medical waste				Volume of waste segregated.  Number of color-coded bins
			Collection, storage, and transportation				Number of designated collection sites and frequency of collection and transportation
		Dzongkhag Health Sector	Treatment and disposal methods				Number of technologies established and volume of waste treated
		Dzongkhag Health Sector, Drungkhag and Gewog Administration	Regulatory framework and monitoring				Policy enforcement, frequency of monitoring and compliance