सफा अभियान
नेपाल

NEPAL NATIONAL INTEGRATED WASTE MANGEMENT STRATEGY AND ACTION PLAN 2020-2035

Supported by:

Federal Ministry
for the Environment, Nature Conservation
and Nuclear Safety

based on a decision of the German Bundestag

INTERNATIONAL CLIMATE INITIATIVE (IKI)

UN environment programme

IETC Technology for Environment

LEAD
LEADERSHIP FOR ENVIRONMENT & DEVELOPMENT NEPAL

The strategy document has been developed based on analyses carried out within the framework of the project titled "Strengthening the capacity of policy makers and practitioners in Bhutan, Mongolia and Nepal to reduce green-house gases (GHGs) and short-lived climate pollutants (SLCPs) from the waste sector, based on circular economy concept", also refered to as the "Waste and Climate Change (WCC)" project for short. The Leadership for Environment and Development (LEAD) Nepal is implementing the project with the support of MoFAGA and IETC with the funds provided by BMUB IKI. Since 2017, UNEP IETC has been working on the waste and climate change project to reduce the impacts of waste sector on climate change, through capacity strengthening and policy support at the national and local level in Bhutan, Mongolia and Nepal.

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Foreword

Responsible consumption and production is one of the United Nations Sustainable Development Goals. Reducing, reusing and recycling resources are vital to achieving this – and we all have a part to play. Nepal is committed to environmental leadership under the Nationally Determined Contributions by reducing air pollution and promoting clean energy technology from the waste sector.

The Nepal National Integrated Waste Management Strategy and Action Plan 2020-2035 (NNIWMS) has set a bold target of diverting 80% of the waste from the landfill by 2035 working steadily towards zero waste. The focus of the strategy is around the 3R principles that require for the establishment of small, medium and large-scale environmentally friendly technology simultaneously strengthening the existing technologies. An integrated resource recovery center is another area of focus. Much stress has also been given to strengthening the legal and institutional framework and the need for behavioral change, transforming waste as a priority sector complete with necessary training and awareness building to facilitate this change.

This strategy document was prepared with several rounds of consultation with different stakeholders. The technical committee and the experts in waste management were consulted in various stages of the strategy development. A baseline study was conducted in 35 municipalities across 7 provinces for one month. Therefore, the strategy document is the outcome of the feedback from thousands of people with LEAD Nepal taking the leadership on behalf of the Government, throughout the strategy development process.

Bishnu Datta Gautam
Joint Secretary
Ministry of Federal Affairs and General Administration

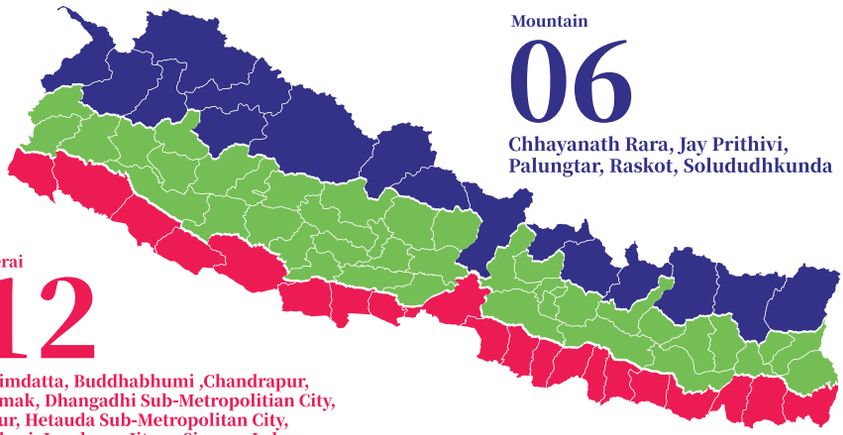
Acknowledgements

The Ministry of Federal Affairs and General Administration (MoFAGA) would like to express its sincere appreciation to the team of Leadership for Environment and Development (LEAD) Nepal lead by Ms. Aisha Khatoon, Executive Director, for leading the strategy development process. We also extend our appreciation to the expert members of the Technical Committee for their rigorous review and valuable comments that helped in the improvement of the Strategy document.

MoFAGA highly appreciates the generous support of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) International Climate Initiative (IKI) for the fund support for the Waste and Climate Change (WCC) Project, as this Nepal National Integrated Waste Management Strategy is a key deliverable of the project. We are also thankful to the United Nations Environment Programme International Environmental Technology Centre (UNEP IETC) for their coordination, support and the successful implementation of the WCC project including the development of this strategy document.

Lastly, MoFAGA would like to take this opportunity to acknowledge individual experts, government departments, municipalities, private sector, civil society organizations, non-governmental organizations, and the society at large for their tremendous support for participating in the assessments and consultation, which led to developing this Strategy document. We look forward to receiving the similar cooperation and participation during the implementation of the Strategy.

Executive Summary



Mountain
06
Chhayanath Rara, Jay Prithivi, Palungtar, Raskot, Solududhkunda

Terai
12
Bhimdatta, Buddhabhumi ,Chandrapur, Damak, Dhangadhi Sub-Metropolitian City, Gaur, Hetauda Sub-Metropolitan City, Itahari, Janakpur, Jitpur Simara, Lahan, Lumbini Sanskriti

Hilly
17
Banepa, Bheriganga, Birendranagar, Bhimeshwor, Dhankuta, Gorkha, Gurbakot, Kathmandu, Kirtipur, Lekbesi, Mahalaxmi, Palungtar, Pokhara-Lekhanath Metropolitan City, Pyuthan, Suryabinayak, Tansen, Waling

The baseline survey in 35 municipalities across seven provinces confirmed that Nepal is experiencing significant waste management challenges at both national and city levels. This is due to a range of technical, social, economic and institutional constraints. It also paves the way for potential improvements through the identification of Environmental Sound Technologies (ESTs), informed policymaking, design, and deployment of bankable projects. The realization of sustainable waste management in Nepal, however, requires some work on its foundation, such as: building more reliable and comprehensive waste-related statistics; improving compliance of waste related regulations; promoting investments in waste sector through public-private participation (PPP) and other business models; encouraging innovation in waste sector; social inclusion; encouraging community participation; promoting waste entrepreneurship; and exercising balanced efforts in harmonizing policy and institutional gaps and barriers through research, training and capacity building activities.

While analyzing the baseline data of 2018 & 2019 the average per capita municipal solid waste (MSW) generation was 0.37kg. Most of the waste was produced at the household level. The findings show that the average composition of the municipal waste is: Organic waste (53.12%), Paper/ Paper Product (20.04%), Plastic (13.04%), Glass (5.35%), Metal (2.76%), Textiles (3.13%), Chemical/Hazardous waste (1.49%) and Others (1.10%).

This composition analysis reveals a high potential for waste recycling and energy recovery. Despite the potential, waste recycling in Nepal is at a primitive level and at the hands of the informal sector. With these opportunities in hand it was seen vital to develop the first Nepal National Integrated Waste Management Strategy (NNIWMS).

The Strategy sets an ambitious pathway 'towards zero waste' with the target to divert 80% waste from landfill sites by 2035. The strategy's Action Plan covers the 15 years period of the strategy and will be implemented in three phases – Phase I: short term (2020-2025); Phase II: medium term (2025-2030) and Phase III: long term (2030-2035).
Given this strategy action plan, Solid Waste Emissions Estimation Tool (SWEET) is tailored to quantify short-lived climate

pollutants (SLCPs) emission from the waste sector as well as make a projection of the emission within the short, mid and long-term implementation phases. These SLCPs are generated throughout the municipal solid waste management process from source to final disposal. Landfills are the third-largest source of anthropogenic methane (CH_4) emissions which accounts for about 11% of estimated global methane emissions (CCAC, 2017).

The vision of the NNIWMS is to develop and implement an integrated waste management system with a partnership approach to reduce the amount of waste we generate, reuse what we can and recycle and recover the remaining resources to reinvest into the economy. The zero-waste strategy ultimate goals are to eliminate waste that is burned, dumped or buried which is harmful for the environment and the people.

The following guiding principles reinforce the NNIWMS towards zero waste:

1. Waste Hierarchy
2. Circular Economy
3. Multi-stakeholder approach and Sharing Responsibility
4. Polluter pays principle/extended producer responsibility
5. Continuous Improvement

The strategy objectives to support the above are a) Strengthen Institutional & Organizational Framework b) Ensure Effective Policy and Legislation and Enforcement c) Ensure Sustainable Financial Mechanism, d) Mitigate Climate Change through Improved Waste Management e) Promote Social Justice and Equity and f) Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Building & Transparency in Waste Management (WM).

The NNIWMS is arranged into seven chapters. The first chapter provides the background for the need of an integrated waste management strategy. Chapter two explains the development process of the strategy. Chapter three shows a glimpse of the major findings of the 2018 and 2019 baseline assessment. Chapter four provides the current legal framework of Nepal. Chapter five reflects the strategy's vision, guiding principles, strategy's objectives, and targets. Chapter six further elaborates on the actions required to meet the zero-waste strategy. Finally, chapter seven focuses on the implementation mechanism, the roles of government and other stakeholders and monitoring and evaluation.

The NNIWMS is designed conceptually on the 3R principles of the integrated waste management hierarchy and focuses on the necessity for embracing a green development pathway. This document identifies bridging policy gaps and harmonizing policies, strengthening institutional capacities and ensuring sustainable financing mechanism. It goes on to promote environmentally sound technologies and options for waste handling, treatment, recovery, and disposal methods. Simultaneously, it acknowledges cross-cutting issues involving waste and gender concerns, caring for the informal sector and vulnerable groups, and reducing impacts of waste on health, soil, air and climate change.

Throughout the development of the Waste Strategy, thousands of participants from across Nepal have provided feedback, engaged in dialogue, and accessed key project information through a variety of consultation and engagement activities. These conversations with stakeholders and the public and the technical committee have had a significant impact on the formulation of the recommendations put forward in this waste strategy.

Acronyms and Abbreviations

3R	Reduce Reuse Recycle
ADB	Asian Development Bank
BC	Black Carbon
CBOs	Community Based Organizations
CCAC MSWI	Climate and Clean Air Coalition Municipal Solid Waste Initiative
CDM	Clean Development Mechanism
CH_4	Methane
CNG	Compressed Natural Gas
CO_2	Carbon dioxide
CO_2e	Carbon dioxide equivalent
C&D	Construction and Demolition
DDC	District Development Committee
EFLGF	Environmentally Friendly Local Governance Framework
EIA	Environmental Impact Assessment
EPA	Environmental Protection Act
EPR	Environmental protection Rules
ESTs	Environmentally Sound Technologies
GHG	Greenhouse gas
GTZ	German Technical cooperation Agency
HH	Household
ICT	Information Communication and Technology
IEE	Initial Environmental Examination
IETC	International Environmental Technology Centre
IKI	International Climate Initiative
INDCs	Intended Nationally Determined Commitments
JICA	Japan International Cooperation Agency
KMC	Kathmandu Metropolitan City
LEAD Nepal	Leadership for Environment and Development Nepal
MEAs	Multilateral Environmental Agreements
MoALMC	Ministry of Agriculture, Land Management and Cooperative
MoFAGA	Ministry of Federal Affairs and General Administration
MoFALD	Ministry of Federal Affairs and Local Development
MoFE	Ministry of Forestry and Environment

MoHP	Ministry of Health and Population
MoICS	Ministry of Industry Commerce and Supplies
MoPE	Ministry of Population and Environment
MoUD	Ministry of Urban Development
MSW	Municipal Solid Waste
NAPA	National Adaptation Programme of Action
NatCom	National Communication
NDCs	Nationally Determined Contributions
NGOs	Non-Governmental organizations
NPC	National Planning Commission
OC	Organic Carbon
POPs	Persistent Organic Pollutants
PPP	Public Private Partnership
PSP	Private Sector Participation
Rs.	Rupees
SDGs	Sustainable Development Goals
SLCPs	Short Lived Climate Pollutants
SWEET	Solid Waste Emission Estimation Tool
SWM	Solid Waste Management
SWMA	Solid Waste Management Act
SWMRMC	Solid Waste Management Resource Mobilization Centre
SWMTSC	Solid Waste Management Technical Support Centre
SWOT	Strength Weakness Opportunity Threat
TA	Technical Assistance
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework on Climate Change Convention
USD	United States Dollars
VDC	Village Development Committee
WCC	Waste and Climate Change
WCF	Ward Citizen Forum
WTE	Waste to Energy

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01 CHAPTER INTRODUCTION TO NEPAL NATIONAL INTEGRATED WASTE MANAGEMENT STRATEGY

Waste is a national as well as a global issue and is everyone's responsibility. Improper management of waste affects not only our health but also our environment and climate overall. Waste management should be a necessity, but in many countries such as Nepal it is not a priority due to lack of awareness, knowledge and financial constraints. Waste generation per capita has risen markedly over the last 50 years. With its rapid urbanization, growth in population and economic development, Nepal has also become aware of its waste management issues and has ratified national Acts and local Declarations. The Solid Waste Management Act (SWMA) 2011 is one of the regulatory efforts. Nepal has also identified the reduction of GHG emissions and is on its way to adopting a low-carbon development pathway through its Climate Change Policy and Intended nationally determined contributions (INDC).

Designing effective and financially sustainable waste management architecture through an Integrated Waste Management Strategy plays an important role in the city's cleanliness and sustainability drive, with people's health and the conservation of resources being high priorities. The NNIWMS 2020-2035 is a visionary document that offers guidance to identify strategic priorities, directions, programmes, and actions to minimize waste generation, introduce source segregation, improve waste collection, establish appropriate treatment options, recover resources, and offer safe disposal options by engaging all relevant stakeholders envisioning a zero-waste society.

The document is named "Nepal National Integrated Waste Management Strategy and Action Plan 2020-2035" as this is taken as an opportunity to address wastes from not only municipal sources but also other specific waste streams. However, as a starting point, this strategy document illustrates in great detail the management of MSW and disaster waste management (DWM) with the scope to add the specific strategy and action plans for E-waste, Construction & Demolition (C&D) waste , and healthcare waste in due course.

The strategy document offers directions towards multi-fold opportunities and benefits of an improved state of the waste management in the municipality. One of which is reducing the climate impacts of the waste sector. Globally, the waste sector contributes to nearly 5% of anthropogenic gas emissions in the atmosphere. Landfills are the third largest source of anthropogenic methane emissions, accounting for approximately 11% of estimated global methane emissions (EESI 2013). In 2000/2001, 1.9% of the total GHG emissions in Nepal came from the solid waste sector. Reducing, reusing, and recycling can be a key part of a Climate Change strategy to reduce the GHG emissions and Short-Lived Climate Pollutants SLCPs from waste handling equipment, emissions from trucks, emissions from landfill fires, open burning of waste, as well as from organic waste decomposition.

The NNIWMS is also guided by the principles of sustainable development and circular economy, both of which promote recirculation of the resources opening new avenues for green business and job opportunities across the waste management value chain.

The NNIWMS respects the collaboration and concerted efforts from all actors for guiding an efficient and effective waste management system. Some of the highlights in the strategy document is the need for waste segregation at source, expanding the waste collection population, putting an end to burning and open dumping of waste, strengthening the legal and institutional framework, the efficient use of resources, striving for environmentally-sound technologies, reducing waste at source and reducing GHG emissions and short-lived climate pollutants generated from the waste sector.

Support for this study:

This baseline was conducted as a part of the Waste and Climate Change (WCC) project. The implementation of the project titled "Strengthening the capacity of policy makers and practitioners in Bhutan, Mongolia and Nepal to reduce green-house gases (GHGs) and short-lived climate pollutants (SLCPs) from the waste sector, based on circular economy concept (the WCC project)" is expected to make the linkages with waste and climate change and work towards achieving sustainable waste management while exuberating climate co-benefits. The WCC project is funded by the German Federal Ministry for the Environment, Nature Conservation, Nuclear Safety, International Climate Initiative (IKI), with co-finance from the United Nations Environment Programme International Environmental Technology Centre (UNEP IETC).

The WCC is a four-year (Aug 2017 - Aug 2021) project with multiple partners involving government actors, non-governmental organization, the private sector, and civil society working towards sustainable waste management. In Nepal, the Ministry of Federal Affairs and General Administration (MoFAGA) is the government partner institution, and the Leadership for Environment and Development (LEAD) Nepal - a non-governmental organization is the executing partner that will oversee the overall project management activities and report to the UNEP IETC. The overarching goal of the WCC project, is to capacitate key actors (policymakers and key waste sector stakeholders) to implement enhanced legislative frameworks, create enabling conditions for the introduction and uptake of suitable environmentally sound technologies (ESTs) in the waste sector, while contributing to the achievement of the pledged intended nationally determined contributions (INDCs).

02 CHAPTER STRATEGY DEVELOPMENT

Strategy Development Process

Participants brainstorming at the workshop

Nepal National Integrated Waste Management Strategy was developed with technical assistance and project management support from the Leadership for Environment and Development (LEAD) Nepal on behalf of the government. The strategy development process ensured an active participation of relevant government agencies, academia, experts, and civil society groups through a series of consultative brainstorming meeting, and review workshops. The strategy development process instituted an 11-member Technical Committee with representatives from government line Ministries, individual experts, university professors, representatives from the Municipal Association of Nepal and LEAD Nepal, chaired by the Joint-Secretary of MoFAGA. The UNEP/UNITAR Guidelines for national waste management strategies, "Moving from Challenges to Opportunities", was referred in developing the NNIWMS, which included the following the key steps:

Establishing a comprehensive baseline

Process of the Strategy Development

Building the Foundation

- Literature Review
- Key informants interview
- Discussion with the key groups
- Questionnaires for the baseline survey prepared
- Training to enumerators provided
- Baseline survey of 35 municipalities in 7 provinces

Baseline Study Completed

Identify Anticipated Needs for the next 15 Years

- Analyse of the data entry conducted
- Baseline report prepared
- Verification of the recommendation and challenges done
- Strategy Vision and Principles identified

National workshop on the baseline study conducted identifying needs of Nepal for the next 15 years

Develop the Strategy

- Round table discussion strategy priorities
- Expert consultation on vision guiding principles and zero waste
- SWOT Analyses of public opinions

Ten meetings with the technical committee on strategy priority, objectives and action plans

Five group meetings with NGO, informal waste workers on strategy needs and action needed

Document & Decide

Drafted the National Integrated WM Strategy & Action Plan of Nepal 2020-2035

Strategy Review workshop conducted

Draft strategy and action plan report prepared

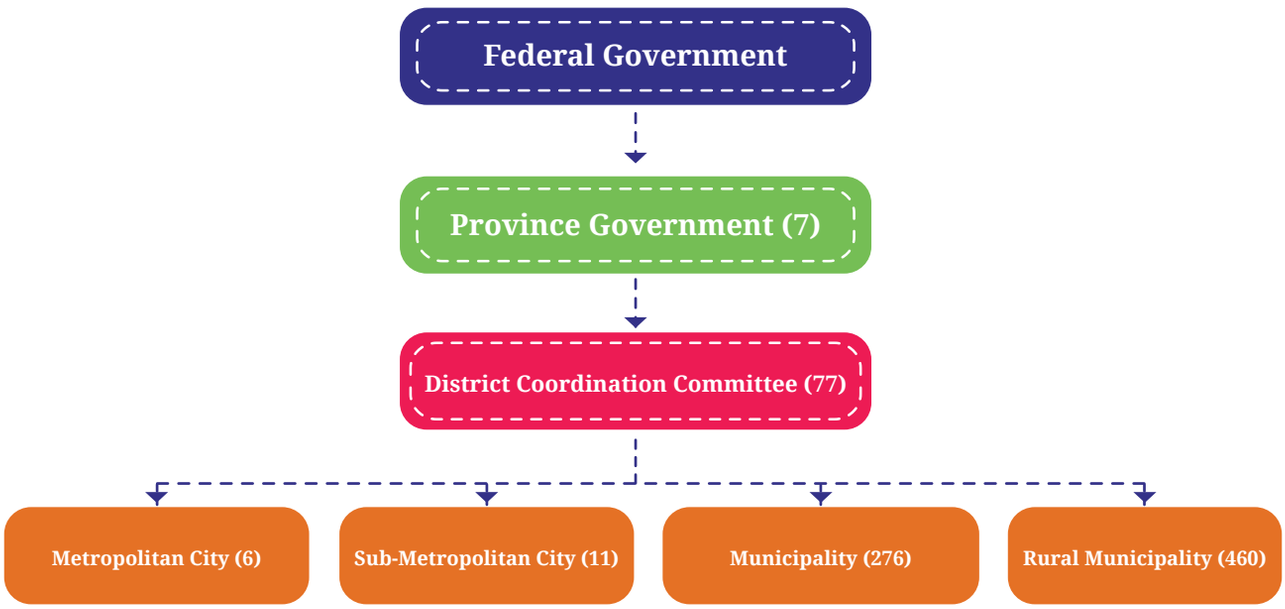
Submission to the technical committee and UNEP IETC

A detailed baseline assessment was conducted across 35 municipalities in all seven provinces of Nepal. Primary data collection and review of secondary literature gave a substantial situational analysis on the state of Nepal's waste management. A quantification of SLCP and GHG emissions from the waste sector was also calculated using the Solid Waste Emission Estimation Tool (SWEET) and Institute for Global Environmental Strategy (IGES) to establish a link between waste and climate sector. Also, a waste and gender assessment was conducted to provide a framework on the gendered nature of the waste sector, to guide policies aimed at bringing gender equality into it. The findings from the baseline assessment provided a foundation to identify and confirm the priorities for the Strategy to address. The table before shows the process followed to develop the Waste Strategy and how the consultations have been incorporated.

Study area- country's new federal administrative structure

Recently, Nepal has entered a Federal system, redefining its administrative boundaries. The Federal Democratic Republic of Nepal (Sanghiya Loktantrik Ganatartra Nepal) is administratively, divided into Provinces, Districts, and Municipalities as illustrated in Figure 1 below.

Figure 1. New administrative structure of the Federal Democratic Republic of Nepal



For the baseline assessment 35 municipalities from across 7 Provinces were selected as study area. The topography (Terai, Hill, and Mountain), population and economic development were considered as an important criterion in selecting the 35 municipalities as the study area.

Figure 2. Location of the 35 municipalities

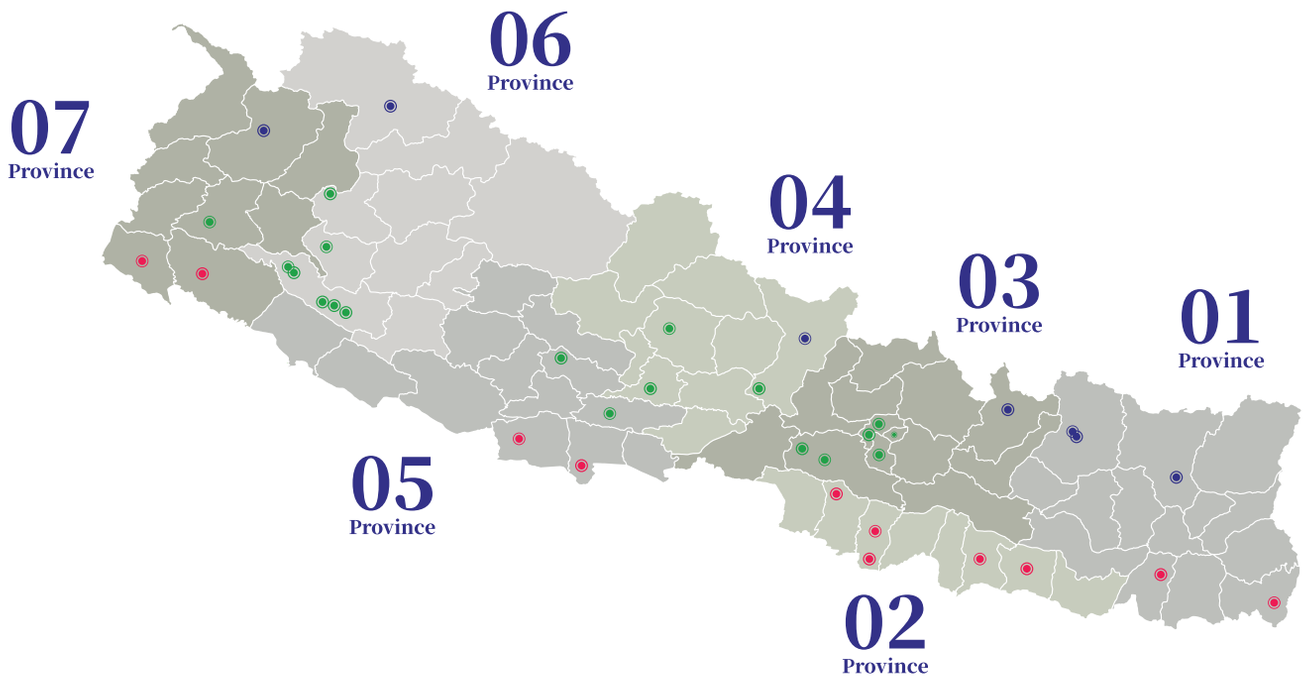


Table 1 and 2 below presents the classification of the municipalities based on its population coverage and geographical distribution. Further details of the 35 municipalities are presented in **Annex 1.**

Table 1 Municipalities based on population

S.No.	01	02	03	04	05	Total
Population Rage	<=25,000	25,000 - 50,000	50,000 - 75,000	75,000-100,000	>=100000	
No. of Muncipalities	05	09	03	07	11	35
Name of the Municipality	Chhayanath Rara, Jay Prithivi, Palungtar, Raskot, Solududhkunda	Bheriganga, Bhimeshwor, Dhankuta, Dullu, Gaur, Gurbakot, Lekbesi, Pyuthan, Sikhar	Gorkha, Lumbini, Sanskriti, Waling	Banepa, Chandrapur, Kirtipur, Lahan, Mahalaxmi, Suryabinayak, Tansen	Bhimdatta, Birendranagar, Buddhabhumi, Damak, Dhangadhi Sub-Metropolitian City, Hetauda Sub-Metropolitian City, Itahari, Janakpur, Jitpur, Simara, Kathmandu, Pokhara Metropolitan City	
Total Population	108,097	351,550	184,939	641,668	3,273,908	4,560,162

Table 2 Municipalities based on geography

Regions	Name of the Municipality	No. of Municipality
Mountain	Chhayanath Rara, Dullu, Jay Prithivi, Raskot, Sikhar, Solududhkunda	6
Hilly	Banepa, Bheriganga, Birendranagar, Bhimeshwor, Dhankuta, Gorkha, Gurbakot, Kathmandu, Kirtipur, Lekbesi, Mahalaxmi, Palungtar, Pokhara-Lekhanath Metropolitan City, Pyuthan, Suryabinayak, Tansen, Waling	17
Terai	Bhimdatta, Buddhabhumi, Chandrapur, Damak Dhangadhi Sub-Metropolitian City, Gaur, Hetauda Sub-Metropolitan City Itahari, Janakpur, Jitpur, Simara, Lahan, Lumbini Sanskriti	12
Total		35

Strategy development

Strategizing a way forward at the workshop

Following several discussions and joint workshop, LEAD Nepal together with MoFAGA and the Technical Committee outlined the table of content for this document and agreed on the guiding principles, scope and timeframe of the strategy. They also drafted their vision, targets, and the key objectives in this strategy. Further, a Solid and Liquid Resource Management (SLRM) expert from India was invited to conduct a mass awareness programme on the SLRM zero waste and zero landfill concept. Succeeding this event, numerous meetings and discussion were held on the action plans towards zero waste. A strategy matrix was developed in the meeting, which was further elaborated by the LEAD Nepal's project team.

Review of the strategy

Glimpse of participants at the workshop

Once an initial draft was ready, another consultative workshop was organized to share the strategy document and seek feedback. Various stakeholders inclusive of but not limited to waste management experts, Solid Waste Management Association from Kathmandu and Birendranagar were invited to critique the drafted strategy and record specific concerns. The content of the Strategy was improved by addressing the comments received in the meetings and workshops. An expert team from Nepal, comprised of the Technical Committee representatives, including LEAD Nepal, Mayors and Deputy Mayors from Birendranagar and Solududkhunda Municipalities, led by the Joint Secretary of MoFAGA visited 3 districts in India to observe the good practices of the SLRM zero waste concepts.

Finalization of the strategy document

A high-level Task Force under the chair of MoFAGA Mayor finally reviewed and finalized the NNIWMS document. The Task Force has taken the responsibility to submit the NNIWMS document for endorsement to the Government of Nepal, to obtain a high-level political endorsement and commitment towards the integrated waste management strategy.

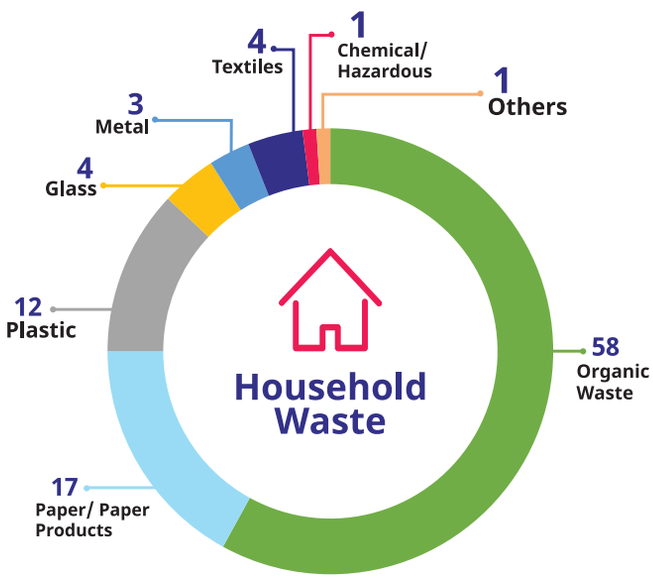
03 CHAPTER

WASTE MANAGEMENT FACTS AND FIGURES

Waste Generation and Composition in 35 Municipalities

The primary data collected from 4,000 households (HHs), 1,175 commercial establishments and 1,100 institutions across 35 municipalities from different economic status and topography indicated that organic waste is the major composition of waste generated at every level. Commercial establishments include restaurants, hotels, shops, marketplace, slaughterhouses, hospitals, pharmacies, scrap dealers etc. Institutions include schools, universities, government, private offices etc.

Figure 3. Consolidated Household Waste Composition (%)



Household Waste Composition:

Data collected from 4,000 HH shows that organic waste is the major waste generated at this level at 58%. It is followed by paper and paper products at 17% and plastic at 12%. While paper and paper products can be composted or recycled, plastic can also be reused. There is also scope to recycle some of the glass, metal and textiles discarded by the households.

Institutional Waste Composition:

Data collected from 1,175 Institutions indicate that organic waste contributed to 45% of waste generated by this level closely followed by paper and paper products at 31%. Plastic waste generated is at 15%. Thus, we can safely assume that 91% of waste generated can be composted, recycled or reused.

Figure 4. Consolidated Institutional Waste Composition (%)

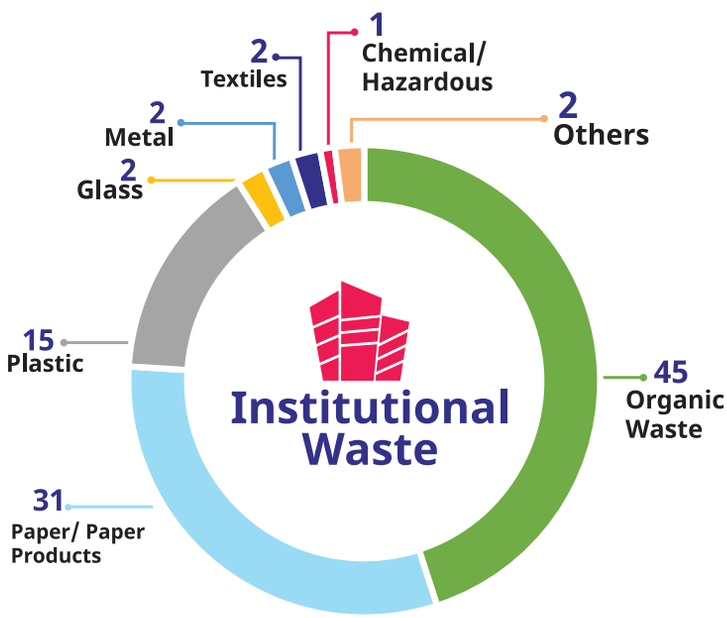
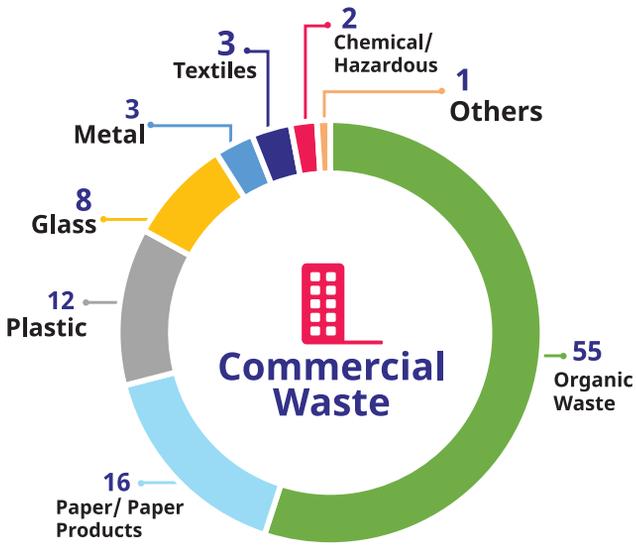


Figure 5. Consolidated Commercial Waste Composition (%)



Commercial Waste Composition:

Data collected from 1,100 commercial establishments from all 35 municipalities show that organic waste generated is at 55% while paper and paper products is at 16%. Plastic waste generated is at 12%. This indicates once again that most of these wastes can be recycled.

With proper education and waste diversion facilities, waste generated in this sector can be minimised by approximately 90% or more.

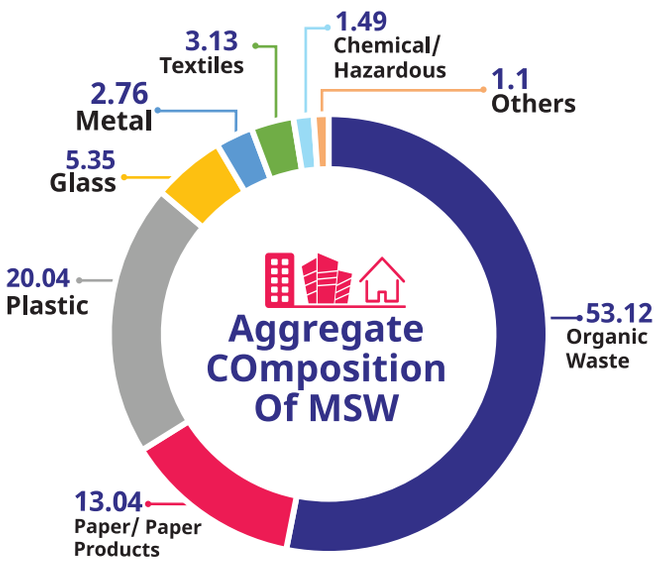
Consolidated Waste Composition of Household, Institution and Commercial Sector

As you can see in Table 3 below, organic waste is the major composition of waste in all their sectors; HH at 57.95%, Institution at 45.15% and Commercial at 55.08%. Paper/ paper products and plastic are second and third largest contributors of waste in all the sectors as well. It is to be noted that Institutions have a higher percent of paper waste than the other sectors at 30.52%.

Table 3. Composition of Waste

Waste (%)	Organic	Paper/Paper Products	Plastic	Glass	Metals	Textiles	Hazardous	Other
Household	57.95	16.78	11.92	3.85	3.20	3.76	1.70	0.86
Institutions	45.15	30.52	14.88	2.08	2.26	2.16	0.75	2.20
Commercial	55.08	15.85	12.59	7.99	2.82	3.35	1.80	0.60

Figure 6. Aggregate Composition of MSW in %



When we consolidate all this data it is observed that the organic waste is at 53.12%, plastic at 13.04% and paper/paper products are at 20.04%. The pie chart depicts the different composition of waste from all sectors. It would be safe to assume that waste can be reduced by approximately 95% if sound waste management is practiced.

Composition of waste varied among different geographical locations

Household Waste Composition in Mountain, Hilly and Terai region:

Nepal has tremendous geographic diversity and is divided into three belts from the south to north transects; Terai, Hilly and Mountain region. The Terai is a low land region containing some hill ranges. It covers almost 17% of the total area of Nepal. The Hilly region comprises of rolling hills which does not generally contain snow. This vast region covers almost 68% of the total area of Nepal. The Mountain region is the northernmost part of the country comprising of snow-capped mountains including the world's highest peak, Mt. Everest. It encompasses 15% of the total area of Nepal.

Amongst the three regions, the Terai is the most densely populated and a hub for factories and industries, thereby generating larger volumes of waste. In contrast, the mountain region remains sparsely populated with minimal economic activities taking place.

Figure 7, 8 and 9 are a clear indication that organic waste continues to comprise of the majority of waste composition across all regions consisting of 60% of total waste in the hilly region, 57% in the Terai and 53% in the mountain region. The Terai generates most of the paper and paper waste products at 19% followed by hilly region at 17% and then mountain region at 11%. Waste composition of plastic in Terai is at 13% closely followed by hilly region at 12% and mountain region at 9%. Thus, you can see that the composition and waste volume is varied in different regions. This should be considered while creating an effective solution for waste management.

Figure 7. Household Waste Composition in Mountainous Region

Figure 8. Household Waste Composition in Hilly Region

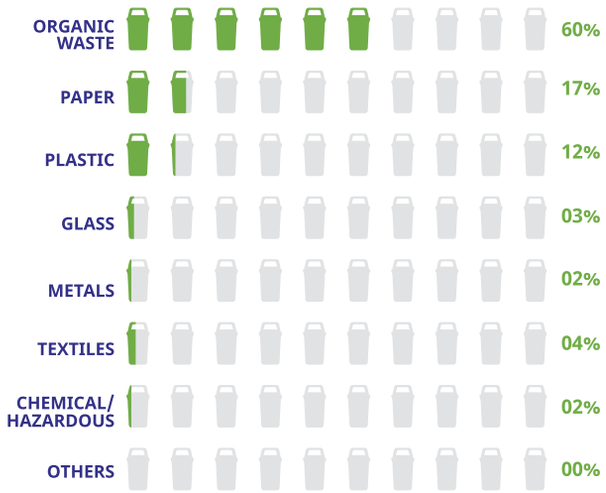
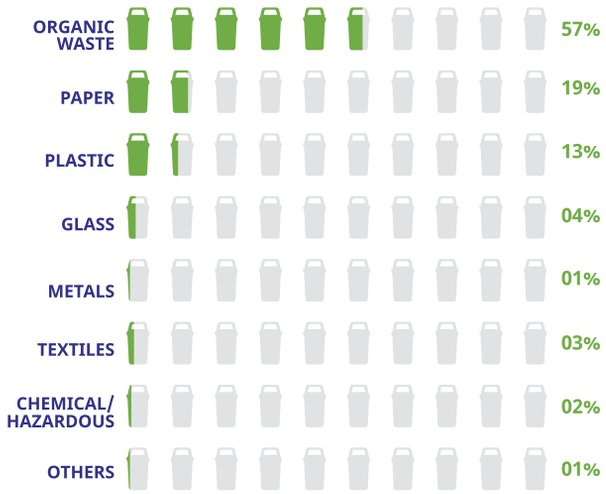


Figure 9. Household Waste Composition in Terai Region



Institutional Waste Composition in Mountain, Hilly and Terai region:

Figure 10. Institutional Waste Composition in Mountainous Region (%)

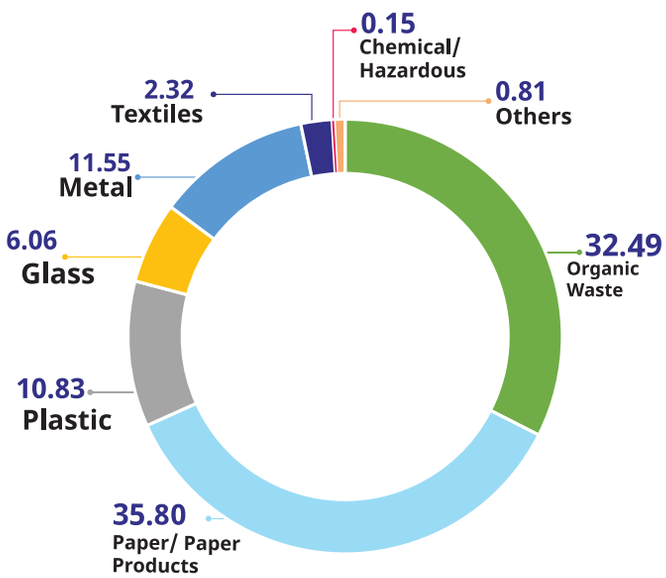
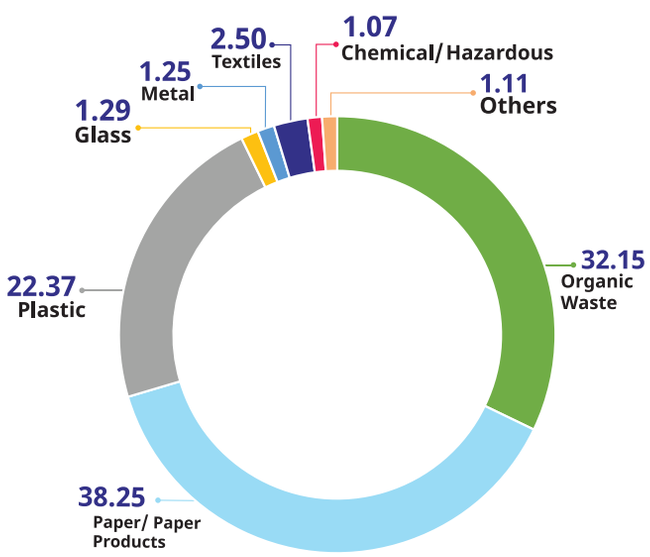


Figure 11. Institutional Waste Composition in Hilly Region (%)

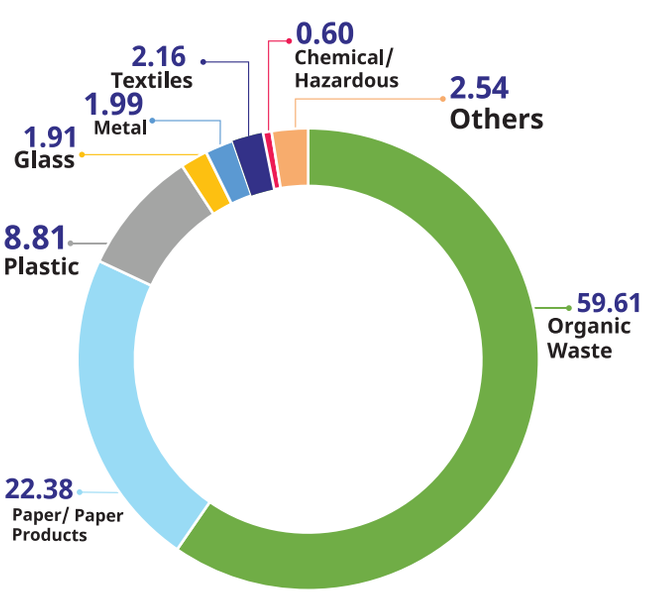


As shown in Figure 10, 11 and 12, there are notable differences in the composition of institutional waste generated in the 3 regions:

1. Major waste composition in hilly and mountain region is paper and paper products at 38.25% and 35.80% respectively. While the major waste composition in Terai is organic waste at 59.61% and then paper at 22.38%.
2. Plastic waste in hilly regions is also a high contributor at 22.37% when compared to the mountain at 10.83% and Terai at 8.81 %.

This clearly shows that the composition of waste varies in different regions and should be kept in mind while formulating an effective waste management solution.

Figure 12. Institutional Waste Composition in Terai Region (%)



Commercial Waste Composition in Mountain, Hilly and Terai region:

Figure 13. Commercial Waste Composition in Mountainous Region (%)

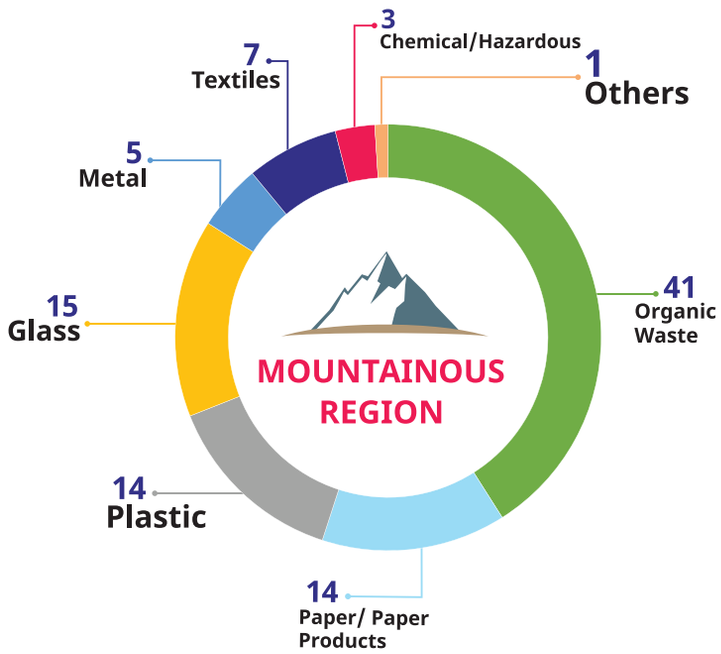


Figure 14. Commercial Waste Composition in Hilly Region (%)

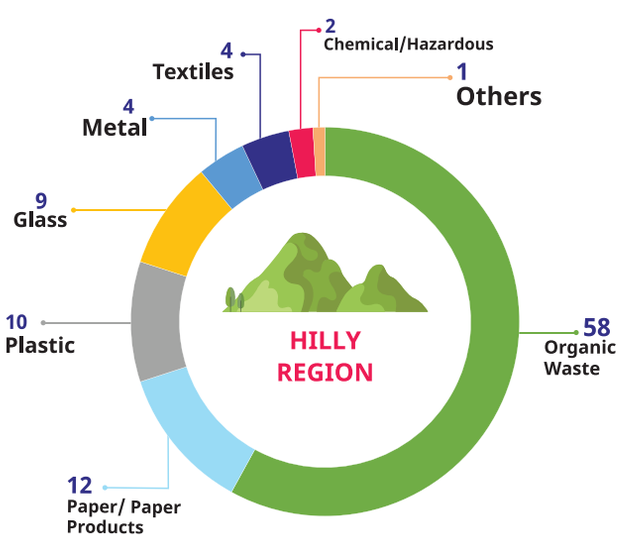
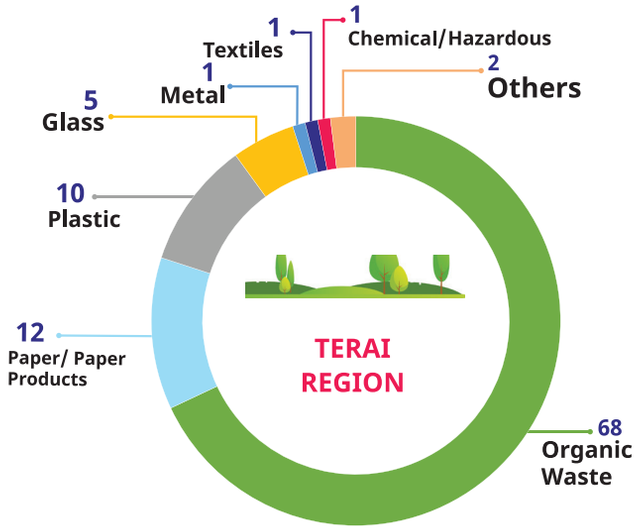


Figure 15. Commercial Waste Composition in Terai Region (%)



Organic waste is once again the major component of waste in the commercial sector. Organic waste in the Terai is the highest at 68% followed by hilly region at 58% then mountain region at 41%.

Waste composition here is slightly different from HH and Institution when comparing plastic and paper products. The values are similar to each other in all the regions:

Mountain: Paper at 14%, Plastic at 14%
Hilly: Paper at 12%, Plastic at 10%
Terai: Paper at 12%, Plastic at 10%

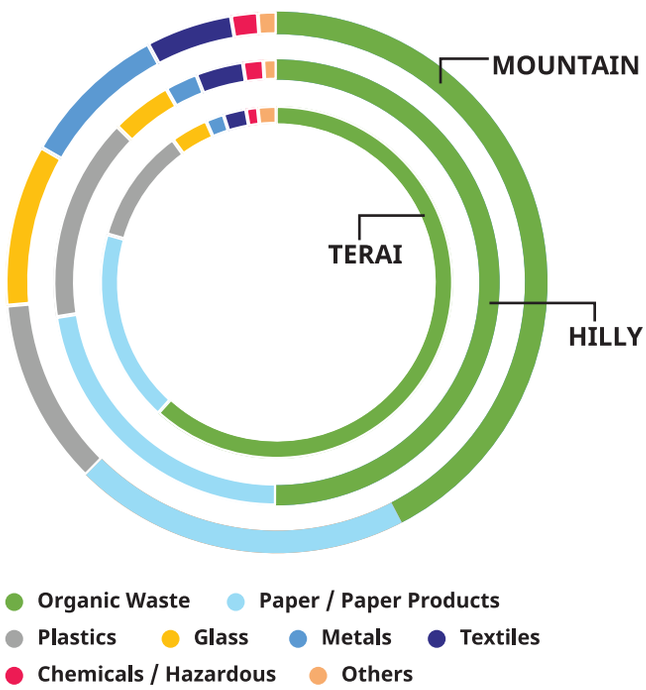
Consolidate waste composition based on varied topography

Consolidate waste composition varied among different geographical locations as depicted in the Table 4 and Figure 16 below:

Table 4 Consolidated composition of waste in various geographical regions

Waste/ Region	Organic	Paper/ Paper Prodcuts	Plastics	Glass	Metals	Textiles	Chemical/ Hazardous	Others
Terai	61.66	17.73	10.61	3.45	1.66	2.10	1.07	1.71
Hilly	50.07	22.47	14.84	4.43	2.36	3.45	1.47	0.95
Mountain	42.35	20.07	11.21	9.66	8.85	5.16	1.59	1.11

Figure 16. Consolidated composition of waste in various geographical regions



Organic waste in the Mountainous region is approximately 20% lesser than the Terai region, which is at 61.66%. This is mainly due to harsher climatic conditions with minimal land/ agricultural productivity. As a result, the people in the mountainous region only use what is necessary, hence generating less organic waste. Some of the waste generated is also used as feed for the livestock. Moreover, most food and drinks are transported from urban centers which are packed in cardboard boxes. Hence, the volume of paper waste is higher in this region. Plastic and glass waste is higher in this region as an influx of tourists and visitors during the peak season leads to accumulation of such waste in the form of snacks, refreshments, juice tetra packs, beer bottles etc.

The Hilly regions generate more paper/ paper products and plastic waste than other regions at 22.47% and 14.84% respectively. This is due to the change in consumer trends. Packaged goods are freely available. Also, faster economic development in the hilly regions contribute to this composition.

These differences clearly show that the composition of waste varies for each geographical location. Therefore, topography is a vital factor while considering a strategy and action plan for waste management.

Waste Management Systems in 35 Municipalities

The survey studied the waste management practices prevalent in the 35 municipalities. It finds that 70% of the waste was collected through formal channels while 30% of the waste remained uncollected or disposed of through informal collection channels.

Collection and Segregation of waste:

Inadequate and ineffective waste collection by local municipalities is one of the weakest links in the MSW management in Nepal. Waste segregation at source by households, institutions and commercial establishments is not a common practice. However, few of the respondents were engaged in selling the high value dry recyclable items like metals, glass and plastic bottles. Only 17% of the total waste collected by the municipality is segregated. Figure 19 depicts how HHs, institutions and commercial establishments segregated their waste. It can be noted that HHs take the most measure in segregating waste at 22%, followed by commercial at 17% and institution at 11%. This can be attributed to the roles that people at the HH level play in making conscious effort in waste segregation.

The Door to Door, Roadside pickup from an open pile and Dumpster Collection are the three-prevailing system of waste collection. Solid waste collection system in many municipalities does not exist and even if the system did exist, it was not of a satisfactory standard. Furthermore, no collection services were found in several locations such as the following municipalities of Dullu, Lekbesi, Mahalaxmi, Palungtar, Raskot and Sikhar, and Lakbasi.

Figure 17. Consolidated Waste Collection at Source (%)

Figure 18. Consolidated Waste Segregation at Source (%)

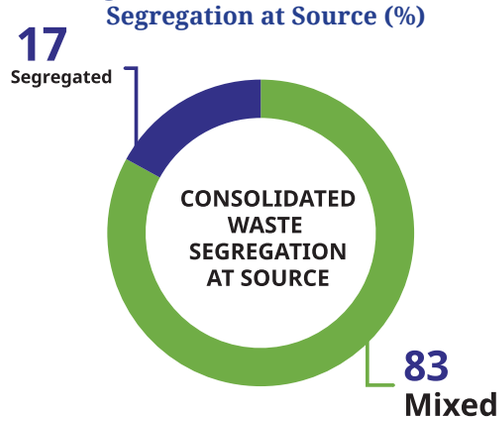


Figure 19. Waste collection at source (%)

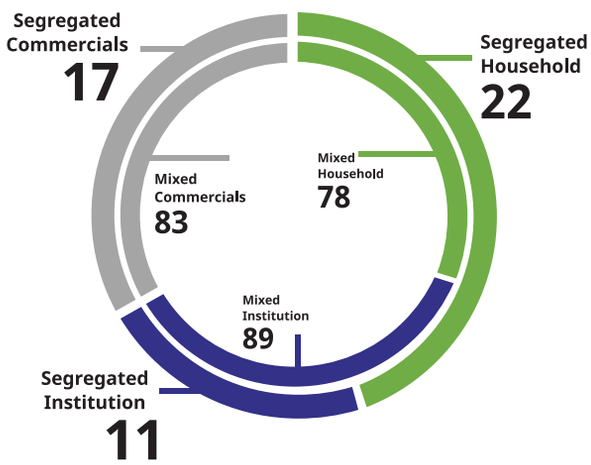
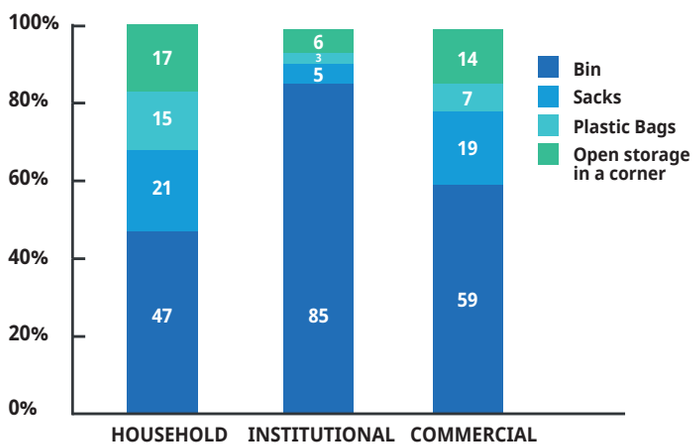


Figure 20. Waste Storage at Source (%)



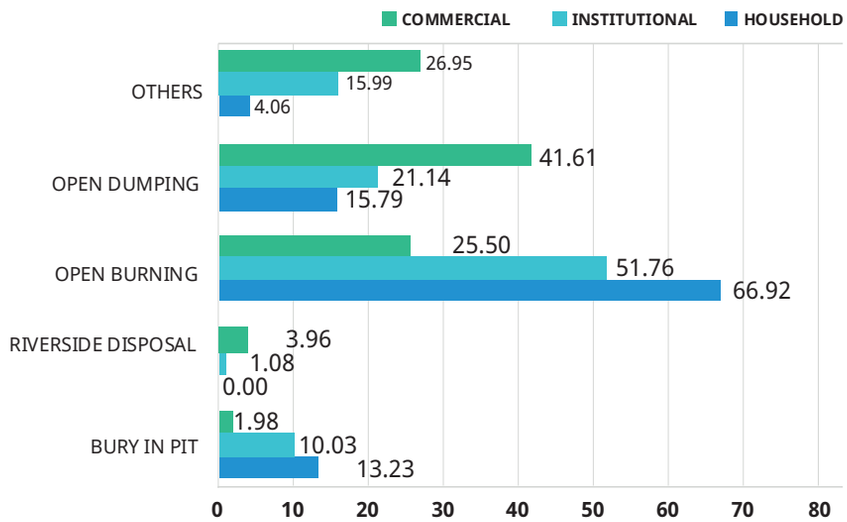


Figure 21. Consolidated waste disposal practice at source due to irregular collection

Figure 20 is a compilation of how HHs, Institutions and Commercial establishments store their waste at source. The baseline survey revealed that irregularity in waste collection could be correlated to public holidays, vehicle breakdowns or during the peak monsoon season when the roads to landfill sites are blocked or damaged. These circumstances often lead to different storage methods adopted by the three strata. However, this kind of storage is limited to only a few days beyond which they are forced to practice either of the methods of disposing waste as depicted in Figure 21. The uncollected waste is either dumped or burned in open spaces, buried in the backyard or left by the riverside. These methods are also utilized in areas where no collection system is in place.

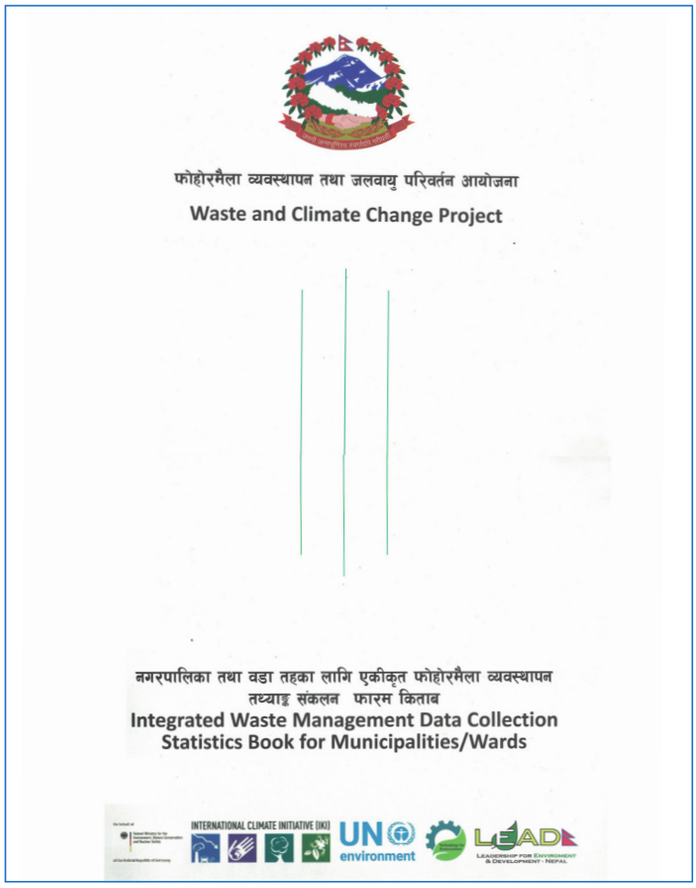
Municipality Data on Waste Management System

The 2018-2019 baseline survey found that the municipalities were missing comprehensive and reliable data on the various waste streams. The difference in data as provided by the municipality to the data gathered by the survey project team is indicated below:

Table 5. Difference in data provided by municipalities and data collected during baseline survey

Waste Related Data	Data Point	Data (%)	
		Municipality Provided	Survey Based
Waste per capita	capita/kg/day	0.25	0.37
Waste composition	Organic waste	0.21	57.95
	Plastic	0.07	12.03
	Paper/Paper Products	0.05	16.74
	Glass	0.03	5.57
	Metal	0.01	2.30
	Textiles	0.04	2.85
	Chemical/ Hazardous	0	1.54
	Others	99.58	1.03
Waste Segregation	%	24.42	17

Figure 22. Report on Water and Climate Change Project



Though some information on MSW is available, it is often estimated by making several assumptions. Importantly, information on material flows and quantity of waste is unavailable. Table 5 clearly indicates this difference in data where the municipality data does not even account for organic waste at 57.95% despite it being a significant composition of waste. Furthermore, information on recycling and livelihood creation and employment in the informal and the formal waste sector was difficult to obtain.

An accurate data collection and sharing system on waste will be beneficial in linking climate changes to the waste sector. Associated socio-economic, health and environmental indicators can also be compiled. Lack of data makes it difficult to quantify SLCP emissions at baseline and thus chart its reduction overtime. Inadequate data affects system design, technology selection, and estimation of investment needs and assessment of policy development. Recognizing the lack of sufficient qualitative data, LEAD Nepal, within this project funding, has developed a waste data collection statistic template based on Excel database (Figure 22.) and a Register book for manual recording at the ward level and the municipality level.

Waste Management Systems at work in the 35 municipalities:

The survey collected information on the volume of MSW collected per day, the waste collection area covered, method of waste collection and frequency of cleaning public spaces such as streets and open spaces.

Table 6. Waste Collection

Waste Collection			
MSW collection (tons/day)	Waste collection coverage (%)	Types of waste collection service	Frequency of cleaning streets and open space %
1706.66	65%	38% Door to Door 21% Roadside Pickup 41% Dumpster Collection	Daily: 54.29% Thrice a week: 5.71% Twice a week: 5.71% Once a week: 2.87% Twice a year: 5.71% No sweeping system: 25.71%

The collection of waste is mostly handled by the municipality or outsourced to contractors. Out of the 35 municipalities 65% have access to waste collection either in the form of the collection at their doorstep (38%), roadside dumping which is then collected by the municipality (21%) or in the public dustbins (41%).

Cleaning open spaces and streets is mostly carried out by the municipalities that measures to approximately 60% as indicated in Figure 23. The private sector is also contracted to do this job that quantifies to about 22.86% and the rest is handled by the community themselves. The baseline data indicate that in 35 municipalities the major service provided by municipality is street sweeping which constitutes nearly 74.29% of the budget followed by collection and final disposal site maintenance.

Figure 23. Street sweeping services in 35 Municipalities (%)

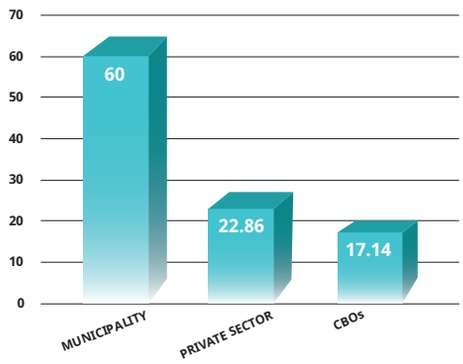
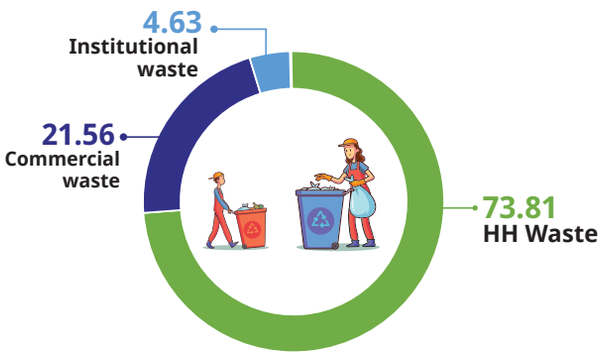
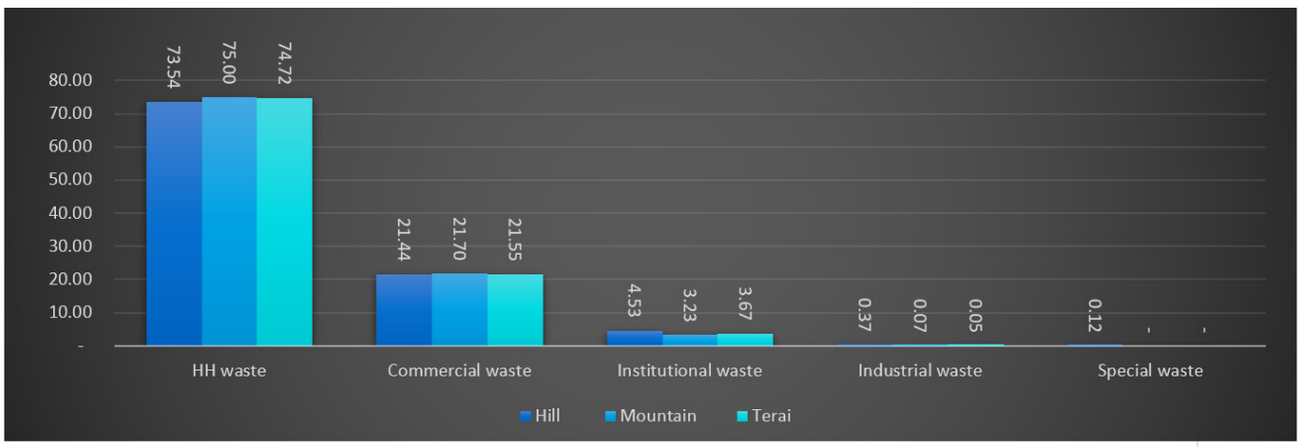


Figure 24. Consolidated average waste collection from 3 strata (%)



The pie chart in Figure 24 indicates that the majority of waste is collected from households at 73.81%. The bar graph below in Figure 25 denotes the waste collected from different regions. It suggests that waste composition and volume vary based on different regions therefore, solution approaches should be planned accordingly.

Figure 25. Consolidated Average waste collection Region wise (%)



Equipment and Vehicles used in Waste Management in 35 Municipalities

The survey identified the below listed (Table 7) equipment and transport vehicles used in the process of waste collection and disposal in the 35 municipalities.

Table 7. Different equipments used in Waste Management in 35 Municipalities

Type of Transport	Total Number	Note
Rickshaw/Cart	98	
Tractor/Power tiller	90	
Tipper/Dump trucks	81	
Heavy duty diesel trucks	66	
Tractors/Backhoes	42	
Other	31	
Light duty diesel trucks	17	
Excavators	11	3 in Kathmandu & 2 in Jitpur Simara
Loaders	8	
Hydraulic Compactor	7	only in Pokhara
Bulldozers	6	
Graders	4	all 4 in Kathmandu
Forklifts	4	all 4 in Kathmandu
Compacter	3	one each in Kathmandu, Hetuada and Buddhabhum

The quantity and quality of equipment and technology for transportation, collection and handling different streams in waste is insufficient for effective waste management. The existing machines are not run efficiently, and proper maintenance was also lacking as per MOFAGA 2018-2019 baseline survey. Most of the machines were not environmentally friendly. All these factors contribute to the pollution of the environment and needs to be rectified as soon as possible. It was found that lack of budgeting and improper planning was one of the reason behind this shortfall.

Figure 26 indicates that heavy duty diesel trucks spent approximately 28,000 idling hours a year while the light duty diesel trucks spent approximately 15,000 idling hours a year. On the other hand, Figure 27 shows that on an average a heavy duty diesel trucks traveled approximately 79,600 kms a year while a light duty diesel trucks covered approximately 37,900 kms a year.

Figure 26. Idling Hours Spent by Collection Trucks (Hours/Year)

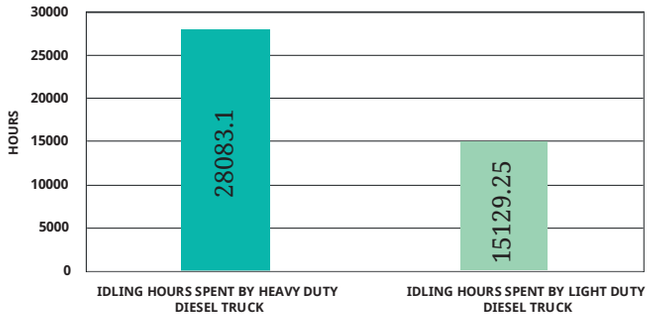
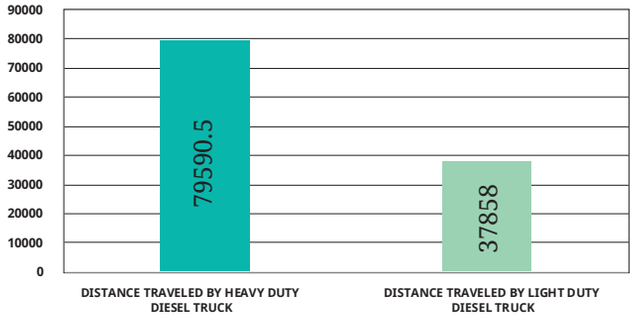


Figure 27. Usage of Collection Trucks (Distance Travelled Km/Year)



Waste Treatment and Disposal

Out of 35 municipalities, only 9 municipalities have an authorized dumping site. A sanitary landfill is a modern engineering landfill where waste is allowed to decompose into biologically and chemically inert materials in a setting isolated from the environment. Authorized dumping site is a location identified and authorized by local authorities for dumping waste. Illegal dumping is dumping of waste in areas not listed as authorized dumping sites. Waste collected by the municipality and private sector is either dumped in the open, river, sanitary landfill or authorized site or burned. A combination of these methods is practiced by the municipalities and private sector.

Table 8. Waste Treatment and Disposal in 35 municipalities

<table>
<tr><td rowspan="9">MSW Disposal</td><td colspan="4">The municipalities waste is collected by either municipality or private sector.</td></tr>
<tr><td rowspan="8">Final Disposal Methods in 35 Municipalities after collection</td><td colspan="2">Methods of Disposal</td><td>Percent (%)</td></tr>
<tr><td colspan="2">Illegal Dumping</td><td>40.00</td></tr>
<tr><td colspan="2">Authorized Dumping</td><td>16.36</td></tr>
<tr><td colspan="2">Sanitary Landfill</td><td>5.45</td></tr>
<tr><td colspan="2">Riverside Dumping</td><td>12.73</td></tr>
<tr><td colspan="2">Open Burning</td><td>21.82</td></tr>
<tr><td colspan="2">Illegal buying</td><td>3.64</td></tr>
<tr><td>Transfer Station</td><td colspan="4">3 out of 35 municipalities Hetauda, Kathmandu and Kritipur</td></tr>
<tr><td rowspan="3">No. Composting Plants</td><td>No. Composting Plants</td><td>Number</td><td>Total Capacity (tons/day)</td><td>Total Waste Received (tons/day)</td></tr>
<tr><td>Community Level</td><td>4</td><td>9</td><td>2</td></tr>
<tr><td>Municipality Level</td><td>3</td><td>3</td><td>1</td></tr>
<tr><td>Anaerobic Digestion Plants</td><td colspan="4">2 out of 5 Anaerobic Digestion Plants is operational (Hetauda and Kathmandu).</td></tr>
<tr><td>Recycling rate (% of total MSW generated that is recycled)</td><td colspan="4">Low (<8%) Most of the scrap dealers are not registered therefore not included in this record.</td></tr>
</table>

As mentioned in Table 8, 40% of the waste is dumped in the open while 16.36% waste are sent to authorized dumpsites, 12.73% to riverside dumping, 21.82% burned and 3.64% buried. Only 5.45% sends it to sanitary landfills. This demonstrates that 94.55% of the waste are mishandled causing human, biodiversity, environmental and revenue losses, in other words paying gravely for the cost of inaction. Thus, it is imperative to act now and make amendments to our ways of waste management before it is too late.

Governance in 35 Municipalities

The newly established federal structure of Nepal devolves more roles and responsibilities to local governments. Good governance goes a long way in ensuring that proper waste management practices are in place. A local body that understands the need for waste management and its repercussions on health, environment, socio-economic cultures and norms, and overall wellbeing of its citizens will play a pivotal role in changing the direction of waste flows and the sector.

Table 9. Governance factors in 35 municipalities

Municipality Budget 2018/2019	15 municipalities did not allocate budget for SWM. Those that allocate budget were 2.96% of the total municipality budget.
SWM Budget Dispersal (NPR millions) 2018/2019	Street Sweeping **8,** Waste Collection **13,** Landfill disposal **12,** Others **18**
Waste Collection Fee (NPRs)	HH **Nrs. 50 - 200,** Institutions **Nrs. 100 - 3000,** Hotels **Nrs. 100 - 7000,** Restaurants **Nrs. 100 - 1000,** Others (Hospital, Slaughterhouse, Industry) **Nrs. 40 - 8500**
SWM Employees	Staff **311**, Male **232**, Female **79**
Sound institutions, proactive policies	Medium but policies are being amended to reflect the need of sound waste management practices

Budget:

The table below portrays that the total municipality budget for 2018/2019 is Nrs. 22,939 million and the SWM budget for the year 2018/2019 is only NPR. 681 million for the 35 municipalities. This amounts to 2.97% of the total municipal budget allocated for waste management. Further, the SWM budget in the same year shows that the municipalities had only spent 29.94 million from the 681 million allocated which accounts for only 4.5% of the total amount. It indicates that the budget allocated for SWM is not fully utilized. The lack of proper planning, inadequate records and knowledge of the importance of proper waste management are some of the factors that contribute to this situation.

Table 10. Total Budget (NPR in million)-Consolidation

	Actual			Budgeted	Total
	2015/16	2016/17	2017/18	2018/19	
Total Allocated Municipal Budget (NPR in million)-Consolidation	3,003.181	7,586	22,156	22,939	55,684
Total Allocated in SWM (NPR in million)-Consolidation	71.325	416	3,003	681	4,171
Total Expenditure in SWM (NPR in million)-Consolidation		33.37	924.99	29.94	988.31

Fees for waste collection are haphazard and vary widely from one ward to another. Some municipalities do not collect fees while several wards do not have a waste collection system in place. Waste collection charges and penalty can be a great source of income that could contribute towards the SWM budget. The revenue from this sector is shown as in following page:

Table 11. Fee collection (NPR in Millions)

2072/73	2073/74	2074/75	2075/76
0	14.54	12.87	23.80

Table 12. Other SWM fee (charges/penalties etc.)

2072/73	2073/74	2074/75	2075/76
0	17.29	14.885	21.03

Table 13. Total Revenue

2072/73	2073/74	2074/75	2075/76
0	31.83	27.75	44.83

SWM Employees: The SWM staffs are a mix of ethnicity and gender. There are patterns to the staffing for example the sweepers, waste collectors, scrap collectors, and drivers mostly belong to the social class.

Male employees are at 62% whereas female employees are at 38%. Data also shows that there is gender disparities based on the job title and category.

Figure 28. Consolidated Designation of SWM Staff (%)

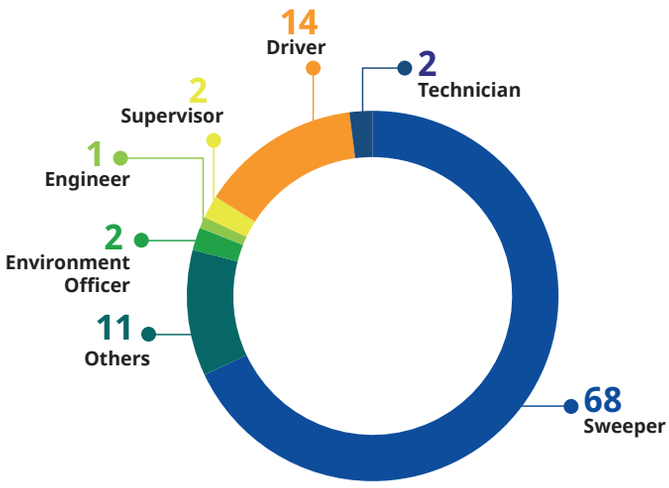
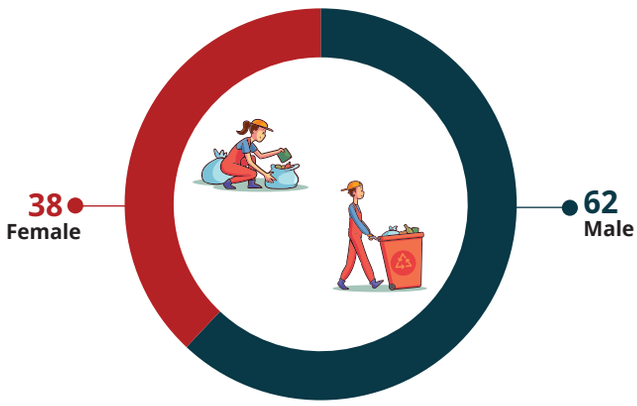


Figure 29. Consolidated Male and Female percentage of SWM Staff (%)



Special Waste:

The focus of the baseline study is on MSW, however a couple of other waste stream such as Temple waste, Slaughterhouse waste, E-waste, healthcare waste, and disaster waste were also studied briefly.

Temple and Slaughter Waste:

Assessment on slaughterhouse and temple waste was done specifically to showcase the idea that these sectors can be handled by the respective team/association at their place of work without outside intervention.

Temple Waste:

33 temples were surveyed to get a picture of waste generated and managed in this sector. 100.86 Kg waste was generated per day in 33 temples. The composition of waste are specified in Figure 30.

Waste generated in this sector is mostly organic and can be converted into compost to reduce waste generation as well as to be used in their own temple garden. In this way, only the dry waste could be sent out of the temple for recycling.

Only one (Dhangadhi Sub-Metropolitan City) out of the 35 municipalities segregated their temple waste. 11 municipalities collected waste daily while 6 municipalities collected waste from their temples twice a week. The rest either dumped their waste on open land, rivers or burned them. It was found that only 3 of the temples surveyed practiced composting.

Figure 30. Consolidate temple waste composition in %

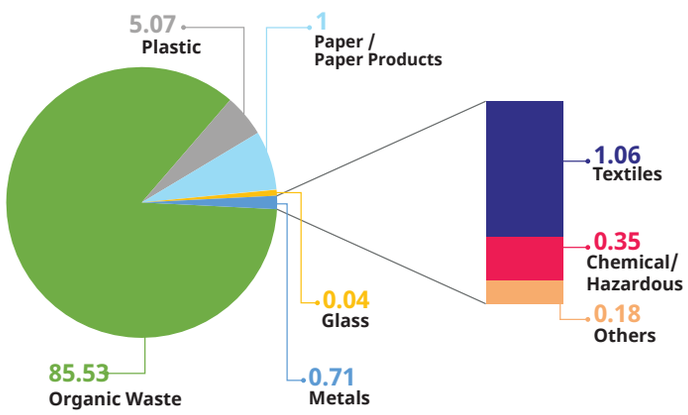
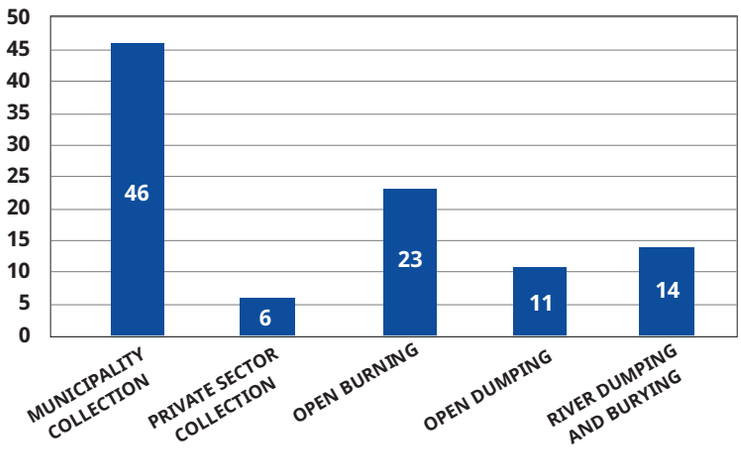


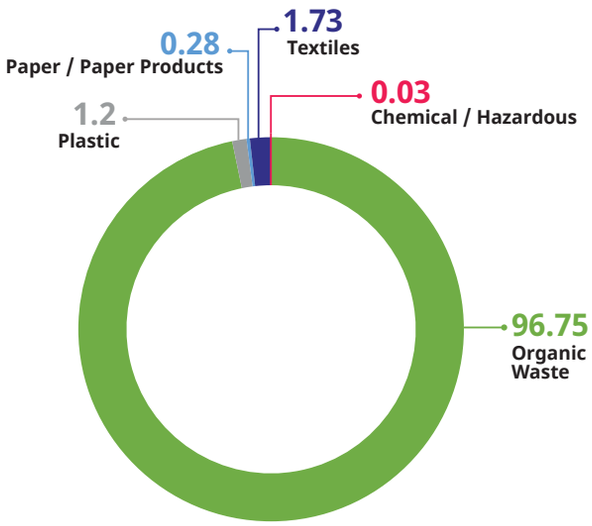
Figure 31. Disposal of Temple Waste in %



Slaughter Waste:

The waste generated in this sector mostly comprised of flesh, fur and bones of animals which were generally sold, and thus the only actual waste was that of animal discharges. This could be a great source for energy (biogas) for the slaughterhouse as they need to constantly boil water to separate the fur from the flesh. However, millions of flies were seen feasting over animal discard. The average waste generated per day was 46.19 kg. The composition of waste is as shown in the following page.

Figure 32. Consolidated Slaughterhouse waste composition (%)

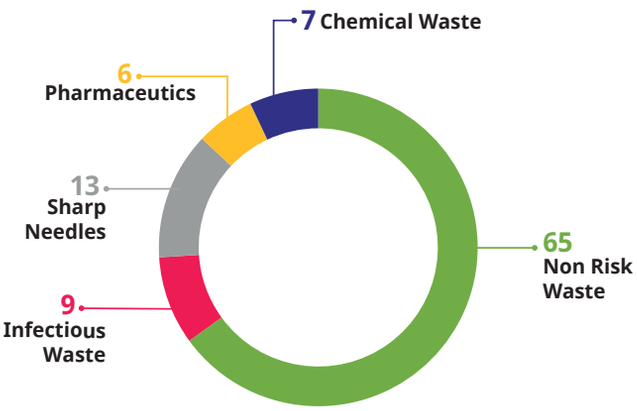


Given the composition of waste from the slaughterhouse, 96.75% of the waste can be recycled by converting organic waste to compost or biogas. Also, some paper, textiles and metal can be recycled. Thus, the realization of zero waste in this sector is also feasible.

Healthcare Waste:

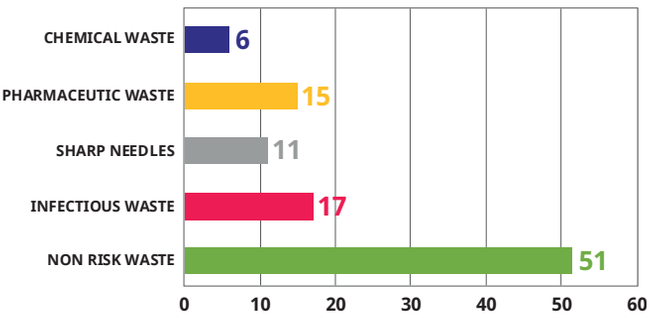
Medical waste is the waste generated from various healthcare facilities including hospital, clinics, as well as from pharmacy shops. During the survey it was observed that the participating hospitals practiced color coded bins for waste segregation. Red bins were for infectious waste such as blood and blood contaminated waste and sharps (syringes); blue bins collected non-hazardous inorganic wastes like paper, metal, and green bins were for non-risk and biodegradable waste. Non risk waste made up to 65%, sharp needles to 13%, infectious waste to 9%, pharmaceutics waste to 6% and chemical waste to 7% as portrayed in Figure 33.

Figure 33. Overall Hospital Waste Composition (%)



Survey results showed that open dumping, burial and open burning of healthcare waste were the most common disposal practices. Like hospitals, pharmacies also produce infectious and general waste. Figure 34 represents the average composition of waste from pharmacies.

Figure 34: Pharmacy Waste Composition (%)

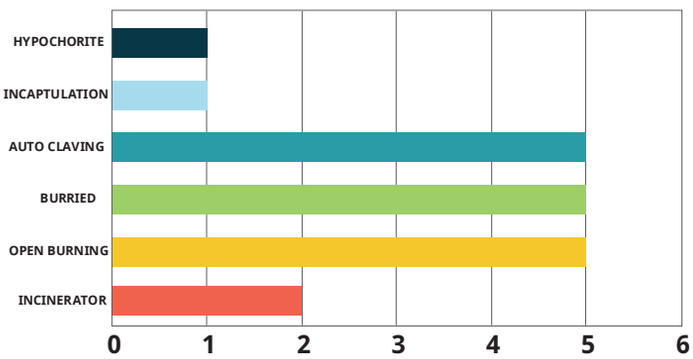


Of the 35 pharmacies surveyed, 70% of the pharmacies did not practice segregation of general and infectious waste. 50% of the waste from the surveyed pharmacies were collected by the municipality and 10% by private company. Rest 40% were never collected and hence was managed by the pharmacy shop owners themselves. These wastes were managed by burning in the open or disposed in the backyard.

Open dumping of health care waste Burning of health care waste, Doti

Very few hospitals have an incineration facility. These incineration facilities are a basic structure with a certain land area demarcated by concrete block to burn sharps. Some hospitals practiced scientific methods such as encapsulation and chlorination using hypochlorite to manage their wastes. Figure 35 depicts the various waste management practices adopted by the healthcare institutions that were surveyed.

Figure 35. Waste disposal methods practiced in surveyed healthcare institutions



It was also found that some of the healthcare institutions outsourced their health care waste collection and management to a private company.

E-Waste:

According to the Department of Customs report on Nepal Foreign trade Statistics, the import of electrical machinery and equipment and their parts and accessories, including television, computer, and mobile have been on the rise since the last few years. In the year 2012/2013, such import was worth Rs.38,744,588 and in just four years this amount doubled to Rs. 70,061,617 in the year 2016/2017. With changing lifestyles and a more consumption based society with easy access to electrical and electronic equipment, more products are used which generates more E-waste in the country.

E-waste are considered valuable recyclable items. After the items become irreparable it is sold to local itinerant buyers, which is then sold to larger dealers. The valuable components are usually extracted by scrap dealers in Nepal itself and sent to India for recycling. During the baseline survey, it was found that a piece of mobile is sold at Rs. 10 per piece. Refrigerators are disassembled to extract copper, aluminum, iron, plastic and motor to be sold separately, while the rest of the parts are discarded by burning or

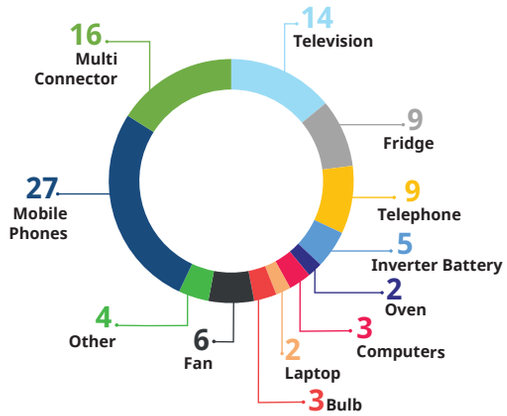
mixing it with MSW. Since the MSW collection service provider charges Rs. 100 to Rs. 500 for these non-MSW components, the scrap dealers would rather burn it than pay the fees. In the case of televisions, only the copper is extracted and the rest of the parts is either burnt or discarded in the municipal waste.

Composition of E-Waste

Data was collected from 22 out of 35 municipalities and several sources were referred to before compiling this data. Due to the lack of concrete data in some cases assumptions were made as mentioned below:

- The average weight of a mobile phone is 0.155kg, multi connector is 0.63kg, television is 5 kg, fridge is 100kg, telephone is 0.3kg, bike batteries are 3.5 kg, and oven at 5 kg respectively.
- The average frequency of changing a mobile phone is 3 years, multi connector 2 years, television 7 years, fridge 5 years, telephone 5 years, bike batteries 5 years, oven 3 years respectively.

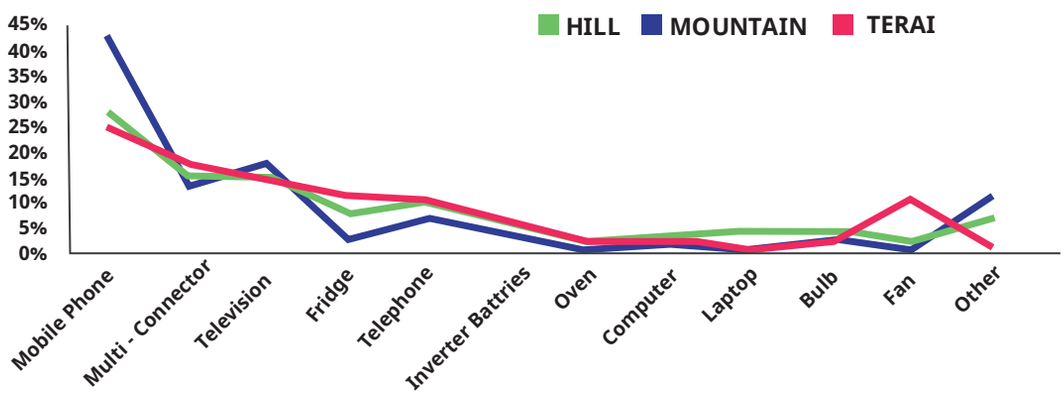
Figure 36. Composition of E-Waste disposed based on number in 22 Municipalities (%)



Based on the survey, 27% of the E-waste were mobile phones, followed by multi-connectors at 16% and television at 14% as depicted in Figure 36.

According to the analysis based on figure 37 mountainous regions have a higher disposal rate of mobile phones at 42% compared to terai (24%) and hilly (27%) regions. This could be due to inaccessibility to mobile repair shops in mountainous region as compared to the hills and Terai region and thus a higher disposal rate. While terai is in the lead in the disposal of multi-connectors at 17% followed by hilly (15%) and mountainous (13%). When it comes to refrigerators, there is a difference in the trend of its disposal, where terai is at 11% followed by hilly (8%) and then mountainous region at 2%. The mountainous region has a low percentage at 2% due to the cold climate where a fridge is not a necessity. These examples indicate that the trends regarding to the type and volume of items disposed may differ as per the geographical locations. These vagaries should be taken into consideration while formulating an effective waste management system.

Figure 37. Composition of E-waste disposed in terms of number region wise



Disposal of E-Waste:

According to the calculation and analysis of available data, 22 municipalities generate an estimated of 581 tons of electronic waste per year. The method of disposal of electronic waste is summarized as follows :

Figure 38. Disposal Methods of E-Waste based on 22 municipalities (%)

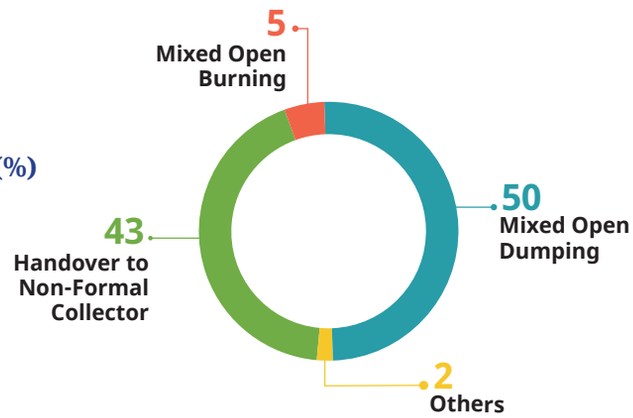
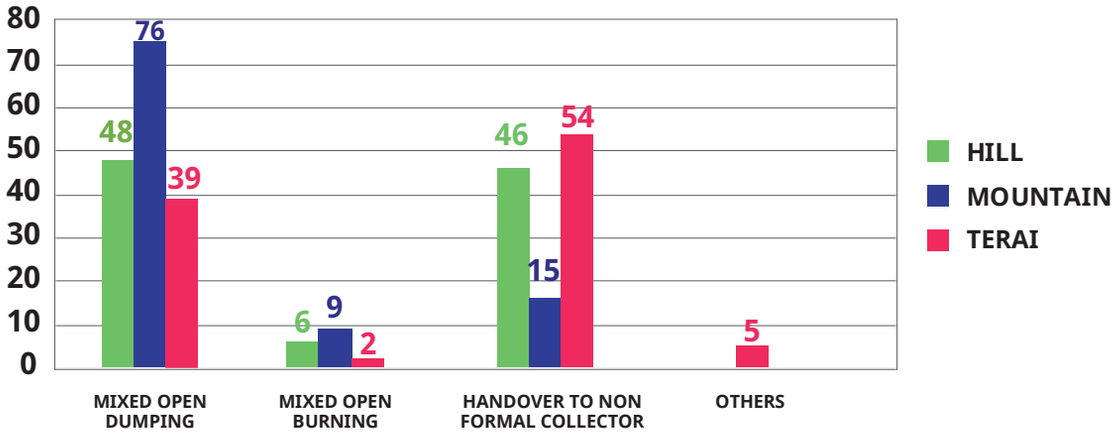


Figure 39. Disposal Methods of E-Waste based on Ecological Region (%)



Please note due to the limited number of survey questions, the analysis of electronic waste had to be derived through frequency of changing electronic devices or equipment of households, commercial and institutional establishments. It is based upon the following assumptions:

- The average weight of mobile phone Is 0.155kg, multi connector is 0.63kg, television is 5 kg, fridge is 100kg, telephone is 0.3kg, bike batteries are 3,5 kg, oven at 5 kg respectively.
- TThe average frequency of changing of mobile phone is 3 years, multi connector 2 years, television 7 years, fridge 5 years, telephone 5 years, bike batteries 5 years, oven 3 years respectively.

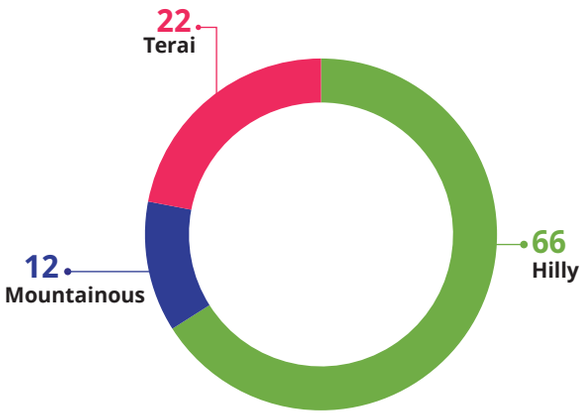
Figure 38 indicates that 50% of E-waste was dumped in the open, 43% handed to informal collectors, 5% burned in the open and 2% constituted of other methods. A very high percentage of the population in the mountainous region practiced open dumping at 76%. This could be due to missing formal waste management system to dispose of E-waste and thus they are forced to dump in the open. Such practice leads to soil contamination due to E-waste leakage and also cause air pollution. If left by the riverside, it could also infect the water streams and channels. On the other hand, it is interesting to note that the Terai region has a higher percentage of selling E-waste to informal collectors at 54% due to accessibility.

Emission from E-Waste:

Analysis of Greenhouse gas emission in 22 municipalities was calculated to be approximately 36,364 kg of CO_2 equivalent emission per year from the open burning of 13,827 kgs of electronic waste per year.It should also be noted that there is no research-based data on the rate of soil degradation caused by open dumping of e-waste.

The following measurement was taken to calculate Greenhouse gas emission:1>The burning of 1 kg mixed electronic waste generates 2.63 kg of CO_2 equivalent

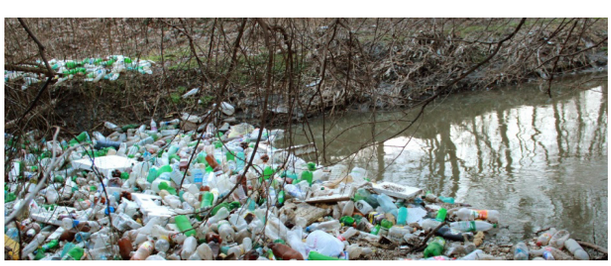
Figure 40. Emission from open burning of E-Waste based on Ecological Region



Disaster Waste:

Nepal experienced a 7.8 Richter scale of earthquake in April 2015, which killed nearly 9,000 people, injured 30,000 and destroyed over 800,000 buildings. Nearly 14 million tons of waste was generated within a couple of days, with 4 million tons of waste generated from Kathmandu alone, which is equal to the amount of waste generated over 11 years under normal conditions (NPC, 2015). Mixed with hazardous wastes, this large amount of disaster related waste resulted in adverse impact on public health and the environment (MoEST, 2015). This was a wakeup call at many levels as it was for realizing the need for documenting and managing disaster waste. Besides earthquakes, disasters like landslides and flood are common occurrence in Nepal that results in disaster debris.

Temporary shelters in Tundikhel, Kathmandu



Waste polluting the water resource

Relief packaging dumped near temp settlements

Burning of waste generated from settlements

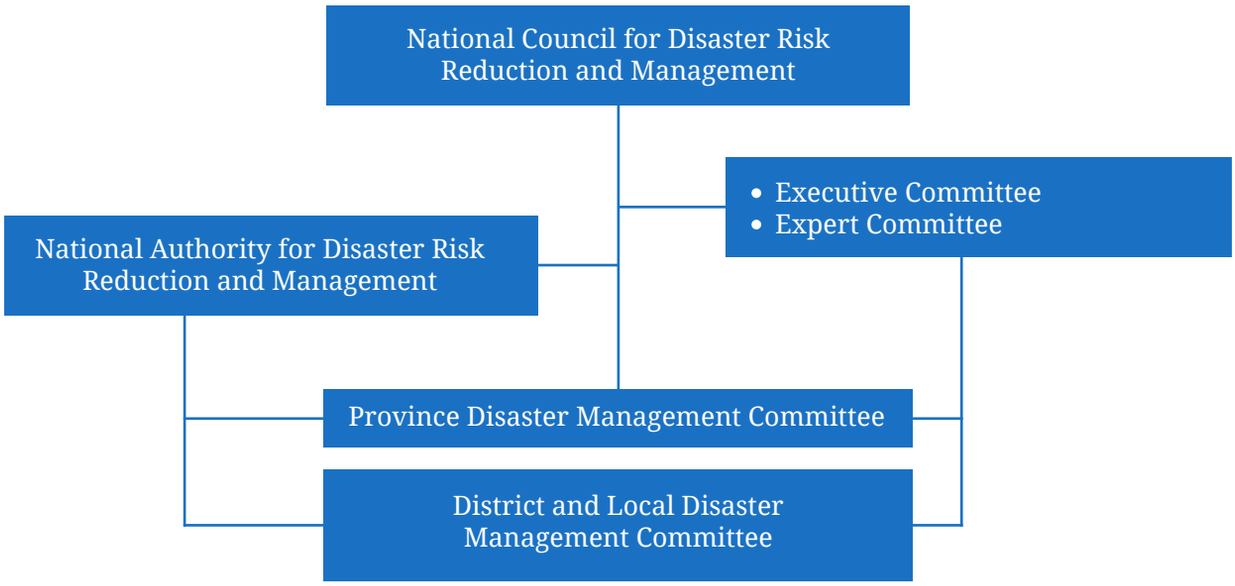
Drawn from the active dataset maintained by the MoHA, covering a period of 45 years (1971 to 2016) shows that a total of 21,856 disaster events have been recorded during this period. Annually, Nepal is exposed to approximately 500 events of disaster on an average and fire is one of the most recurrent hazards. The number of fire incidences was recorded at 8,721 times, followed by flood (3,950 times), epidemic (3,452 times) and landslide (3,246 times).

7.8 Richter scale earthquake - 2015 killed 9000 people and destroyed 80000 infrastructures generating 14 million tons of waste

Table 14. Major Disasters in Nepal and the Damages and Loss, 1971-2016

Disaster Type	No. of deaths	No. of persons missing	No. of persons injured	No. of houses damaged or destroyed	No. of affected families	No. of incidents
Epidemic	16,583	-	43,111	-	512,989	3,452
Earthquake	9,771	-	29,142	982,855	890,995	175
Landslide	4,980	174	1,871	33,617	558,264	3,246
Flood	4,445	42	544	216,190	3,710,065	3,950
Fire	1,605	-	1,619	86,261	259,935	8,721
Thunderbolt	1,620	129	2,684	963	7,140	1,711
Cold wave	515	-	83	-	2,393	390
Snow storm	87	7	-	-	-	5
Avalanche	16	3	7	-	-	2
Wind storm	2	-	11	215	191	44
Hailstones/ heavy rainfall	9	-	24	155	3,280	131
Others*	26	2	51	1	36	29
Total	39,659	357	79,147	1,320,257	5,945,288	21,856

Figure 41. Institutional structure according to the Disaster Risk Reduction and Management Act - 2017



Both the government and the public lack awareness of disaster waste segregation and management, especially handling hazardous waste. Disasters also adds pressure to regular MSW management because these events interrupt regular municipal waste collection and disposal added with waste generation from temporary shelters and the disaster itself.

Table 15 outlines the responses received by the surveyed households in 35 municipalities about their views on the challenges and opportunities for disaster waste management.

Table 15. Voices of Respondents on Challenges and Opportunities of Disaster Waste

Challenges	Opportunities
Lack of knowledge in Disaster waste management	Awareness program required on managing disaster waste
Lack of knowledge in segregating disaster waste	Training on handling different types of hazardous waste
No dumping site for disaster waste	Transfer or temporary dumping site to be allocated by the government demarking the types of DW
Smell from decomposed dead animals	Awareness on handling dead animals
No safe zones for temporary shelter	Contingency plan to incorporate temporary safe heaven during disaster events
No collection system from the municipality	DW removal/collection/transfer task and equipment plan to be mentioned in the contingency plan
Lack of proper equipment	Need assessment for appropriate equipment and resource mobilization to be done
No recycling facility	Establish Integrated Resource Recovery Center
No waste treatment facility	Treatment facilities should be established
No rain gears or water food storage	Food Water and rain gears and other emergencies items to be stored based on municipality or wards
No government officials claimed responsible for DW	Law and policies for DWM to be adopted giving clear role and reasonability at the central, province and local level and also to the community

Disaster Waste Management Planning

Major natural disasters can generate large volumes of debris in a short period of time. This underlines the need for removal and disposal operations to be implemented quickly to expedite recovery operations and to protect public health and safety of the local population. Therefore, before the occurrence of a disaster, it is important to prepare a contingency plan to guide the waste and debris removal and disposal operations. The quantities of wastes generated may overwhelm the capacity of existing recycling, composting, and disposal facilities. Hence, there may be a need to develop additional storage areas to store, separate, or process the waste material. A disaster debris management plan should aid communities in determining the appropriate management options in advance and help avoid rushed or, ultimately, poor decisions. Careful contingency planning can speed recovery, protect human health and the environment, and prevent the generation of additional waste. The SWMTC, UNEP and LEAD Nepal joint publication report on Disaster Waste Management Policy, Strategy and Action Plan, December 2015 has taken the 2015 earthquake findings and drafted a strategy and action plan for Nepal.

Snapshot of Waste Created from Disasters

An important first step in planning for disaster waste management is to understand the types of waste materials that result from different natural disasters.

1. Hurricanes and typhoon involve powerful winds, storm surge, and rain. Flooding produce construction and demolition (C&D) debris, damaged automobiles and furnitures. Winds produce fallen trees and flying debris. Vegetative debris is usually generated in exceptionally large quantities in most hurricanes and typhoons. Major hurricanes can also leave behind large amounts of displaced sediments.

2. Floods and landslides destroy structures and personal property; uproot trees; and displace soil and sediment including roads and bridges. In the aftermath of a flood, individuals dispose of damaged household items. Mud, sediment, sandbags, and other reinforcing materials also add to the volume of debris that require management, as do C&D materials and mixed materials from demolished houses and automobiles.

3. Earthquakes waste includes C&D materials, automobiles, furniture, and significant damage to roads, bridges and buildings.

Public Awareness:

4,000 HHs, 1,071 commercial enterprises and 720 institutes were surveyed for this baseline and questioned whether they were aware of what happened to their waste after it was collected. An overwhelming 74% of the respondents were not interested in this knowledge or was not responsive.

Public Awareness

	Knowledge of SWM Disposal		Knowledge of Impact of Dumping Waste on open land		Knowledge of Impact of Dumping Waste in River/River Bed		Willing to pay for Waste Collection	
	Yes	No	Yes	No	Yes	No	Yes	No
Household	1	70	118	1	226	12	119	0
Institution	150	164	277	10	645	17	230	62
Commercial	269	233	405	33	733	59	160	162

Respondents from institutes and commercial sector were more communicative in this regard. The response of remaining 26% is shown below:

Figure 42. Awareness on Waste Disposal

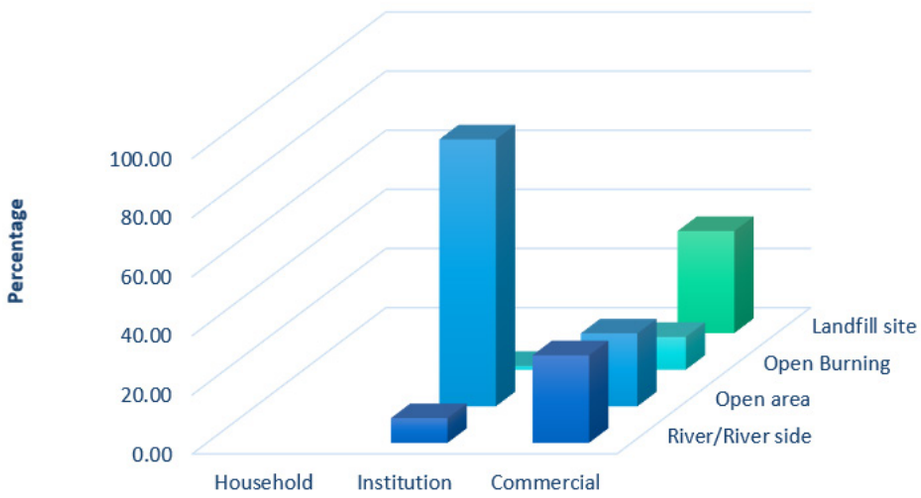


Figure 43. Knowledge on Waste Disposal

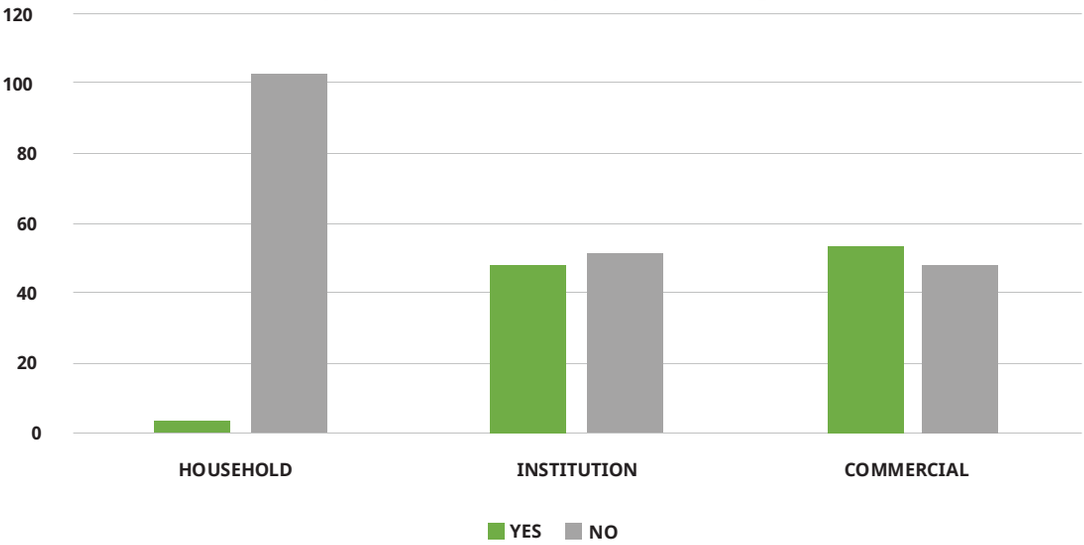
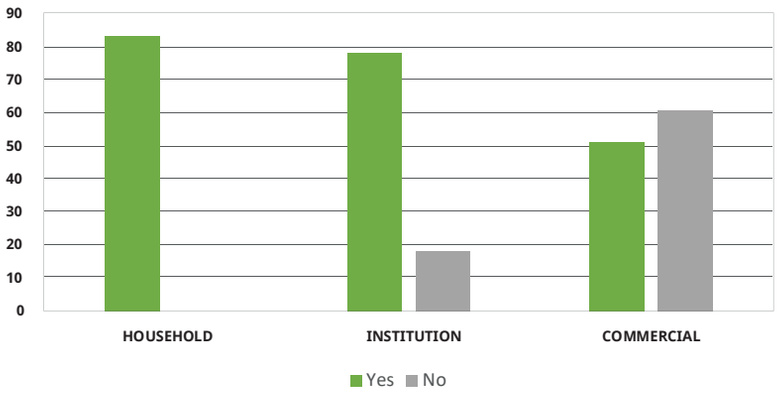


Figure 44. Willingness to pay for waste collection (%)



The survey indicates the importance of public awareness on waste management practices and systems. Almost 100% of household surveyed had no knowledge of waste disposal, while approximately 50% of commercial establishments and institutes had knowledge. However, a positive outcome was to know that 100% of HHs were willing to pay for waste collection.

These outcomes indicate the willingness of the community at large to practice and adopt proper waste collection and management. However, continuous efforts must be made to spread awareness and educate the mass on the importance of and need for clean and proper waste management practices and its benefits. Various media outlets like radio, newspapers and news channels can be utilized to raise awareness. Another interesting method could be to stage plays from village to village and engage the public in its activities. Additionally, children from a young age should be taught on the importance of waste management and such topics should be included in course books.

Gender and Waste Management

Gender Mainstreaming

The Constitution of Nepal provides the rights against discrimination, the right to reproductive health, the right against physical, mental and other forms of violence and equal right to property. The Constitution and the Election Act (2007) provide substantive quota for women (33%) to be represented in the Constituent Assembly (CA). Further, Nepal was the first country in Asia to develop a National Action Plan on Women, Peace and Security in 2011 and womens' and girls' right are protected in the Comprehensive Peace Accord. In addition, Nepal is signatory to 23 human rights treaties and international human rights instruments with legal framework in Nepal largely supporting women's right and equality including the Convention on the Elimination of All Forms of Discrimination Against Women, Beijing Platform for Action, the Millennium Development Goals, UN Security Council Resolutions 1325 and 1820.

The country has adopted several policies, programmes and plans of action to promote gender equality and the empowerment of women. It has made some notable progress on legal and policy reforms concerning discrimination against women and gender equality, with many discriminatory laws recently being amended and gender equality laws being adopted. In spite of progress in this regard, 65 remaining laws have been identified that adversely impact on gender equality and women's empowerment. As many civil society organizations have noted, gender equality is often limited to laws and policy and is not translated into reality for women.

Gender and waste

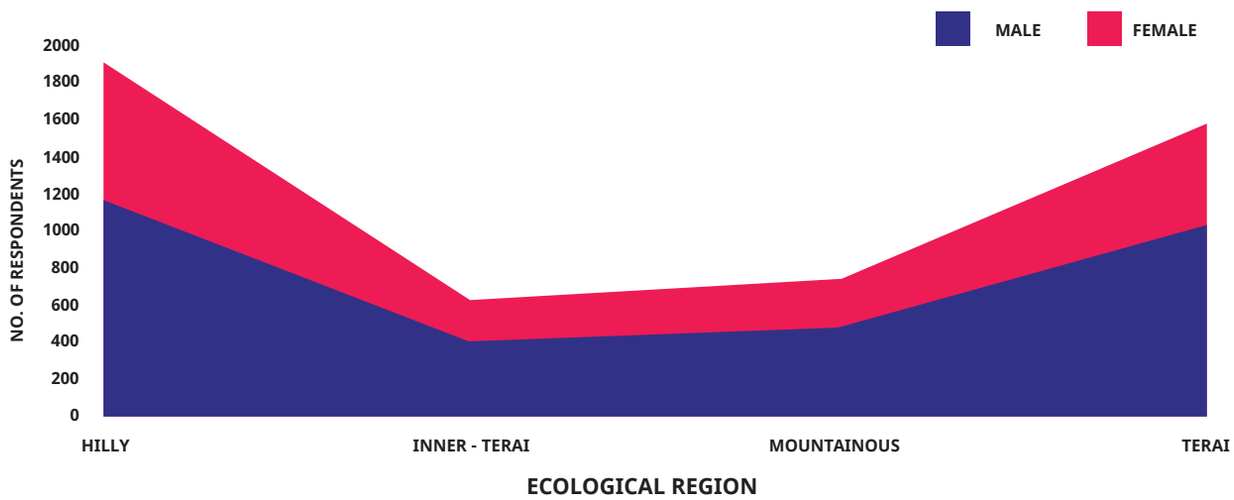
In Nepal, waste management is predominantly the responsibility of the women at the household level and men at the commercial, institute and informal sectors. This reveals that the men are engaged in productive roles and women are limited to reproductive and community management role as an extension of their reproductive role both considered as voluntary or unpaid thus creating economic in-equalities and setting the boundaries of control.

Looking at the organizational/institutional hierarchy, very few women hold decision-making or resource management position, thus demonstrating unbalance in gender equity. Therefore, from the perspective of the gender framework women and men, irrespective of their status, must participate as equals in decision-making, priority setting and resource allocation process. These principles are realized by ensuring that sex-disaggregated data is used as the basis for planning a service delivery which means gender equality is central to all activities be it policy development, research, advocacy, legislation, resource allocation and planning, designing, implementing and monitoring and evaluation stages of waste management programmes and projects.

Gender distribution of respondents based on Ecological region

Figure 45 depicts the gender distribution of respondents for the survey based on ecological region. As one can notice the number of males in the Hilly and Terai region far outweighs those of women, almost double the number. Whereas this difference is much lower in the Inner-Terai and Mountainous region, with the numbers almost equal.

Figure 45. Gender distribution of respondents based on Ecological region



Gender Role in Waste Management:

The bar graph below denotes the gender disaggregated data where the females are limited to the lower paid jobs while the men held higher positions. Further, in the decision-making category men again play a vital role surpassing the role of women in decision making.

Figure 46. Designation wise Gender Value

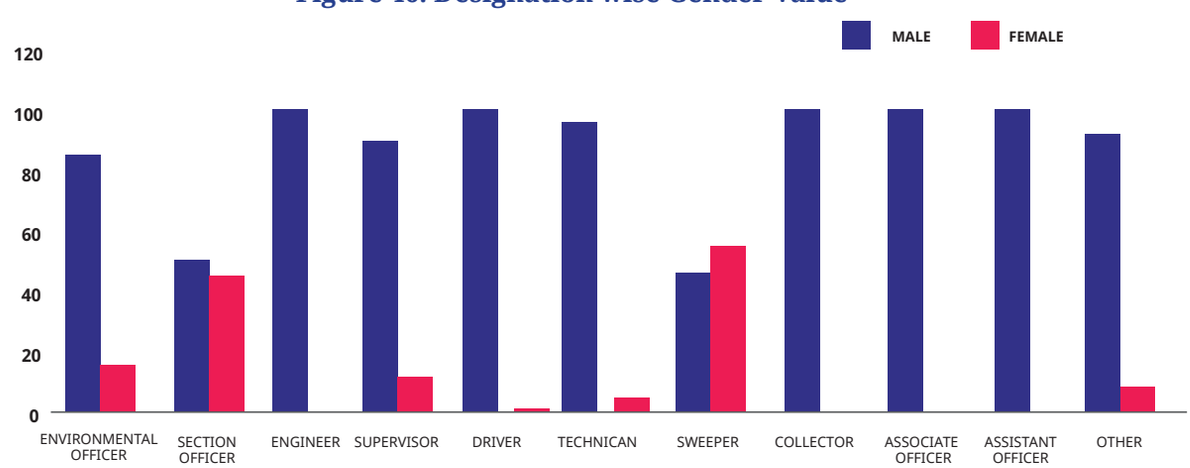


Figure 47. Decision Maker, Officer and Non-Officer Category of SWM Staff (%)

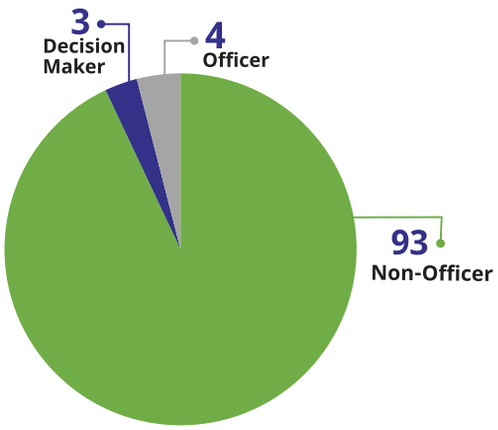
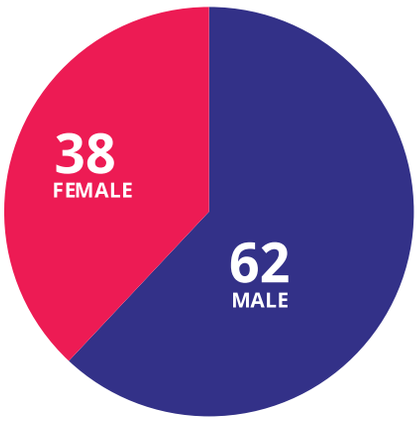


Figure 48. Consolidated Male and Female % of SWM Staff

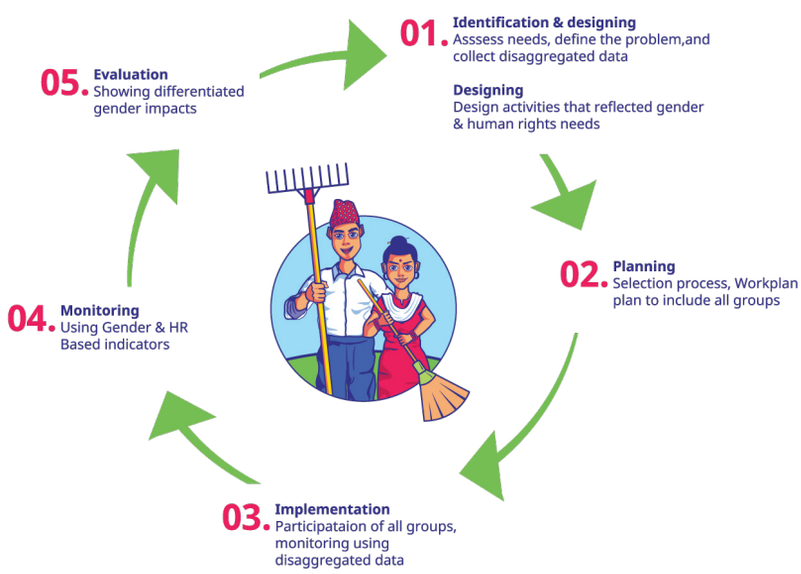


Issues of concern to women in waste management

- Equitable access to waste management
- Involvement, participation and equity
- Affordable cost of services
- Reliable services
- Appropriateness of technology
- Security and safety of the infrastructure
- Privacy
- Health and Hygiene
- High social, economic and opportunity costs

Integrating gender into waste management from theory to action

There is still a lack of understanding on the gender dynamics of waste management. Therefore, adopting a gendered approach to waste management to address the multiple dimensions is necessary. Including a gender perspective is the best possible way to solve operational problems of the waste collection services. An inclusive gender perspective in the recycling sector will also enhance equality in access to and control over the benefits from (waste) resources.



Gendering waste management programmes

Women as caretakers of a household are involved in waste collection, sorting, reusing and disposal of waste. As a waste handler, women's decision on what is considered as waste and what isn't, what can be re-used, what time is suitable for waste collection,

how to dispose and where to dispose etc. are important aspects and should not conflict with the waste management program or activity designed by the local authorities or private sector. Consultation with women groups while designing a waste management program can be a vital source of information.

Mainstreaming gender into institutes

Gender mainstreaming is never automatic. It calls for institutional reforms by revisiting and reviewing the organizational culture and ensuring gender is mainstreamed into the waste management institutes (governments, private, public partnership, NGOs or CBOs). Generally, the design and operation of the waste management systems, social and gender issues are often not recognised and considered by the largely male engineers and local government leaders. Similarly, at times, women employed by the municipalities for street sweeping and other cleaning activities are paid less than male staffs. Correction of such gender bias requires for a waste management strategy at the institutional level changing the unequal relations of men and women to resources, decision-making and rights with a gender perspective.

Gender Budgets

Commitment to gender mainstreaming in waste management can only be realized with adequate budget allocations. Budget is one of the most influential tools for organizations because without funds, policies or programmes cannot be implemented. They influence the overall objectives of a project and reflect the strategic priorities by any organization.

The failure to allocate human and financial resources to gender in waste management activities can reduce the efficiency of the programs and policy implementation. Because project implementation is largely determined by the source of funding, budgets can either promote gender equality or exacerbate inequalities. A holistic waste management programme calls for including equity in budget planning and examining impact of budget decisions on both men and women. Budgeting for gender equity is a step forward.

Integration of gender in waste management

At the household level

Collecting of gender disaggregated data on waste management practices, needs and demands at the household level on issues like:
Selection, re-use, control and ownership
Practices and division of tasks with collection, storing and disposal
Practices, needs and demands concerning formal and informal/illegal waste disposal and collection points
Perception, knowledge and information needs on health and hygiene related to waste handling, health and safety risks
Willingness and affordability to pay
Design and production of information and education materials that are gender sensitive and not sustaining or promoting specific/traditional gender roles and divisions.
Design and production of low-cost, hygienic and women-friendly waste storage and disposal equipment and materials.

At the community level

Collecting of gender disaggregated data on waste management practices at community level:
Management structure and power relations in community based formal and informal organizations.
Division of tasks with collection, disposal and recycling
Practices, needs and demands concerning formal and informal/illegal waste disposal and collection points
Perceptions, knowledge and information needs on health and hygiene related to waste handling, health and safety risks
Labour conditions in waste management organizations.
Formation of stakeholder groups, where women will have access to meetings and can take part in decision making.
Training sessions for men and women stakeholders on waste management and environmental issues as well as gender sensitization.
Provision of opportunities for women to get paid employment in community-based waste management services.
Involvement of schools, through gender sensitized education and information on health and hygiene related to waste management.

At local government and private enterprise level

Collection of gender disaggregated data in waste management services at local government level.
Management structure and hierarchy
Payment conditions
Health and safety risks, labour conditions
Communication flows within the departments
Communication and information exchange with citizens
Social and gender awareness/consciousness of staff
Training of staff on gender issues in waste management, participatory and gender disaggregated data collection and communication and information strategies.
Setting up of formal structures with involvement/representation of women on management and labour conditions.
Setting up of department for direct communications and information with citizens, with special attention to female stakeholders.
Training possibilities for female staff to upgrade their positions within the organization.
Representation of women into labour organizations and unions.

Source: Gender and Waste Alliance (GWA). No capacity to waste- training module gender and waste. http://www.waste.nl/sites/waste.nl/files/product/files/genderwastemodule_final100831.pdf

Collection of gender disaggregated data in waste management at HH, community, and local government and private enterprise level is a prerequisite to understand the gender aspects of waste which will facilitate the plan of mainstreaming of gender in the waste sector. The current baseline study attempted to perceive waste from the gendered eye, however, it was not an in-depth study. Therefore, it is suggested that a detailed study on gender in waste sector is conducted in the future.

Resource Recovery

The Informal waste sector has always been an integral part of Nepal's waste management system accelerating the recycling activities that takes place in the country. The recycling occurs in a value chain of door to door itinerant buying, scavenging of recyclable items in landfill, bulk trading in scrap shops, and sending the recyclable items to factories in Nepal and India.

Individual itinerant buyer/scrap collector

Itinerant buyers going door to door

The recycling value chain involves scrap dealers in a series of steps, wherein an individual itinerant buyer (commonly known as kabadiwala) visits homes and purchases recyclable items. The items collected are then sold to a medium or large scrap dealers (operated as junk shops). These scrap dealers trade the recyclables to either large companies or directly to recycling companies or middleman. Once the scrap materials are traded, they are recycled into new products. 5% of the collected materials are reused by the scrap dealers, while the rest are sold for recycling. Earlier, the scrap collected in Nepal was sent to India for recycling, as there were no local recycling factories. Lately, there is a noticeable positive change in the recycling sector in Nepal with at least 25 local recycling factories operating within the country. Private initiatives that connect recyclable waste-buyers to waste-sellers, by substantially increasing the diversion of recyclable materials away from landfills are also gaining traction in the country. This indicates the change in outlook of how people are now perceiving waste and recyclables and that if properly segregated, there is potential for recycling in Nepal itself. The recycling companies operating in Nepal are listed in Annex 2.

Scrap dealers

Waste dumped at scrap dealers

There are 152 scrap dealers registered with the Office of Company Register and are spread across 7 provinces. Besides these registered businesses, it is estimated that the unregistered small scrap shops are 10 times more than the registered scrap dealers.

The respondents were asked to rank items from 1 to 10 with 1 being their best selling item and so on. As we can see iron in the Hilly and Tarai region was ranked 1 and in the mountain region beer bottles were the best-selling item. Paper products were 2nd and plastic 3rd in the Hilly region and beer bottles followed by paper products in Tarai and glass bottles and aluminum respectively in the Mountainous regions.

These differences can be observed in the figure 50,51 and 52 and should be referred to while creating an effective solution for waste management.

Figure 49. Composition of waste collected by scrap dealers (%)

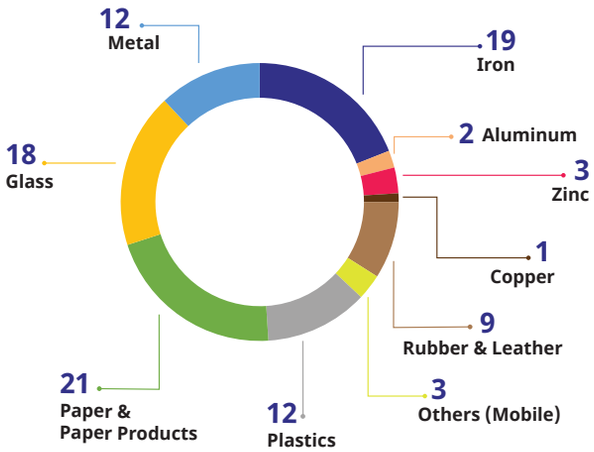


Figure 50. Hot selling item of Hilly region based on the priority listed by the scrap dealer

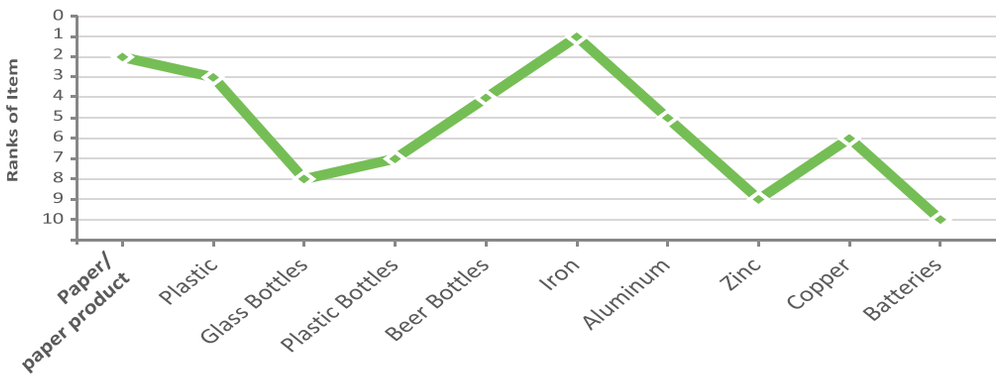


Figure 51. Hot selling item of Mountainous region based on the priority listed by the scrap dealer

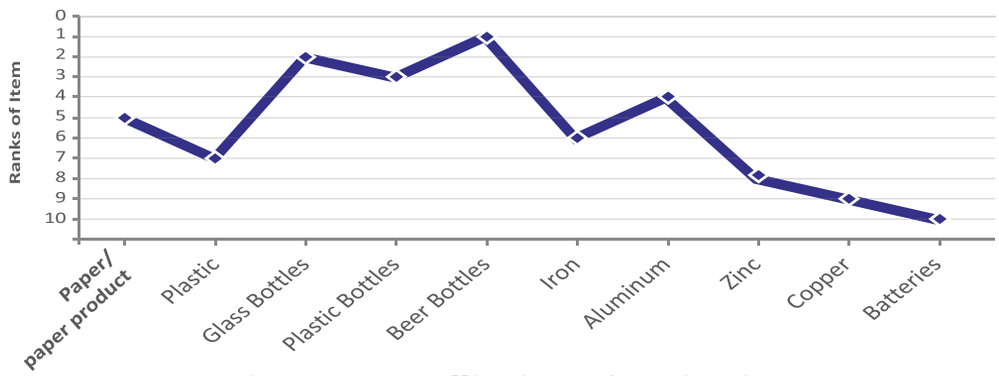
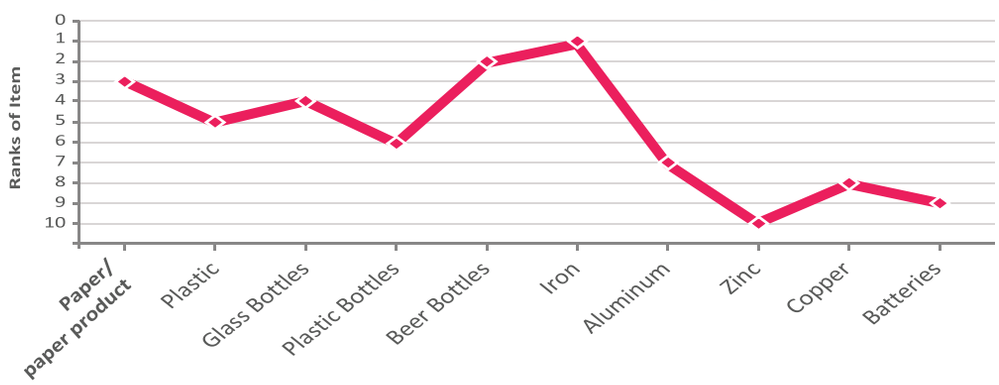


Figure 52. Hot selling item of Terai region based on the priority listed by the scrap dealer



Gender Roles in Scrap dealing business

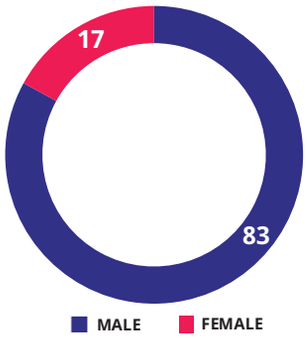


Figure 53. Consolidated Gender Disegregated data of Scrap Dealer (%)

Human resources engaged in scrap dealing businesses include men and women. In 84 scrap dealer shops, a total of 614 personnel were found to be working. Out of which male staffs represented 83% of the total workforce as compared to 17% female workers. The workforce shows a distinct gender role, where men maintain control by engaging primarily in all level of business activities including scrap collection, transportation segregation, trading (buy/sale) of the collected and segregated items, and overall management of the scrap shop. Women were found to be engaged in collection and segregation. It is to be noted that the women workers are generally excluded from managerial and trading roles. Such a division of roles make women's work invisible and less valued which results in a lack of recognition in the economical contributions of women in the recycling business.

The scrap dealers were asked if they were aware of the impact of throwing waste in the riverbanks and open spaces. Figure 54 charts their response where an alarmingly high percentage of scrap dealers at 91.80% seemed to be aware of the impact of throwing waste in the open space and a similar 91.80% of them knew of the impact of disposing waste into water channels. The survey also exposes the gender disparity that is inherent in the scrap dealing business. As can be noticed in Figure 55, women's participation in scrap dealing business is often limited to unskilled jobs such as sweepers and bottle washing. While men dominate the majority of tasks such as waste collection, segregation, and scrap packaging. It is however encouraging to witness that there isn't much difference between men and women when it comes to holding accountant job positions.

Figure 54. Awareness amongst Scrap Dealers on Waste Disposal

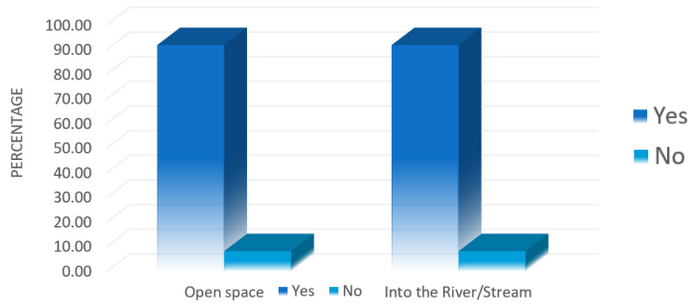
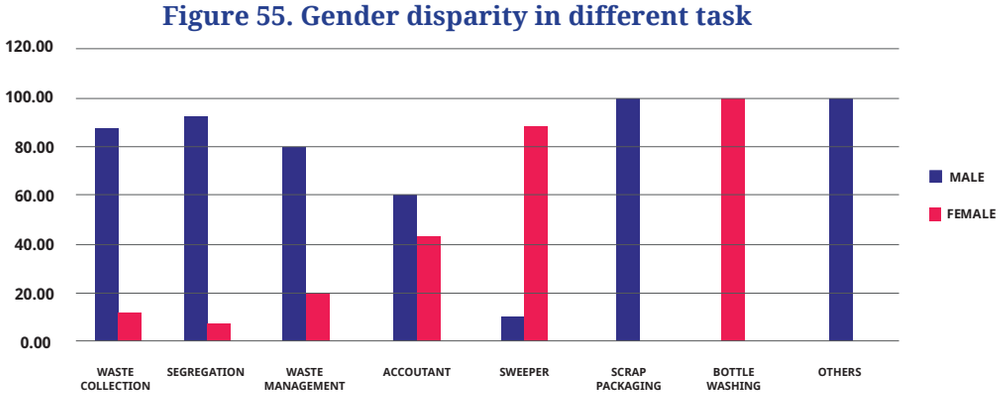


Figure 55. Gender disparity in different task

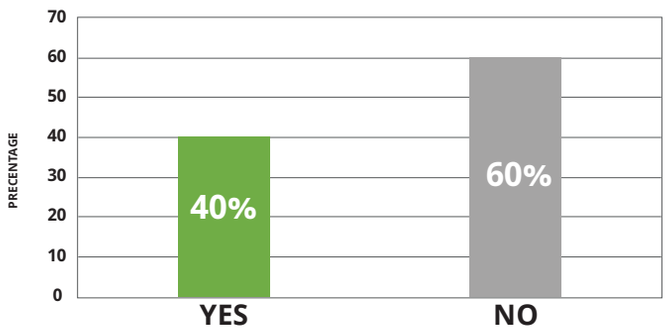


Income from Scrap dealing business

Most of the scrap is transported to bigger cities or to India. There are very few recycling industries in Nepal. Only a small quantity is sold to the locals, about 39%.

All Municipality Total	(Kg/Day)
Total Scrap received by All Municipality	**165668**
Average Scrap received per Scrap Dealer	**100**

Figure 56. Percentage of Scrap sold to Locals



During the peak season, a scrap dealer's daily business generates an income of NRs. 15,000 per day (USD 132) on an average, which is the income without deducting overhead cost which is anticipated to be around 60% of the total profit made. Table 16 displays the buying and selling cost of 20 scrap dealers.

Table 16. Income from trading scrap materials

Scrap Types	Average Quantity of items bought per day (Kg)	Average Quantity of items sold per day (Kg)	Buying Cost (NRs.)/Kg	Selling Cost (NRs.)/Kg	Average Profit/Day
Paper	18,488.00	18,130.67	835.00	1,297.50	96,274.58
Plastic	11,634.50	11,452.50	1,368.00	1,693.00	41,346.27
Glass	15,549.50	14,915.00	549.92	811.48	42,288.61
Iron	23,176.75	22,912.75	1,544.00	1,853.75	79,638.19
Aluminium	6,089.30	6,036.30	3,389.00	3,994.45	41,369.77
Zinc	3,487.00	3,521.00	126.00	193.00	2,859.42
Copper	942.67	930.20	5,720.00	6,427.00	6,980.24
Rubber	288.50	277.50	347.00	430.00	228.76
Battery	615.00	624.00	550.00	840.00	2,213.21
Steel	18.00	18.00	100.00	135.00	7.50
Dolls	1.00	1.00	40.00	50.00	0.12
Textile	10.00	10.00	11.00	15.00	0.48
Tin	95.00	88.00	23.00	30.00	5.42
Old Bikes	100.00	80.00	30.00	50.00	11.90
Others	11.00	9.00	50.00	70.00	0.95
Total					3,13,225.42

The survey found that a scrap dealer has to face numerous challenges while going about their daily activities. A major dissatisfaction they voiced was the social stigma attached to their profession despite their contribution in maintaining a standard of cleanliness in society. They also pointed at the occupational health and safety hazards they faced, cramped work environment and fluctuating or minimal prices for recycled items. High staff turnover rate and inadequate government support were other concerns raised by them. Those involved in scrap collection and trading recommended a number of ways in which one could support in breaking barriers. They are:

- Increasing social acceptance towards the scrap dealing occupation,
- Identification of scrap dealers as a stakeholder by local municipality,
- Provision of occupation health and safety insurance,
- Provision of loan facility for setting up a workspace,
- Designation of a specified area for scrap shop operations,
- Establishment of local recycling facilities,
- Uniformity in the price of scrap/recyclable materials, and
- Legal recognition and opportunities for green financing in the waste management act and policies for scrap dealers in Nepal.

Of late, scrap collection activities are taking the shape of social entrepreneurship, giving the much-needed recognition to the scrap collectors. Use of Information, Communication and Technology (ICT) and involvement of youth is a refreshing change that is breaking the social stigma attached to the occupation of scrap collection and recycling in general.

Landfill Operators & Final Disposal

Two landfill/dumpsite operators from each of the municipalities that had landfill sites or authorized dumpsites were interviewed. The quartering and coning method was applied to estimate the waste composition. Additionally, solid waste and leachate samples were sent to a laboratory for their characteristic's analysis.

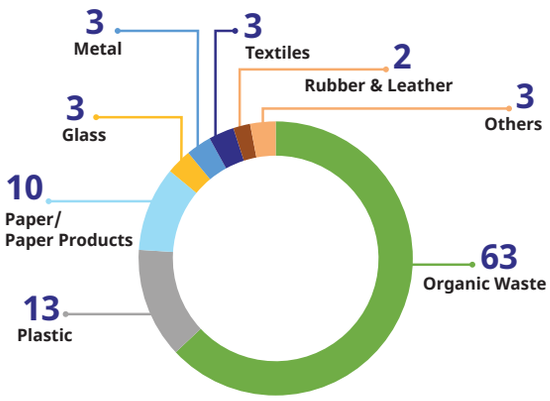


Figure 57. Waste composition at landfill site (%)

Figure 57 represents the composition of waste at the final disposal stage which indicates that more than half of the waste received comprised of organic waste at 63%. Landfill workers also contribute to recycling efforts as they too scavenge recyclable items such as paper and paperboards, glass, plastic, metals, battery and shoes on site.

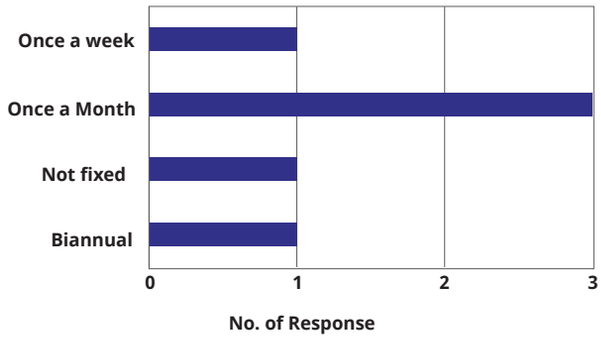
The surveyed landfills received waste from the municipality in both covered and uncovered vehicles. Nowadays most of the municipality have covered vehicles for waste transportation to the landfills however, waste is also transported in uncovered vehicles such as rickshaw/cart, tractor/power tiller, tipper/dump trucks etc.

71% of landfill workers used safety equipment like gloves and masks but neglected their foot gear while handling waste. In the survey, a majority of the respondents did not have any awareness training/programmes on landfill operation. It is to be noted that there is hardly any awareness program targeted for the landfill workers. When asked about the challenges the landfill workers faced, the respondents listed various factors such as lack of adequate manpower, unhygienic working conditions and no social recognition of their profession.

Waste cumulated in landfill and dumpsites

It was encouraging to note that landfill sites were frequently monitored by the municipal officers. Some reported to have weekly M&E visits while others had biannual visits depending on the municipality. Figure 58 depicts the frequency of such visits.

Figure 58. Frequency of monitoring visits to the landfill site



Landfill operators suggested a list of actions that could improve the current state of landfill sites. These included proper landfill site planning by the municipality including the design as well as operation guidelines, provision for training for the staffs, and landfill gas extraction.

Scavenging of recyclable items also take place at the landfill site. In the case of Kathmandu municipality, the recyclable items from Sisdol landfill site are segregated by the waste scavenger. On an average each scavenger collects 3-4 bags of recyclable items weighing approximately 30-40 kg which is temporarily stored for 1-2 weeks at the landfill site. Within 7-15 days, a truckload of these bags is then transported to Teku or Golphutar to be sold to scrap dealers. The scrap dealers make a one-time payment every three months. Recyclable items are also traded directly from landfill sites. In these cases, the scrap dealers visit the landfill site and pay Rs. 300 per bag of recyclable items. Since these activities happen through an informal channel, no data is available in the municipality about the recycling rate and/or the informal recyclers.

Scrap Collectors at Sisdol Landfill

Truckload of recyclable items ready to be transported from Sidol landfill to the scrap dealers in Kathmandu

Scaling up recycling

Recycling trends in Nepal has picked up in the last few years. Informal waste scavengers and small scrap dealers are formalizing their businesses by registering as a company. Environment conscious youths are establishing and promoting social enterprises that deal with recycling and the formal private sector are increasingly engaged in the recycling businesses. Many NGOs/CBOs, especially women's groups, are actively engaged in converting waste to upcycled products (such as bags, rugs, placemats and decorative items from plastic) which supplement their income. Few municipalities, for instance, Hetauda is investing in constructing a transfer station that segregates recycling materials and sells them to recycling factories. These actors and their contributions have played an important role in the waste management system in Nepal and needs to be scaled up. They could be instrumental in strengthening the recycling business as it transitions towards a circular economy while still focusing on climate change mitigation.

A circular economy is restorative and regenerative by design which aims to minimize the resource (material and energy) input and waste, emission, and energy leakage by closing the loop through long-lasting design, maintenance, repair, reuse, remanufacturing, refurbishing, and recycling. Adopting a circular economy principle can accelerate transformational change in solid waste management by establishing infrastructure for recycling and reuse of waste and thereby reducing the amount of disposed waste. This can be achieved only when all concerned stakeholders participate and contribute. Manufacturers will have to step up their efforts towards more eco-friendly designs and promote the reuse of products; the government needs to make efforts on a legislative and administrative level to establish a stable, ambitious and economically viable regulatory framework, and promote recycled products through green procurement policies; the private sector needs to invest more in recycling businesses/infrastructure; and finally, the citizens need to make environment-friendly consumer choices and make efforts to separate waste, which will ultimately increase recycling.

Final disposal

Landfill and authorized dumping sites are still a prevalent method for final waste disposal by municipalities. Most of the municipalities do not have an engineered sanitary landfill and hence practices conventional dumping. Out of 35 municipalities, 19 municipalities do not have a dumping site, i.e., the municipality has not allocated any land for waste dumping purposes, hence they practice open dumping, which is equivalent to illegal dumping. This illegal dumping is again different to littering by the type and amount of waste materials discarded. An example of littering could be throwing a cigarette on the ground. However, emptying a rubbish bin with no permission in a public or private area can be classified as illegal dumping. The impact of illegal dumping will include health, environmental, water and economic consequences.

Old landfill sites is another issue that needs to be tackled. For example, Janakpur municipality's landfill site has reached its end of life and is currently closed. However, a new landfill site had not been established during the baseline survey. Kathmandu sanitary landfill site too has reached its end of cycle and is currently being used as an authorized dumpsite. Approximately 1,700 tons of waste is dumped daily in the landfill site. The construction of the second landfill site at Banchare dada has been delayed for many years now. As of present, only Pokhara Lekhnath metropolitan city, Damak

and Dhankuta operates a sanitary landfill site. Rest of the municipalities have open dumpsites, few of which (as in case of Hetauda and Birendranagar) run as a controlled or authorized dump sites, which is an in-between dump site that is neither a sanitary landfill nor an open dump, some activities like covering the dumped waste with soil is practiced. Details of landfill and dumpsite of 35 municipalities are presented in Annex 3.

Not-in-my-backyard (NIMBY) syndrome is one of the challenges in designating landfill site in many municipalities, as locals often protest operation of such sites in their locality. Also, the lack of technical expertise and financial constraints are the other major barriers faced by the municipalities while designating final disposal sites. Nonetheless, many of the surveyed municipalities including Dullu, Janakpur, Solududhkunda, Tansen, Chandranigahpur, Sikhar, Suryavinayak and Gorkha have mentioned the allocation of an official dumpsite is one of their SWM plans.

Landfill workers offloading waste from open trucks

SLCP emissions from the waste sector

Waste is a by-product of everyday human activities which if not managed properly affects our health and impacts the quality of air, water, soil and the natural ecosystem. Nearly 5% of anthropogenic GHG emissions (IPCC) in the world can be attributed to the waste sector. As per UNFCC estimates, landfills are the third-largest source of anthropogenic methane (CH_4) emissions, accounting for approximately 11% of estimated global methane emissions. Thus, if left unmanaged and unchecked, the waste sector will have lasting short and long-term climate impacts and be responsible for releasing various other pollutants into the environment.

Open dumpsite, Bhimdatta Municipality

The municipal waste sector is a significant source of SLCP emissions such as methane (CH_4), black carbon (BC), NOx, and organic carbon (OC). As opposed to carbon dioxide (CO_2), which has an atmospheric lifetime of about 100 years, SLCPs have an atmospheric lifetime of only a few years to even a few days. The most common SLCPs are methane and black carbon, which results from emissions from waste handling equipment, emission from trucks, and emission from landfill fires, open burning of waste, and

emission from organic waste decompositions. Reducing these SLCPs through well-managed waste systems will contribute to overall efforts to mitigate climate change and could have significant health, environmental, and economic benefits, including improved quality of life for local communities.

If no measures are taken, GHG emissions from waste management is expected to continue to increase in urban areas, in developing and less developed countries. On the other hand, measures such as waste prevention, resource recovery, reusing, and recycling offer the potential for reducing GHG emissions and other pollutants, caused by the supply chain and product disposal. Integrated and sustainable waste management provides significant opportunities to control environmental pollution and minimize the negative impacts of global climate change. Adoption of appropriate waste management technologies can transform this sector into a net carbon reducer.

Methane from leachate at Sisdol landfill

The United Nations Environment suggests that appropriate waste management can reduce annual GHG emissions by 15 to 20% (UNEP). At the international level, waste management has attracted climate finance, initially through market mechanisms such as the Clean Development Mechanism under the Kyoto Protocol and later through Nationally Appropriate Mitigation Actions. Sustainable waste management projects also have the potential to obtain international finance from funding schemes aimed at climate change mitigation such as the Green Climate Fund. Due to the potential to reduce GHG emissions while decreasing overall pollution and creating jobs, waste management can also assist countries in achieving their commitments in the international arena, such as their NDCs under the Paris Agreement.

Measuring and tracking SLCP is one of the first steps in reducing their emissions. This baseline study has attempted to quantify the SLCP emissions from MSW handling and management in municipalities of Nepal for the first time. The CCAC-MSWI's SWEET tool was applied in five municipalities, Kathmandu, Pokhara, Dhankuta, Birendranagar and Hetauda.

Measuring and Mitigating SLCP Emissions

Carbon dioxide (CO_2) is responsible for more than half of the total current global warming impact from human-caused emissions (EESI, 2013). The CO_2 emitted remains in the atmosphere for hundreds of years creating warming effects. However, mitigation efforts solely focused on CO_2 will not slow down the impact on climate change in the next few decades as city and national strategies should focus on reducing short-lived climate pollutants (SLCPs), which are in fact responsible for half of the global warming and has an atmospheric lifetime of less than 20 years (EESI, 2013). SLCPs include black carbon, methane, tropospheric ozone and hydro fluorocarbons (HFCs).

The national and local government in Nepal face numerous challenges to reduce SLCP emissions from MSW. Improper waste management practices such as open burning, open dumping, dumpsites and the increasing volume of waste are a major concern. The Nepal National Integrated Waste Management Strategy and Action Plan 2020-2035 plans to reduce SLCP from the waste sector by 60% by 2035. Solid Waste Emission Estimation Tool (SWEET) tool is being used to estimate the SLCP and GHG emission.

The Solid Waste Emissions Estimation Tool

Climate and Clean Air Coalition (CCAC) is an intergovernmental organization including business, scientific institutions and civil society organizations committed to improving air quality and protecting the climate through actions to reduce SLCPs.

The Solid Waste Emissions Estimation Tool (SWEET) was developed by the U.S. Environmental Protection Agency (with assistance from Abt Associates and SCS Engineers) on behalf of the CCAC Municipal Solid Waste Initiative. It is an Excel-based tool that quantifies emissions of methane, black carbon and other pollutants from sources in the municipal solid waste sector. The updated version 3.0 of the SWEET (2019) has been used to estimate the SLCP emission from the waste sector and mitigate potential diversion from the landfill sites.

Limitations of the Study

The SWEET analyses were specifically targeted for Kathmandu and Pokhara metropolitan cities, Hetauda, Birendranagar and Dhankuta the three sub-metropolitan cities of Nepal due to time and budget constraints. All the same, these analyses will forecast a clear understanding of the impacts of SLCP and GHG emission from the waste sector and the means of mitigation which can then be replicated in other municipalities in Nepal.

A number of assumptions were taken into consideration to complete this document which are listed below:

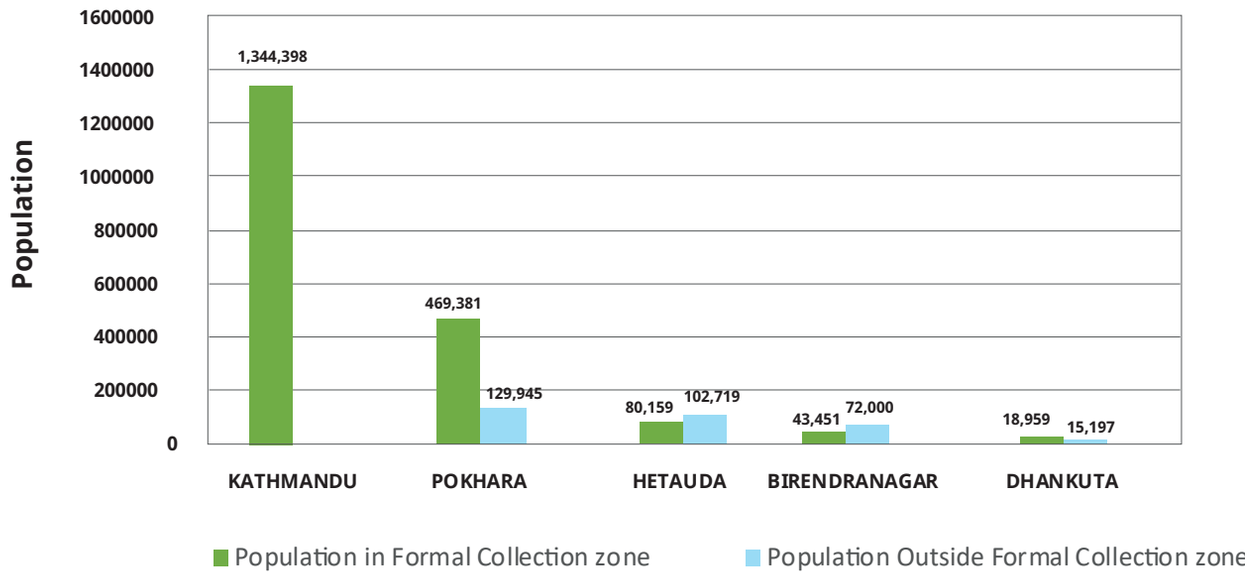
- Reduction of the proportion of waste burnt
- Reduction of fugitive dust emissions while handling, transporting and processing of waste
- Improvement in collection coverage and efficiency through,
    - Increased collection efficiency and coverage
    - Diversion of an increased amount of waste to different other treatment options and gradual reduction of landfilling
    - Encouraging composting and anaerobic digestion from organic waste
    - Promoting recycling of all possible recyclable waste
    - Maintenance of transport vehicles and equipment

Limitations of the SWEET

SWEET with its many advantages has few limitations which is mostly linked to developing country waste management practices. SWEET is not programmed to calculate the food waste that is fed to animals thus it remains in the recyclable segment of the tool which then shows an increase of SLCP and GHG emission for some time. This is seen in the case of Pokhara when 47% of its food waste was fed to the pigs. This can also occur in case of cows where they are fed with the food waste which in 24 hours turns to manure and can be used as feeder for biogas plant or mixes with other green waste for compost. Second, the SWEET only considers waste that is collected thus analyses is done only

for population within the formal collection zone. Therefore, the uncollected waste indicated in this document as outside formal collection zone is excluded, although it produces equal or even more SLCP and GHG emission. Therefore, in a developing country like Nepal where waste collection is limited the SWEET analyses will not portrait a holistic picture. A case for example, in Birendranagar Municipality only 37.64% population receive waste collection services and the rest 62.36% do not. As a result, the SWEET records CO_2 emission in 2020 as only 22,588MT whereas in actual it is 60000 MT. Figure 59 provides details of population inside and outside collection zone in the five municipalities.

Figure 59. Population distribution in the formal and outside formal collection zones



Implementation Timeframe

The mitigation of SLCP and GHG emission from the waste sector is planned in three scenarios: short term (2020-2025), midterm (2025-2030) and long term (2030-2035) within a span of 15 years. This timeframe will complement the NNIWMS (2020-2035). The findings of the MoFAGA baseline survey of 2018 and 2019 will serve as the measurement foundation which is indicated in this document as business as usual condition (BAU). Table 17 provides further clarification of the 3 scenarios.

Table 17. Three Implementation Timeframe

Scenarios	Description
Business as Usual (2020)	BAU scenario projects the emission from the solid waste sector that produce GHGs and SLCPs based on the MoFAGA baseline survey of 2018 and 2019.
Short-term (2025)	The improvements made in waste management within the 5 years period is anticipated to divert 24.09% waste from the landfill into different recycling activities.
Mid-term (2030)	This scenario focuses on the positive changes adapted over the course of 10 years from the baseline year and will divert 77.58% waste from the landfill site.
Long-term (2035)	The 15-year improvement period in waste management will divert 80% from the landfill site from the BAU condition. Thus, mitigating SLCP and GHG emission from the waste sector.

Waste Composition and Diversion Plan

In view of the above-mentioned implementation timeframe Birendranagar municipality with 63% wet and 37% dry waste has anticipated to divert 11.79% of its waste to composting, 8.42% waste to anaerobic digestion and 7.85% to recycling activities in 2025. In the mid-term period it plans is to divert 19% to composting, 16.9% to anaerobic digestion and 3.4% to the recycling. Finally, in the long-term scenario 12.1%, 10.7% and 2.7% waste will be diverted to composting, anaerobic digestion and recycling respectively. Hence, within the 15-year period Birendranagar envisages a potential to divert 92.86% of waste from the landfill site by adopting three recycling methods a) composting of 42.89%, b) anaerobic digestion of 36.02% and c) recycling of dry waste by 13.95%. At the end of 2035 it leaves behind 7.14% waste at the landfill site as residual waste.

Similarly, Dhankuta Muncipality with its 60% wet waste and 40 % dry waste envisage to divert 47.6% to composting and 34% to recycling dry waste within the 15-year strategy action plan timeframe. This will entail wet waste diversion of 4.3% to composting and 15.9% to recycling in 2025. Again in 2030, 2.8% wet waste diversion to composting and 3% of dry waste to waste recycling and in 2035 the diversion of 2.8% to composting and 2.5% to recycling leaving 18.4% waste at the landfill site for further processing in the coming years.

Following the same strategy action plan, Hetauda Municipality with 53.2% wet and 46.8% dry waste predicts to divert 26.1% to composting, 12% to anaerobic digestion and 44.5% to recycling within the 15-year period.

In the same way Kathmandu with its waste composition recorded at 66.55% wet and 33.45% dry waste proposes to divert 30.5% waste to composting, 27.3% to anaerobic digestion and 22.2% to recycling by end 2035.

Last but not the least Pokhara, with 58.7% wet waste and 41.3% dry waste will be diverting 3.1% waste to composting, 10.7 to anaerobic digestion, 47% to livestock feeding and 30% to recycling. Table 18 illustrates the details of the waste diversion plan.

Table 18. Waste Composition and Diversion Plan

Waste Composition and Diversin Plan																					
Cities	Waste Composition		Composting					Anaerobic Digestion					Waste Combustion					Recycling				
	Wet Waste (%)	Dry Waste (%)	BAU 2020	Short term 2020- 2025	Mid-term 2020-2030	Long term 2020-2035	Total	BAU 2020	Short term 2020- 2025	Mid-term 2020-2030	Long term 2020-2035	Total	BAU 2020	Short term 2020- 2025	Mid-term 2020-2030	Long term 2020-2035	Total	BAU 2020	Short term 2020- 2025	Mid-term 2020-2030	Long term 2020-2035	Total
Kathmandu	66.55	33.45	0	5	15.2	10.3	30.5	0	5.08	10.2	11.94	27.3	0	0	0	0	0	12	2.01	3.99	4.2	22.2
Hetauda	58.70	41.30	15.1	3	4	4	26.1	0	5	3	4	12	0	0	0	0	0	23.4	5	5	11.1	44.5
Pokhara	58.70	41.30	0	1.04	1.06	1	3.1	2.2	3.19	2.71	2.6	10.7	47	0	0	0	47	8.9	3.97	7.83	9.3	30
Dhankuta	60	40	37.7	4.3	2.8	2.8	47.6	0	0	0	0	0	0	0	0	0	0	12.6	15.9	3	2.5	34
Birendranagar	63	37	1	11.79	19	12.1	42.89	0	8.42	16.9	10.7	36.02	0	0	0	0	0	0	7.85	3.4	2.7	13.95

SWEET Analysis Results

Overall Emission of CO_2e based on three Implementing Scenarios

Birendranagar Muncipality:

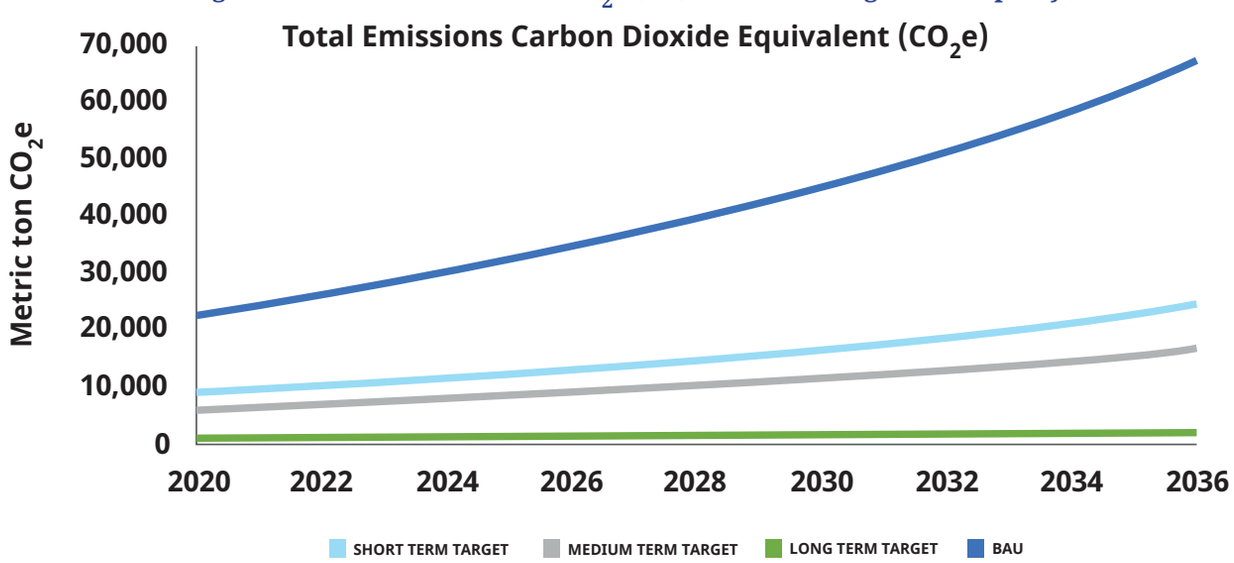
Figure 60 represents the overall CO_2e emissions from the waste sector based on three implementation scenarios and its diversion plans as stated above.

More specifically, the CO_2e emission under the BAU scenario is measured to be equal to 22,588 MT in 2020 and 32,001 MT in 2025. In comparison, the 2025 emission under the short-term scenario is estimated to reach 12,010 MT. As a result, the reduction in CO_2e emission is estimated to be reduced by 62.47% in 2025.

In 2030, emission under the BAU scenario is found equal to 45,031 MT, while under the midterm scenario they reach 11,436 MT. In other words, comparing the baseline to the mid-term scenario reveals that in 2030 emission to be lowered by 74.60%.

Finally, in 2035 the emission under the BAU scenario stands at 63,243 MT and in the long-term scenario reach 2055 MT which represents a reduction of 96.74%.

Figure 60. Overall Emissions of CO_2e (MT) in Birendranagar Municipality

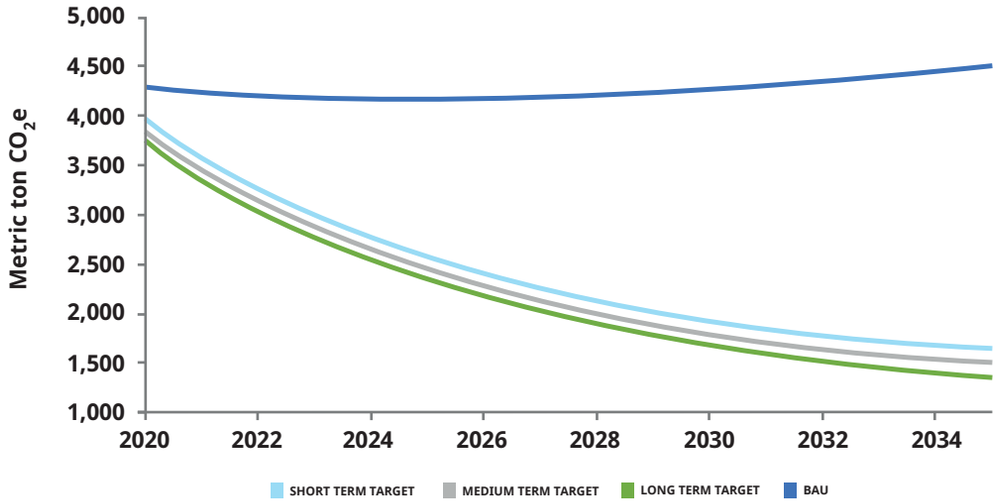


Dhankuta Municipality:

Following the similar pattern as in the above figure it illustrates that CO_2e emissions in 2025 has reduced by 38.55% from the baseline scenario. In the midterm (2030), with gradual improvements in waste management practices the CO_2e emissions is decreased by 54.92%. Finally, in the long-term scenario that is in 2035, 69.33% CO_2e emissions was reduced from the BAU scenario.

Compared with other municipality Dhankuta is recognized for its improved waste management practices in Nepal. Hence the emission is low and given the above implementation plan CO_2e emissions can further be reduced as indicated.

Figure 61. Overall Emission of CO_2e (MT) in Dhankuta Municipality

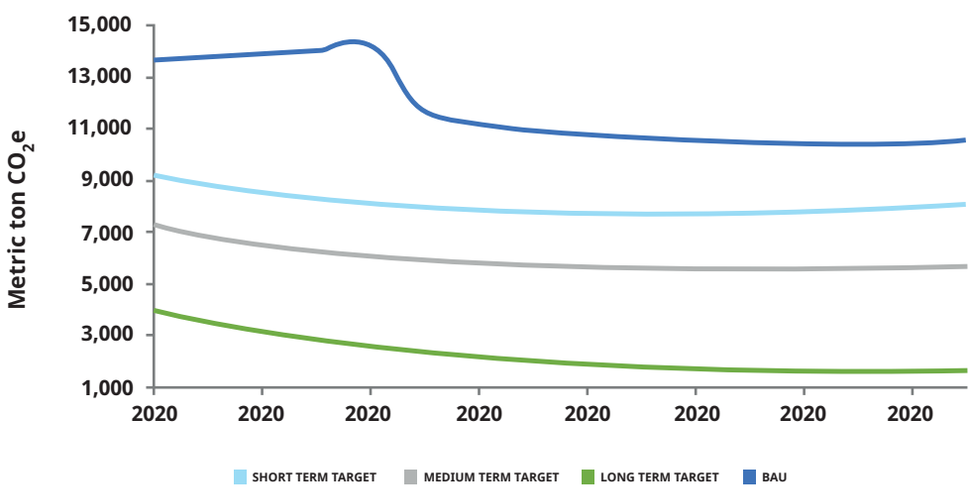


Hetauda Sub-Metropolitan City:

Figure 62 reflects that the CO_2e emissions is measured at 13,722 MT in 2020 and it dropped to 11,657 MT in 2025. Under the short-term scenario, emission is projected to reach 7,974 MT by 2025 which is a decrease of 31.61% emission in 2025. In 2030, it decreases by 45.53% and in 2035 the emission further decreases to 84.42% from the baseline line scenario.

These changes in emission are based on the enhancement in waste management practices from collection to recycling and final disposal.

Figure 62. Overall Emission of CO_2e (MT) in Hetauda Sub-Metropolitan City

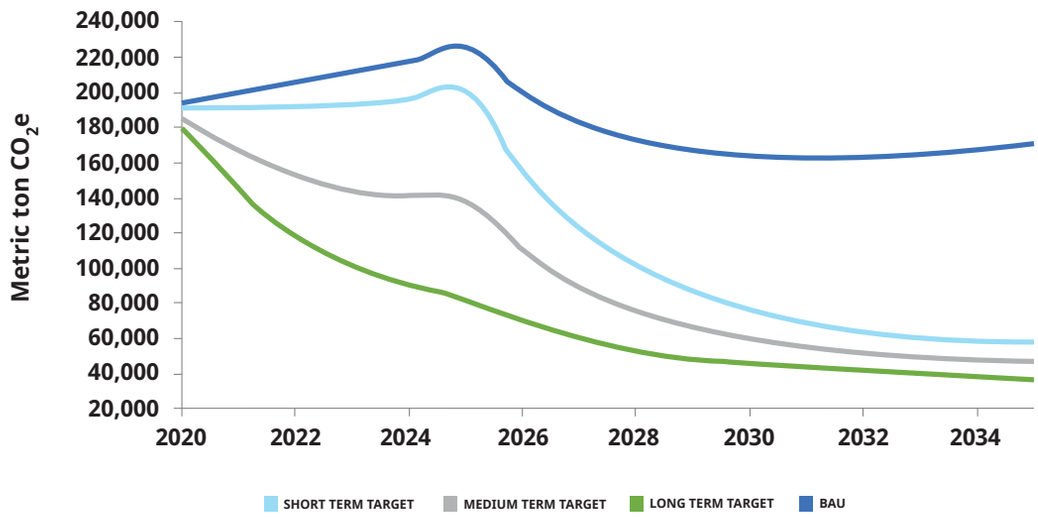


Kathmandu Metropolitan City:

Under the BAU scenario CO_2e emissions are valued at 193,312 MT, 224,534 MT, 163576 MT and 171,000 MT in 2020, 2025, 2030 and 2035 respectively. Under the short-term scenario, the emission is projected to be 200,837 MT in 2025 which is reduced by 10.55% in comparison to the BAU scenario. Likewise, under the BAU scenario in 2030, CO_2e emission is projected to be at 163,576 MT and is reduced to 59,469 MT in given scenario as of mid-term. It shows that in 2030, CO_2e emissions will decrease by 63.64%

in comparison to the BAU scenario. Similarly, the emission under the BAU scenario in 2035 stands at 171,000 MT and in the long-term scenario reach 36,765 MT which represents 78.5% reduction in, CO_2e emissions. Figure 63 below gives a clear estimation.

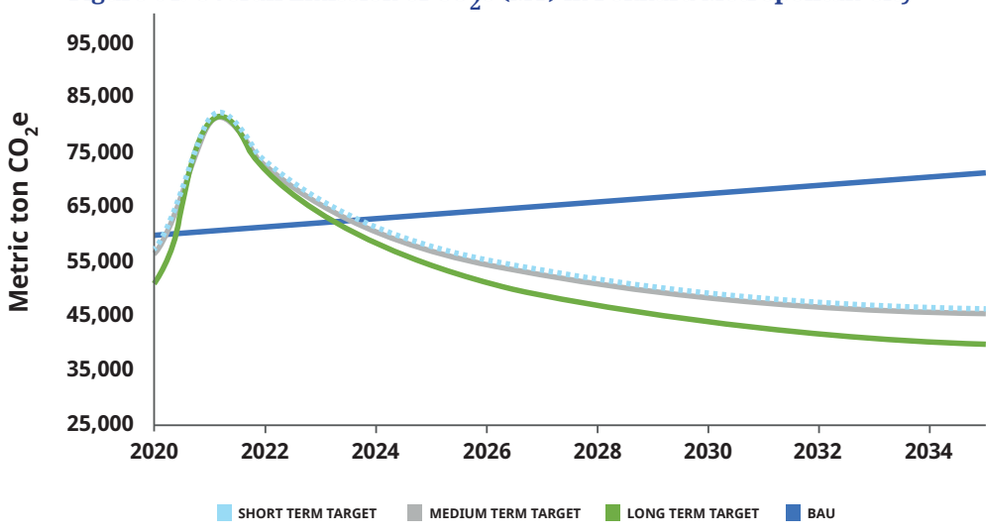
Figure 63. Overall Emission of CO_2e (MT) in Kathmandu Metropolitan City



Pokhara Metropolitan City:

In 2020 the CO_2e emissions is recorded at 59,901 MT as shown in Figure 64. However, from 2020 to 2023 you see that CO_2e emissions has increased to 81,240 MT. This is because food waste that constitutes of 47% is directly sent to the piggery to feed the pigs and SWEET is not programmed to record this activity thus this 47% remains in the treatment options. As a result, increasing the emission to 81,240 MT. Nevertheless, by the end of 2025, CO_2e emissions is valued at 57,431 MT which denotes a reduction of emission by 9.94%. With further advancement in waste management in 2030, CO_2e emissions will reduce by 28.52% as compared to the BAU scenario. Likewise, in 2035 the emission under the BAU scenario stands at 71,509 MT and in the long-term scenario the CO_2e emissions reach 39,955 MT which represents a reduction by 44.13%.

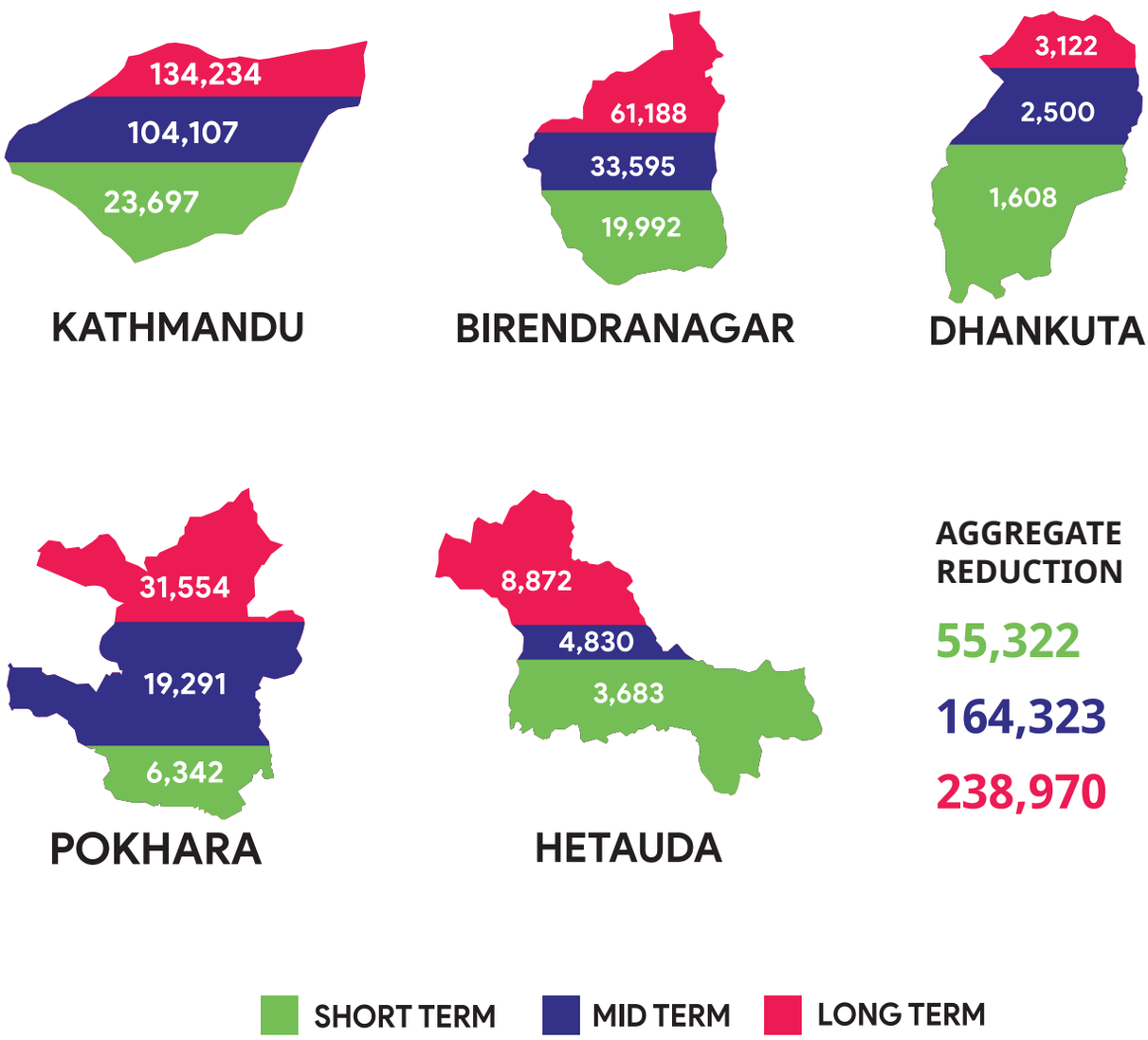
Figure 64. Overall Emission of CO_2e (MT) in Pokhara Metropolitan City



Total Emissions of CO_2e Reduction on Improvement Scenarios

The strict implementation of the NNIWMS (2020-2035) action plan in the five municipalities will bring about an estimated reduction of CO_2e emission of 238,970 MT. The short-term reduction at 55,322 MT, the mid-term at 164,323 MT and the long term at 238,970 MT. Kathmandu will achieve highest emission reduction which cumulates to 56.2% of the total emission reduction followed by Birendranagar with 25.6% reduction, Pokhara by 13.2%, Hetauda by 3.7% and Dhankuta by 1.3% CO_2e emission reduction.

Figure 65. CO_2e emission reduction from 5 municipalities in 3 scenarios (MT)



Emissions of CO_2e Based on Waste Management by Sources

The highest fraction of emission is triggered from waste thrown in the landfill and dumpsite (67.4%), followed by practice of open burning (13.4%), waste collection and transportation (12.7%), waste handling (6.4%) and organic management (0.1%). Table 19 next page presents detail of the emission of CO_2e based on waste management by sources.

The table clearly identifies Birendranagar and Hetauda having a significant CO_2 emission from waste burning. On the other hand, Kathmandu Metropolitan city has the highest emission from the landfill site followed by waste handling equipment's and waste burning. In Pokhara, the SLCP emission is largely caused from waste collection and transport, and waste burning. On a positive note the waste management of Dhankuta Municipality is found more progressive than the other four municipalities.

Table 19. Total CO_2e emission by sources

Year	Emission by Source (metric tons)								
	CO_2e Emissions					PM10	SOx	PM2.5	CH_4
	Collection Transport	Waste Burning	Landfill Dumpsite	Organic management	Waste handling equipment				
Birendranagar Municipality									
2020: BAU	916	20,571	647	5	448	145	6	120	1,778
2025: Short term	735	10,500	221	34	519	1	3	1	831
2030: Mid term	554	9,490	105	285	526	1	3	1	909
2035: Long term	361	459	61	265	908	1	1	1	352
Dhankuta Municipality									
2020: BAU	162	240	3,092	191	605	1	0	2	3,297
2025: Short term	170	168	1,632	429	164	0	0	0	2,070
2030: Mid term	179	89	954	442	125	0	0	0	1,401
2035: Long term	125	94	616	465	82	0	0	0	1,085
Hetauda Sub-metropolitan									
2020: BAU	177	9,723	3,005	119	698	41	2	34	3,434
2025: Short term	154	5,722	1,356	440	302	0	1	0	1,978
2030: Mid term	164	4,060	778	516	128	0	1	0	1,423
2035: Long term	135	435	499	603	72	0	0	0	1,116
Kathmandu Metropolitan									
2020: BAU	3,837	7,942	166,483	-	15,050	74	13	64	166,927
2025: Short term	4,145	9,207	172,298	1,456	13,732	17	13	16	174,264
2030: Mid term	4,805	6,497	33,750	6,380	8,037	10	8	10	40,489
2035: Long term	2,726	3,766	15,414	11,567	3,292	4	4	4	27,189
Pokhara Metropolitan									
2020: BAU	32,249	829	24,877	37	1,910	11	3	15	25,003
2025: Short term	30,967	698	23,775	164	1,827	10	3	9	23,981
2030: Mid term	32,498	553	13,349	292	1,670	9	3	9	13,676
2035: Long term	27,769	580	9,701	433	1,473	8	3	8	10,169

Comparison of the emission with national reports

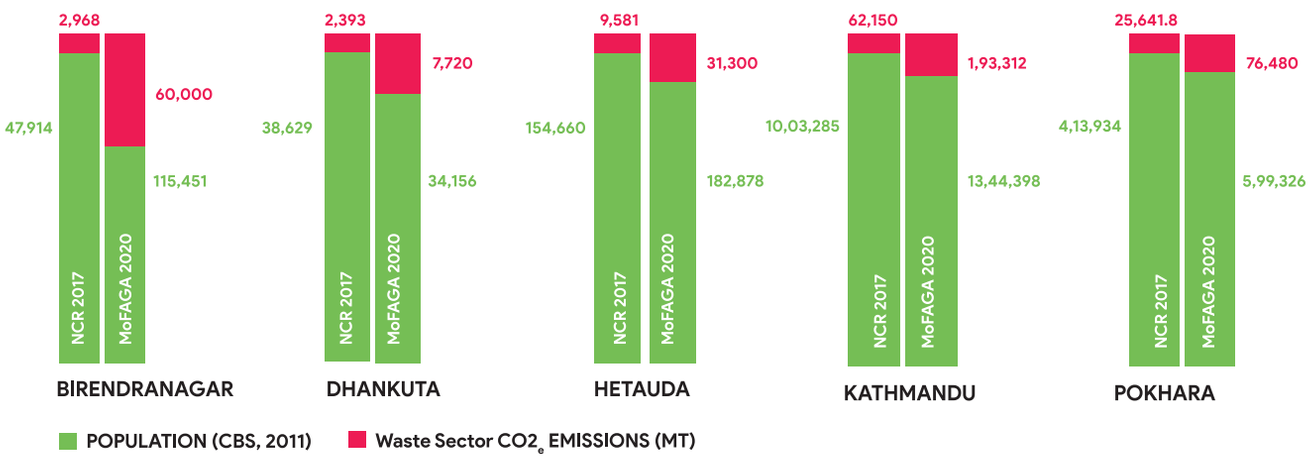
The Third National Communication Report (2017) of the Government of Nepal records the solid waste management emissions at 278.76 Metric Gg of CO_2e (data from 2011). The report took into account the overall national urban population emissions from landfill sites which was 4.5 Million in 2011.

Based on this report the CO_2e emission of Kathmandu is measured at 62,150 MT in 2011 with population recorded at 1,003,285 as per the CBS census 2011. In comparison, the SWEET estimates CO_2e emissions at 193,312 MT for 2020 with projected population at 1,344,398.

Likewise, Pokhara records CO_2e emission at 76,480 MT based on the projected population of 599,326 (2020) in contrast to emission measured at 25,641.80 MT with 413,034 as its population. Birendranagar CO_2e emission is recorded at 60,000 MT, Dhankuta at 7,720 MT and Hetauda at 31,300 MT for the year 2020. All the municipalities in 2020 has measured significantly higher emission than the 2011 data from the Third National Communication Report (2017). Kathmandu city with the highest emissions at 193,312 MT, followed by Pokhara at 76,480 MT, Birendranagar at 60,000 MT, Hetauda at 31,300 MT and Dhankuta at 7,720 MT respectively.

The higher emissions from the SWEET tool analysis could be due to more detailed and wider approach of emissions taken into account by SWEET tool as well as the population growth within the nine years including differences in data calculations and recording.

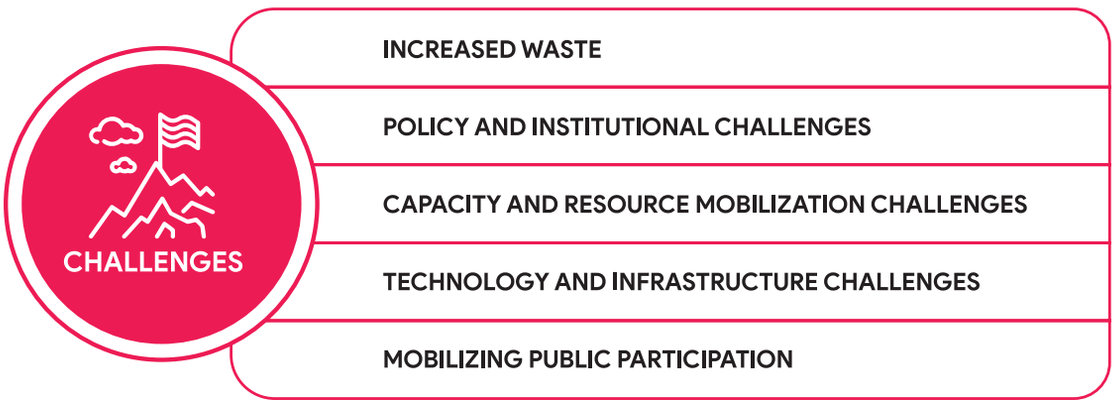
Figure 66. Comparison Chart



Challenges and Possibilities in MSW Management

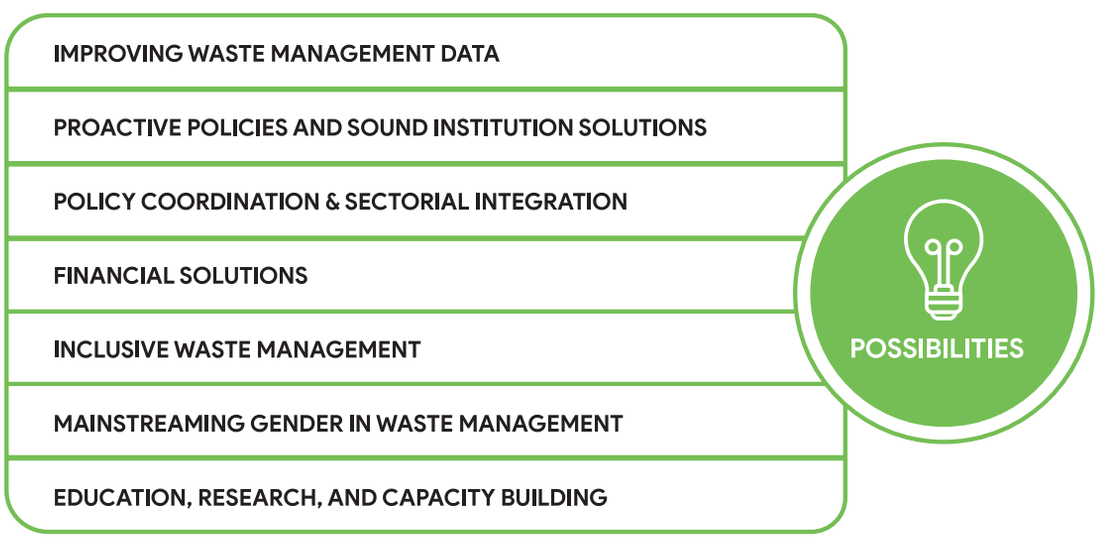
This section summarizes key challenges and possibilities in MSW management. The findings are drawn from the situation analyses presented in Chapters 3 and 4. Key informant interview was conducted engaging the policymaker at the central, provincial, and local level, business sectors, investors, researchers, and other actors involved in Nepal's waste management.

Challenges



Possibilities

Amidst multiple challenges, there is also the opportunity to achieve sustainable waste management through careful planning, developing and enforcing policy environment. Investing in ESTs for waste treatment and recovery, mobilizing financial resources, building capacity and encouraging public participation in waste management are other opportunities as well. For these opportunities to materialize, few fundamentals, however, needs to be in place:



04 CHAPTER WASTE GOVERNANCE

Institutional Arrangements

Political and economic context:

Nepal has undergone turbulent political changes in the last three decades, including a decade-long armed struggle (1996-2006) and 7 constitutions in the last 70 years. On 20 September 2015, the newly adopted constitution transformed Nepal into a federal democratic republic with three government tiers: central (federal), provincial (7) and local (753). Each tier has legislative, executive, and judicial functions and authority under exclusive and shared jurisdictions. Government in all three tiers were formed in early 2018 following the election in 2017.

The National Planning Commission (NPC), Ministry of Finance (MOF), and sector ministries are responsible for developing national plans. The government development strategy is outlined in the Fifteenth Five Year Plan (FY 2020-FY 2025).

Institutional arrangement in the federal structure:

Most sector ministries and departments at the federal level have been downsized or restructured and several functions have been devolved to subnational governments (SNGs or local government). The function of the local government has been affected by the lack of human resources and low capacity of several staff members. This points towards the need for institutional development and strengthening of the local government and public institutes as a key reform priority for the effective and efficient implementation of federalism.

National level institutions in the Waste Sector

The Constitution of Nepal 2015 authorizes local government to ensure basic health and sanitation services to the public and formulate local level development plans and project. Based on the constitution, the Local Government Operation Act 2017 and the Solid Waste Management Act 2011 obliges the local municipalities to provide waste management services. The direct responsibilities of waste management services falls under the purview of the local authorities. The institutions at national level guide the overall policy for waste management. This institutional arrangement for waste management at the federal, provincial and local level is shown in Figure 67 in the following page.

Ministries and Institutional Arrangements

Waste with its numerous streams is a crosscutting issue within several line ministries. They are the Ministry of Forestry and Environment (MoFE), Ministry of Urban Development (MoUD), Ministry of Health and Population (MoHP), Ministry of Industry, Commerce and Supplies (MoICS), and the Ministry of Agriculture Land Management and Cooperatives (MoALMC). They all have some roles in the waste management sector. Table 20 summarizes the specific roles and responsibilities of these line agencies in the context of waste management.

Figure 67. Institutional arrangement for waste management at the federal, provincial and local level

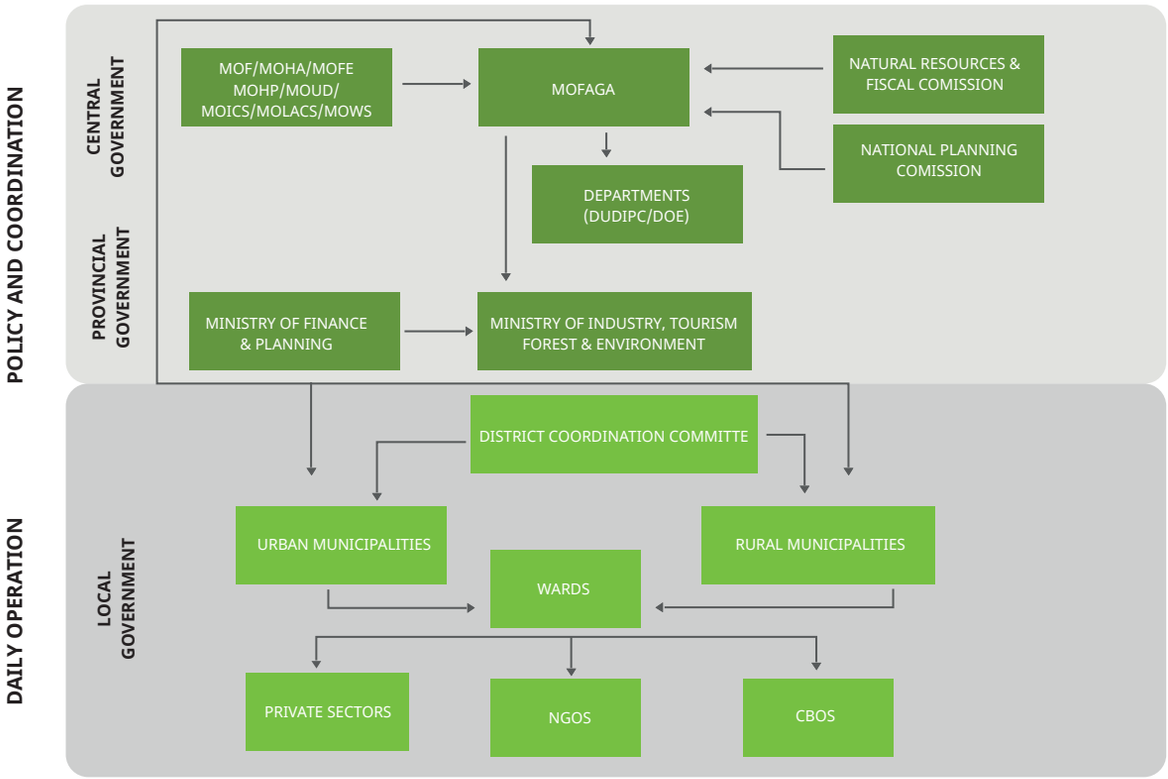


Table 20. Role of line agencies in policymaking and coordination in waste sector

Ministries and Institutions	Specific Roles and Responsibilities in Waste Management
National Planning Commission	A planning body appointed by the Cabinet to formulate national vision, periodic plans and develop policies. It provides a framework for policy for all sectors and serves as a central agency for monitoring and evaluating development plans, policies and programs.
Ministry of Federal Affairs General Administration (MoFAGA)	MoFAGA is the ministry of Nepal accredited with the role of coordination, cooperation, facilitation and monitoring and evaluation of programs at the local government. It also formulates, implements and reviews policies and programs for recruitment, placement, promotions, salary, and disciplinary action of civil servants. It is the only ministry with direct linkage with the country's local governments, namely the municipalities, rural municipalities and the provinces related to federalism issues.
Solid Waste Management Council (Constituted under Article 23, SWM Act 2011)	The Solid Waste Management Council offers technical advice on solid waste management issues. The main responsibility of the Council is to; a) formulate a national policy on the management of solid waste and to submit for approval of the Government of Nepal. b) To make policy arrangements among the concerned agencies for coordination. c) To approve a standard for fixing service charges for maintaining uniformity, while fixing service charges by the Local Body. d) To determine a percentage of the investment if any, investment is needed to be made by the Local Body for the proposal of the solid waste management works in an integrated manner. e) To perform other functions as prescribed.
Ministry of Forest and Environment (MoFE)	MOEF is responsible for developing and regulating the pollution control standards at the national level.
Ministry of Urban Development (MoUD)	Responsible for urban development affairs including waste management.

Ministries and Institutions	Specific Roles and Responsibilities in Waste Management
Ministry of Health and Population MoHP	According to SWM Act 2011, health care institutions are solely responsible and accountable for the waste management within their institution. MOHP plays a role to develop guidelines for the healthcare waste management and regulate the healthcare institutions on waste management.
Ministry of Industry Commerce and Supplies (MoICS)	In line with the standards developed by the MOFE, the MOICS regulates the industries and industrial waste.
Ministry of Agriculture, Land Management and Cooperatives (MoALMC)	MOALMC is the focal ministry for managing agricultural waste. However, until now no database on agricultural waste has been generated.
Ministry of Finance (MOF)	National financial manager, with oversight of revenues and expenditures, budget preparation and responsibility for maintaining a stable economy. Mobilizing and allocating resources, managing public investments and expenditures and strengthening the productive capacity of public enterprises.

Provincial Level Institutions

The Constitution of Nepal adopted in 2015 affirms Nepal as a secular federal republic that is divided into seven provinces. Each province is composed of 8 to 14 districts. The districts, in turn, comprise of local units known as urban and rural municipalities.

The local governments enjoy executive and legislative as well as limited judicial powers in their local jurisdiction. The local and provincial governments exercise absolute power but some role is shared with provincial and federal governments as stipulated in the Constitution of Nepal. The laws enacted by local governments may not contradict existing laws at the provincial and federal levels or the national constitution. Similarly, the provincial legislature may not enact laws contradicting federal laws or the national constitution. The district coordination committee, a committee composed of all elected officials from the local governments in the district, has a very limited role.

District Coordination Committee

The District Coordination Committee is currently solely authorized to conduct monitoring and coordination between the municipalities with MoFAGA as the Lead Agent. The representative will be an elected body under the umbrella of MoFAGA.

Local-level institutions: Municipality

The municipal is responsible for the overall management of waste in their jurisdictions while the central and provincial governments look into policy and coordination affairs. The municipalities are divided into urban and rural municipalities.

Urban municipalities are further categorized into different levels, a) Metropolitan city (Mahanagarpalika) b) Sub metropolitan city (Upmahanagarpalika) and c) Municipality (Nagarpalika). There are six metropolitan cities, 11 sub-metropolitan cities and 276 municipalities in Nepal.

Rural municipalities (gaunpalikas) were established in 2017, replacing the village development committees. The role and responsibilities of the rural municipalities resembles that of a village development committee, but it has more rights on the collection of royalty and taxes and has a higher annual budget than the VDC. Several VDCs were combined into a new rural municipality. There are 460 rural municipalities

in Nepal and each local unit is composed of wards. There are 6,743 wards in total.

During the baseline survey, it was revealed that most of the municipalities do not have a separate waste management division or unit. Therefore, budget for waste management activities were obtained from the environment, social welfare or the urban development budget. For example, in Birendranagar the administrative structure has nine divisions/ sections and 27 sub-sections, but none overseeing waste management. The budget for waste management activities are extracted from the budget line of the Department of Environment or Social Welfare budget. Therefore, to prioritize waste management, a dedicated Integrated Waste Management division or section has to be established which will give valid justification for a separate budget code on waste management.

Non-government actors/institutions

At the local level, NGOs, CBOs, private companies, and informal waste collectors, scrap dealers and the community are an integral part of the waste management system. They are involved in different aspects of waste management from a lobbyist to collaborator, to change agent, educator, regulatory and policy implementer.

Policy and Regulatory Framework

Waste and climate-related policy and regulatory framework in Nepal can be broadly categorized into six categories: a) set of fundamental principles according to which a state is governed, b) waste management related frameworks c) climate change-related policies, d) generic environmental protection frameworks, and e) multilateral environmental agreements (MEAs) and international commitments guiding towards a better environment.

Table 21. Policy and Regulatory Framework

A	State Governance Frameworks	Constitution of Nepal, 2015 Fifteenth Five-Year Plan (2019-2023) Local Government Operation Act, 2017
B	Waste Management Related Act, Policies and Legislations	Solid Waste Management Act, 2011 Health Care Waste Management Guideline, 2002 Circular on plastic bag ban, 2016
C	Climate change related policy frameworks	Climate Change Policy, 2019 Nepal's Nationally Determined Contribution, 2016
D	General Environmental Frameworks	Environmental Protection Act, 1996 and Environmental Protection Rule, 1997 Environmentally Friendly Local Governance Framework, 2013
E	International Commitments	Rotterdam Convention in the Prior Informed Consent Procedures for Certain Chemicals and hazardous Pesticides in International Trade Stockholm Convention on Persistent Organic Pollutants (POPs) Minamata Convention on Mercury
F	SDGs	All 17 SDGs are directly or indirectly relevant to waste management based on the 3 R principles, livelihood, protection of soil, waste, air and living mammals, poverty alleviation, social inclusion, circular economy and so on.

05 CHAPTER NEPAL NATIONAL INTEGRATED WASTE MANAGEMENT STRATEGY (2020-2035)

Moving Forward

The purpose of the NNIWMS is to chart a way towards achieving an improved integrated waste management system, towards zero waste by 2035. The vision, targets, strategies, and objectives set in this Strategy document reflects the respect for the holistic nature of waste management. It advocates that the integrated solid waste management should be approached within the broader context of resource conservation, environmental protection, health, sustainable development, green economy, green growth, and social inclusion and equity. The strategic direction taken in this document is to prevent waste generation, increase waste recovery, reduce waste disposal in landfills, and to reduce GHG emissions from the waste sector through waste management improvements.

Vision

Ensuring sustainable waste management service to all citizens by minimizing waste generation, introducing source segregation, extending sound waste collection service, eliminating uncontrolled disposal and open burning of waste. Simultaneously, promoting environmentally sound and cost-effective technology and solutions for material and energy recovery, and sound disposal of residual waste, aiming towards zero waste.

Targets

Defining objectives is an important focus for the implementation of the Strategy. At this stage, however, it is not possible to set the exact targets in terms of waste quantities. Nevertheless, some indicative milestones are set as a considerable step in the transition towards zero waste society building on the principles of a circular economy, environmental protection and gender sound livelihood opportunities.

These ambitious municipality wide targets for 2035 are comparable with the findings from 2018 & 2019 baseline assessment across 7 provinces of Nepal. These targets will be tracked and revised, if needed, over different phases of the Strategy implementation period of 15 years.

- NNIWMS to be endorsed by the Government by the end of 2020.
- E-Waste law will be introduced and endorsed by the Government by the end of 2022.
- Infrastructure for an Integrated Resources Recovery Center (IRRC) will be established gradually in the three phases short, mid and long term with a decentralized and combined approach.
- Regular and effective waste collection services access increased to 80% by 2035.
- Reduction in the waste generation (per capita and total waste) by at least 20% by 2035.
- Upscale dry waste Recycling and Reuse by 37.60 % by 2035.
- Increase Anaerobic Digestion of waste by 18%.

- Upscale composting of waste by 14% by 2035.
- Upscale waste combustion by 10.40% by 2035.
- Open and uncontrolled dumping and burning of waste banned completely by 2035.
- The percentage of waste diverted from the landfill to be 80% by 2035.
- GHG emissions from the waste sector reduced by 60% as compared to the 2035.
- Achieve 50% representation of females in business and decision-making by 2035.
- 80% of the population aware of sound waste management practices.

Guiding Principles

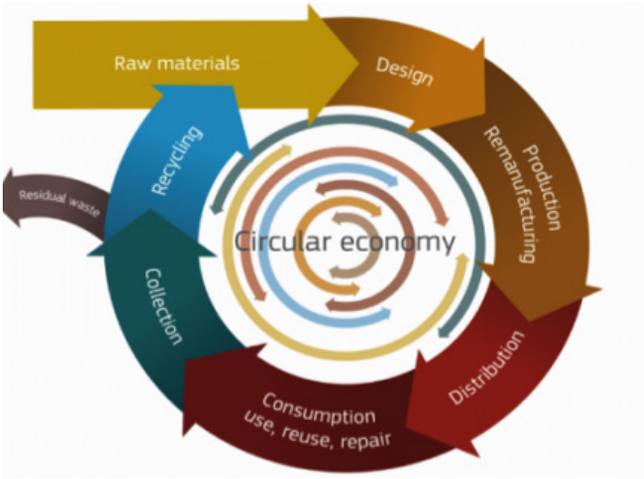
The strategies and action plans towards zero waste are based on the following guiding principles.

• Waste Hierarchy

The Waste Hierarchy is a strategic tool for addressing waste management value chain through three stages of waste management, where the first R stands for reduce, second for Reuse and the third R for recycling.

• Circular Economy

Circular Economy is how can we make the whole lifecycle more efficient, reduce our production and consumption levels and bring some of the generated waste back into the life cycle? Thus, more material can "be kept" in the circle of production and consumption.



The circular economy is a key pathway for sustainable development: A circular economy action plan will be instrumental in reaching Sustainable Development Goals'. Particularly, it will contribute to lowering resource demands, thereby increasing resource security and lowering pressures on the environment domestically and global. It will help Nepal toward transforming their economies toward circularity, such as material footprints, municipal waste generation per capita and progress toward circular economy targets. Businesses will instrument behind circular economy from the design stage to enabling re-use / re-manufacturing / recycling and raising the durability of goods for keeping within the economy longer. Remanufacturing and recycling are key business operations critical to scaling up the circular economy.

• Multi-sectorial approach and shared responsibility

Waste management and pollution control approaches shall involve multiple sectors (such as climate change, biodiversity, health, tourism, agriculture etc.) to improve the success and effectiveness of interventions. Hence, effective waste management is a shared responsibility and requires partnerships and collaborations between all sectors of government, industry, research institutions, NGOs, and the general community.

• Polluter pay principle/extended producer responsibility

All elements of the society (both producer and consumer) are fundamentally responsible for waste management. Those who generate waste must bear the cost of waste management, i.e. Polluter pays principle ensuring that 'whoever is responsible for damage to the environment should bear the costs associated with it.' The extended producer responsibility is a practice and a policy approach in which producers take responsibility for management of the disposal of products they produce once consumers designate those products as no longer useful.

• Continuous Improvement

This will be an ongoing effort to improve by continuously re-evaluating and improving products, services and implementation.

Scope of the Strategy

The main objective of the 15-year Nepal National Integrated Waste Management Strategy is to ensure that waste management becomes one of the main priorities of the municipalities and the national government. The main purpose of the strategy document is to minimize the generation of waste and the amount of waste being transported to the landfill. Also maximizing the recovery of resources and improving the management of residual waste using environmentally sound techniques. The strategy document covers the municipal solid waste from households, commercial and institutes. In terms of geographical coverage, the scope of proposed strategic frameworks and actions covers the whole of Nepal.

Timeframe of the Strategy

This Strategy covers 15 years commencing from 2020 to 2035, spread across three phases: Short term (2020-2025), Medium-term (2025-2030), and Long term (2030-2035).

Phase I: Short term (2020-2025): The institutional arrangements and legal frameworks should be completed by then to establish a strong foundation for effective planning, strict implementation mechanism and effective monitoring systems. During this period, the Strategy document will be endorsed and communicated to all relevant line agencies and partners. Capacity building, public awareness on waste minimization, source segregation will be advocated. Phase I will also provide all the municipalities with time to prepare a detailed implementation plan with defined interventions involving infrastructure planning, fund sourcing, promoting inclusive participation and capacity building. During this phase, the Solid Liquid & Resource Management (SLRM) concept will be fine-tuned into the Nepal context and interpreted into Integrated Resource Recovery Center (IRRC) and will be applied in 20% of the municipality and a learning center for IRRC will be established.

Phase II: Medium-term (2025-2030): The second phase will implement the IRRC to 32% of the remaining population including an E-Waste and C & D Resource Centre. Capacity building and public awareness will continue and infrastructure on waste recycling facilities will be enhanced. During this phase, there will be an evaluation of the impact of GHG and SLCP based on improvements made in the waste sector. Further, a mid-term review of the Strategy is recommended.

Phase III: Long term (2030-2035): The third phase will continue the implementation of the remaining action plans on waste management and achieve the set targets. The recommendations from the mid-term review in Phase II will also be incorporated and acted upon during this phase. Further, a team will evaluate and monitor the strategy implementation from 2020-2035 and prepare a final report with recommendations.

06
CHAPTER

STRATEGY OBJECTIVES AND ACTION PLAN

Setting the objectives and action plan

The NNIWMS 2020-2035 is to forge a clear path to meet integrated waste management needs. The development and implementation of this strategy is thus aligned with relevant national and international environmental frameworks, policies, laws, strategies, and programmes that include issues and concerns of the waste sector, in particular, the National Environment Policy 2019, Waste Management Act 2011, Nepal's Intended Nationally Determined Contributions to Climate Commitments and the Sustainable Development Goals.

While setting the objectives all avenue for sound waste management was explored and debated thoroughly some of which were the pursuit of sustainability, economic efficiency, environment protection, economic growth, safety, health, equity and social inclusion amongst others.

The six Objectives given below specify the directions for improvements of sound waste management in Nepal and the targets indicates the desired outcome that support achievement of the set objectives. The six objectives have direct or indirect association with all the targets set in page 61. For example, the target for endorsement of the strategy and action plan and enacting a legislation on E-Waste is the direct outcome of the objective 1 and 2 stated below. Simultaneously, it also has nexuses with the rest of targets and objectives since without a strong policy and legal framework the implementation would be unsuccessful or weak.

Another case for example objective 4: mitigate climate change through improved waste management is directly linked to the target of diverting 80% waste from the landfill including reducing, reuse and recycling of waste and also the reduction of GHG by 60%. Given that the national waste composition which stands at 53% wet and 47% dry waste so has the targets for treatment options been categorized. For example, the target for diversion to anaerobic digestion is set for 18%, composting by 14% and waste combustion by 10.40%. This will divert 42.40% wet or organic waste from the landfill while converting waste into energy and resources. At the same time from the total volume of 47% of dry waste, 37.60% will be segregated, treated and sold to wholesale market or private companies. These entire processes of reuse, reduce and recycling of wet and dry waste will save energy, save resources, protect the environment and save natural reserves. This will facilitate moving towards a circular economy which aims to keep products, equipment and infrastructure in use for longer and improve the productivity of these resources. Further we must bear in mind that for every ton of household waste double the amount of manufacturing waste is created - mining, petrochemical production, etc.

Strategy Objectives

1. Strengthen Institutional & Organizational Framework to Deliver IWM Actions
2. Ensure Effective Policy and Legislation and Enforcement
3. Ensure Sustainable Financing Mechanism
4. Mitigate Climate Change Through Improved Waste Management
5. Promote Social Justice and Equity
6. Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Building and Transparency in integrated waste management

Strengthen Institutional & Organizational Framework to Deliver IWM Actions

Under the current federal and local government system, a clear institutional and organizational framework for integrated waste management is the most necessary element. This is especially due to changes in the structure, for example, the dissolved Solid Waste Management Technical Support Centre (SWMTSC) at the Federal level, the announcement of numerous new municipalities and the increased responsibilities of the local government.

The administrative national structure of Nepal does not have a dedicated Department for ISWM. Further, at the province and municipal level, this clear structure for waste management is also missing. Most of the waste management functions are either implemented from within the environment and forest division or social welfare division. Therefore, to ensure sound waste management an IWM department, divisions and sections at all level has to be created. Clear roles and responsibilities with direct budget line under IWM have to be ensured. These actions will validate national commitments towards the National Environment Policy 2019, Waste Management Act 2011, Nepal's Intended Nationally Determined Contributions to Climate Commitments and the Sustainable Development Goals.

Waste with its many streams makes it a common concern for different line ministries, divisions, sectors and sub-sectors. The impact of sound waste management influences the activities of different sectors within the line ministries/departments toward the protection of individuals and the ecosystem. Therefore, there is a need to have an IWM section in the different sectorial function within the line ministries and the provincial and the municipalities. Frequent meetings to share and plan joint activities will help coordination, reduce duplication of work and promote budget efficiency. Therefore, the waste stream management calls for institutional and budget streamlining for sound waste management initiatives.

Given the high vulnerability and probability for natural disasters in Nepal, this strategy also draws our attention to Disaster Waste Management (DWM). The DWM preparedness and contingency plan, which is based on a sound analysis of risk in a specific context, reflect the nature of the hazards or threats, as well as the vulnerabilities and capacities in a particular context. Scenario planning for the DWM contingency planning will look at a full range of possible hazardous events and then try to prioritize those most relevant to the risk profile of the area. When developing scenarios an honest analysis of previous disasters will be taken into account to assess current levels of risk. Projections of the likely humanitarian implications of a particular hazard/threat within a particular risk context will then be developed.

Identifying focal point and specifying clear roles and responsibilities is important at both the provincial and municipal level. Besides these designated focal points it is important to allocate focal points within the wards and toles structure from within the community, as they are the first to respond. Also, periodic simulation preparedness exercise is of importance.

Objective 1: Strengthen Institutional & Organizational Framework

Action Plans

1.1 Endorse the Nepal National Integrated Waste Management Strategy & Action Plan
1.2 Establish an NNIWM department and sections at the national, provincial and municipal level.
1.3 Establish linkages between institutions for effective coordination and delivery of the assigned role and responsibility.
1.4 Secure sufficient human resources based on inclusive participation with professional skills.

Ensure Effective Policy, Legislation and Enforcement

Practical, effective and executable policy and legislation is critical to support integrated waste management activities. These include identifying policy gaps, reviewing and harmonizing the overlapping and contradicting provisions in different laws, and finding a complementation of policies and initiatives in the waste management sector. The strategy also suggests enacting laws and policy for E-Waste and Chemical waste and to develop guidelines for its safe treatment.

Objective 2: Ensure Effective Policy and Legislative Framework & its Enforcement

Action Plans

2.1 Develop/Amend the SWM acts 2011 and policies mainstreaming Gender and Disaster Waste with a strong enforcement mechanism.
2.2 Develop E-Waste, Medical Waste and Chemical Waste legislation.
2.3 Develop hazardous waste handling policy and guidelines.
2.4 Integrate and harmonize W.M policies and concerns into other sectoral policies (health, WASH, agriculture, industry etc.)

Ensure Sustainable Financial Mechanism

Solid waste management is an increasing challenge for national and local governments. It is an expensive activity, and underfunded. Until now it has been looked upon as an expenditure incurred rather than a resource management activity. The strategies suggested below considers waste as a resource and suggest identifying and accessing new and innovative sources of resource management towards a more self-sustaining programme.

Objective 3: Ensure Sustainable Financial Mechanism

Action Plans

3.1 Make sound financial commitments at the National, Provincial and Municipality level towards waste management at all levels.
3.2 Make WM systems and programs financially effective and self-sustaining.
3.3 Enhance W.M financing options by encouraging public-private and corporate partnership in financing the W.M facilities and programmes.
3.4 Maximize W.M funding opportunities using existing and new innovative sources.

Mitigate Climate Change Though Improved Waste Management

The Climate Change impacts from the waste sector is linked to its entire value chain, from the minimization, production, consumption, post-consumer, waste transportation, handling, treatment, recovery and disposal. Reducing the amount of waste at the source is the first driver towards mitigating GHG and SLCPs. It may involve the Eco-design of products/cleaner production at the manufacturing stage, or sustainable consumption choices promoting the products that generate the least waste. Recycling is the second main driver for reducing emissions in the waste sector, as it avoids the use of virgin materials, as well as diverts a flow of waste away from landfill and incineration. The strategies and actions mentioned here thus include emission reductions through resource-efficient, cleaner and sustainable production, responsible consumption, waste reduction, waste segregation at source, using environmentally friendly technologies for waste transportation & handling, recycling, composting, energy recovery, and scientific management of final disposal sites, which are the pathway to attain an improved state of Integrated Waste Management.

Objective 4: Mitigate Climate Change Impact through Improved WM

Action Plans

4.1 Mitigating climate change by ensuring effective waste minimization interventions
4.2 Mitigating climate change by developing waste MIS for cost-benefit analyses and tracking of GHG mitigation.
4.3 Mitigating climate change by improving and expanding the waste collection with priority to environmentally friendly technologies.
4.4 Mitigating climate change by institutionalizing source segregation.
4.5 Mitigating climate change by developing an action plan for sound legacy waste management.
4.6 Mitigate climate change through resource recovery & establishing recycling educational park.
4.7 Mitigate SLCP through scientific management of disposal sites.
4.8 Mitigate climate change by creating, communicating and establishing a strong link between WCC.

Promote Social Justice and Equity of WM

Integrated Waste Management is based not only on the waste hierarchy and on using the 3Rs, but also built upon the principle of Social Equity, i.e., allocation of resources, services and opportunity to all segments of the population "Leaving no one behind."

This strategy embraces gender-sensitive approaches that can increase project effectiveness and ensure equitable access to livelihoods, resources or benefits. Beside gender, there are other factors too which cause particular groups of people to be in a disadvantaged position in society. Such factors include age, membership in a specific social group, religion, profession and caste. The informal sectors fall under this category, although they contribute positively to recycling and diverting waste from the landfill sites. Therefore, these social groups may be caught in a vicious circle which can either be deepened or broken by external intervention. Thus, there is immense scope for the NNIWMS to bring about positive changes to this circle.

Objective 5: Promote Social Justice and Equity of Waste Management

Action Plans

5.1 Ensure gender and social groups are mainstreamed in all waste management activities.
5.2 Improve the conditions of the informal waste sector, recognize and build a mutually beneficial partnership.
5.3 Protect the health and safety of the waste management workers.

Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Building and Transparency in IWM

Creating behavioral change through improved perceptions, attitudes and performance is essential in achieving the goals set in these strategy documents. Sensitizing the communities is also effective in encouraging advocacy by the communities themselves for improved waste management in their localities. Similarly communicating with political, religious, clubs and societies is equally important to secure political commitments. Capacitating the communities through various capacity building activities should be an integral part of the communication, awareness and advocacy strategies. Last but not the least a strong monitoring and evaluation framework is important for making informed decisions as well as to examine the relevance, effectiveness, efficiency and impact of activities in the light of specified objectives.

Objective 6: Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Development and Transparency in IWM

Actions Plans

6.1 Develop an integrated waste management communication, advocacy, and awareness strategy and plans.
6.2 Conduct research for evidence-based interventions on new waste streams linking to GHG and SLCP emission.
6.3 Mobilize public and build effective partnerships for integrated waste management.
6.4 Enhance the capacity of the lead waste management entities.
6.5 Develop and Implement a Monitoring and Evaluation Framework.

Figure 68. Nepal National Roadmap towards Zero-Waste

Vision

Ensuring sustainable waste managemnet service to all citizens through minimizing waste generation, waste segregation at source, sound waste collection service, eliminating uncontrolled disposal and open burning of waste, promote environmentally sound and cost effective technology and solutions for material and energy recovery, and sound disposal of residual waste, aiming towards zero waste and a resource circular society.

Guiding Principles

- Waste Hierarchy
- Circular Economy
- Multi-stakeholder approach and Sharing Responsibility
- Polluter pays principle/extended producer responsibility
- Continuous Improvement

Strategic Objectives (SO)

1. Strengthen Institutional & Organizational Framework to Deliver NIWM Actions
2. Ensure Effective Policy and Legislation and Enforcement
3. Ensure Sustainable Financing Mechanism
4. Mitigate Climate Change Through Improved Waste Management
5. Promote Social Justice and Equity
6. Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Building and Transparency in integrated waste management.

SO 1. Strengthen Institutional & Organizational Framework

Action Plan 1
1.1 Endorse the Nepal National Integrated Waste Management Strategy & Action Plan
1.2 Establish an NNIWM department and sections at the national, provincial and municipal level.
1.3 Establish linkages between institutions for effective coordination and delivery of the assigned role and responsibility.
1.4 Secure sufficient human resources based on inclusive participation with professional skills.

SO 2. Ensure Effective Policy, Legislation and Enforcement

Action Plan 2
2.1. Develop/Amend the SWM acts 2011 and policies mainstreaming Gender and Disaster Waste with a strong enforcement mechanism.
2.2. Develop E-Waste, Medical Waste and Chemical Waste legislation.
2.3. Develop hazardous waste handling policy and guidelines.
2.4. Integrate and harmonize W.M policies and concerns into other sectoral policies (health, WASH, agriculture, industry etc.)

SO 3. Ensure Sustainable Financial Mechanism

Acton Plan 3
3.1 Make sound financial commitments at the National, Provincial and Municipality level towards waste management at all levels.
3.2. Make WM systems and programs financially effective and self-sustaining.
3.3. Enhance W.M financing options by encouraging public-private and corporate partnership in financing the W.M facilities and programmes.
3.4. Maximize W.M funding opportunities using existing and new innovative sources.

SO 4. Mitigate Climate Change through Improved Waste Management

Action Plan 4
4.1. Mitigating climate change by ensuring effective waste minimization interventions.
4.2. Mitigating climate change by developing waste MIS for cost-benefit analyses and tracking of GHG mitigation.
4.3. Mitigating climate change by improving and expanding the waste collection with priority to environmentally friendly technologies.
4.4. Mitigating climate change by institutionalizing source segregation.
4.5. Mitigating climate change by developing an action plan for sound legacy waste management.
4.6. Mitigate climate change through resource recovery & establishing recycling educational park.
4.7. Mitigate SLCP through scientific mana
4.8. Mitigate climate change by creating, communicating and establishing a strong link between WCC.

SO 5. Promote Social Justice and Equity of Waste Management

Action Plan 5
5.1. Ensure gender and social groups are mainstreamed in all waste management activities.
5.2 Improve the conditions of the informal waste sector, recognize and build a mutually beneficial partnership.
5.3 Protect the health and safety of the waste management workers.

SO 6. Design & Administer Awareness, Advocacy, Research, Partnership, Capacity Building and Transparency in NIWM

Action Plan 6
6.1. Develop an integrated waste management communication, advocacy, and awareness strategy and plans.
6.2 Conduct research for evidence-based interventions on new waste streams linking to GHG and SLCP emission.
6.3 Mobilize public and build effective partnerships for integrated waste management.
6.4 Enhance the capacity of the lead waste management entities.
6.5. Develop and Implement a Monitoring and Evaluation Framework.

NNIWMS Action Plan Matrix (2020-2035)

This NNIWMS 2020-2035 provides an outline of major actions to be taken. Building upon those outlines a detailed action plan will have to be further prepared. Nonetheless, an indicative action plan is presented here as a starting point. Implementation of these actions is subjected to availability of resources, budgetary allocation, and other approvals.

Table 22. NNIWMS Action Plan Matrix (2020-2035)

#	STRATEGIC ACTION PLAN	ENFORCEMENT TIME FRAME	LEAD AGENCY	SUPPORT AGENCY	PERFORMANCE INDICATOR	TARGETS
STRATEGIC OBJECTIVE 1: STRENGTHENING INSTITUTIONAL AND ORGANIZATIONAL FRAMEWORK						
1	1.1. Endorse NNIWMS & Action Plan. Action 1.1.1. Establish Special Taskforce and endorse the NNIWMS.	Mid 2020	MoFAGA	Technical Committee	IWM Strategy & Action Plan endorsed	Short Term: 100%
	1.2. Establish an Integrated Waste Management department at the national, province and the municipality. Action 1.2.1. Define roles and responsibilities with clear TOR Action 1.2.2. Establish IWM and Advisory board as per WM Act 2011	2020-2021	MoFAGA Line Ministries	Provincial and Municipal Head of Divisions Technical Team	IWM Department/ Unit & Advisory Board established with clear TOR	Short Term: 100%
	1.3. Establish linkages between institutions for effective coordination and delivery of the assigned role and responsibility. Action 1.3.1. Convene effective coordination, collaboration between line ministries, agencies and sections. Action 1.3.2. Avoid roles and responsibility overlap between institutions while co-creating integrated waste management solution across actors. Action 1.3.3. Build a coalition and support advocating for the mainstreaming of integrated waste management in different sectors of multiple functions.	2020-2035	MoFAGA IRRC focal points	Interagency focal points LEAD Nepal	Regular sharing and planning meeting. No overlapping of activities Joint programmes initiated	Short Term: 30% Mid Term: 30% Long Term: 40%
	1.4 Secure sufficient human resources based on inclusive participation with professional skills. Action 1.4.1. Conduct a human resource need assessment Action 1.4.2. Develop staffing policy based on social equity and technical skills with retention strategies. Action 1.4.3. Capacity Building	2020-2035	MoFAGA Chief of Line Ministries Provincial Municipalities	Environment, health, water and sanitation and urban development division	Human Resources Strengthened	Short Term: 30% Mid Term: 30% Long Term: 40%

STRATEGIC OBJECTIVE 2: ENSURE EFFECTIVE POLICY AND LEGISLATIVE FRAMEWORK & ITS ENFORCEMENT						
2	2.1. Develop/Amend the SWM acts 2011 and policies mainstreaming Gender and Disaster Waste with a strong enforcement mechanism. Action 2.1.1. A multi-stakeholder committee established to review and suggest amendments to strategy policies and the 2011 SWM Act Action 2.1.2. Ensure Gender, DWM and IRRC are mainstreamed Action 2.1.3. Develop IRRC SOP Action 2.1.4. Sharing & Capacity building	2020-2025	MoFAGA IRRC Focal Points Head of Provincial Municipalities	Different divisions within National, Provincial and the municipality framework LEAD Nepal	Amendments endorsed and implemented IRRC SOP developed Sharing and capacity building completed	2021: 20% 2022: 20% 2023: 20% 2024: 20% 2025: 20%
	2.2. Develop E-Waste, Medical Waste and Chemical Waste legislation. Action 2.2.1. Establish Multi-discipline committee to draft the laws Action 2.2.2. Endorsement of the relevant laws Action 2.2.3. Sharing & Capacity building	2020-2025	MoFAGA Chief of Judiciary	IWM focal point, environment, Health, industry divisions MoFAGA/Bar Association/ LEAD Nepal	E-Waste, Medical Waste, Chemical Waste laws drafted & endorsed	2021: 20% 2022: 20% 2023: 20% 2024: 20% 2025: 20%
	2.3. Develop hazardous waste handling policy and guidelines. Action 2.3.1. Multi-stakeholder committee established Action 2.3.2. Endorsement of the policy and guidelines Action 2.3.3. Sharing & Capacity building	2021-2025	Head of Municipalities	IWM focal points, industry, environment, Health, water and sanitation, urban development and LEAD Nepal	Hazardous Waste Guidelines developed Training and sharing completed	2021 20% 2022 20% 2023 20% 2024 20% 2025 20%
	2.4. Integrate and harmonize waste management policies and concerns into other sectoral policies (health, WASH, agriculture, industry etc.) Action 2.4.1 Conduct policy review on existing ordinances, study the different national laws and identify the conflicting provisions and recommend amendments for harmonization Action 2.4.2 Link waste sector with climate impact, green growth, sustainable development, WASH, and other relevant sectors Action 2.4.3 Improve coordination with national organizations and local authorities in harmonizing and reconciling waste management policies.	2021-2025	MoFAGA Technical Committee Line Ministries Provincial Municipality Heads	IWM focal point, Environment, Disaster Management, Industry, Health, Water & Sanitation, Social welfare, Education, Agriculture, Administration and Finance sections	Review committee established Number of meetings WM activities mainstreamed into sectoral policies and its enforcement	2021: 20% 2022: 20% 2023: 20% 2024: 20% 2025: 20%

STRATEGIC OBJECTIVE 3: ENSURE SUSTAINABLE FINANCIAL MECHANISM						
3	Strategy 3.1 Make sound financial commitments from the provincial and municipality towards solid waste management at all levels Action 3.1.1 Establish a Municipal Waste Management Fund to secure a regular and adequate budget for waste management Action 3.1.2 Ensure all wards have allocated a regular budget for waste management in its jurisdiction.	2021-2023	MoFAGA National Planning Commission & heads Province Municipality	IWM, Admin & Finance section Ward Chief	Waste Management Fund established Timely and accurate annually budget prepared	Short Term: 2021-2023
	3.2. Make WM systems and programs financially effective and self-sustaining. Action 3.2.1. Improve and introduce revenue generation by adopting full cost-recovery features and strategies e.g. collection fees, penalties, grants and donations. Action 3.2.2. Strictly follow the waste fees, penalties and taxation provisions illustrated in the WM act 2011 and further amendments if needed. Action 3.2.3. Establish incentive schemes that implement the polluter's pays principle by encouraging extended producers' responsibility, anti-littering, promoting recycling business etc. Action 3.2.4. Minimize the cost of WM facilities construction and operation by supporting municipalities in alliance building, clustering and sharing of facilities etc.	2020-2025	National Planning Commission, MoFAGA Provincial Municipality	IWM, Provincial Municipality Administration & Finance LEAD Nepal	Administration Finance & Procurement policy prepared Monitoring Action plans developed Number of joint sectorial meeting held Joint venture MOU prepared	2020: 10% 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%
	3.3. Enhance waste management financing options by encouraging public-private and cooperate partnership in financing the waste management facilities and programmes Action 3.3.1 Organize an investment summit with private sectors and corporates and ensure participation of women in business. Action 3.3.2 Create a conducive environment through favourable legal, policy and institutional support mechanisms for encouraging public and private sector investment for waste management. Action 3.3.2 Implement result-based financing.	2021-2025	MoFAGA Province Municipality Heads	Line division heads within the municipality, Provincial and National line ministries	Private Sector Summit organized Legal and policy framework include favourable working incentives done	2021: 20% 2022: 20% 2023: 20% 2024: 20% 2025: 20%
	3.4. Maximize waste management funding opportunities using existing, and new innovative sources. Action 3.4.1 Identify potential sources of investment opportunities from bi/multilateral, international agencies and private sector donors for waste management activities Action 3.4.2 Identify innovative green financing schemes, bank loans, municipal bonds etc. Action 3.4.3 Plan, develop and capacitate provincial, and local authorities and focal persons in accessing these funds	2021-2022	MoFAGA Finance Ministry Province Municipality Heads	IWM focal points, Finance, Administration Heads LEAD Nepal/I/NGOs	Donor Mapping is completed Capacity building conducted Proposal writing completed	2020 2022

STRATEGIC OBJECTIVE 4: MITIGATE CLIMATE CHANGE IMPACT THROUGH IMPROVED INTEGRATED WASTE MANAGEMENT						
4	4.1 Mitigating climate change by ensuring effective waste minimization interventions Action 4.1.1 Develop and implement a Waste Minimization Plan Action4.1.2. Promote sustainable consumption culture for waste prevention and Minimization through regular awareness Action 4.1.3. Develop incentives to encourage waste minimization through pricing interventions such as pay-as-you-throw or volume-based waste collection fees, plastic bag charges and so on. Action 4.1.4. Make individual producers responsible for the end-of-life management of their products and packaging through enabling extended producer responsibility policy Action 4.1.5 Establish cleaner and responsible production policies and practices to reduce the quantity of virgin materials that will ultimately become waste.	2021-2025	MoFAGA Province Municipality Heads	Planning, Social Welfare Environment Sanitation Health Industry Education Business entities Civilians I/NGOs	Waste Minimization Strategy prepared Clear TOR established Vigilantly established	2020: 10% 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%
	4.2. Mitigating climate change by developing waste MIS for cost-benefit analyses and tracking of GHG mitigation. Action 4.2.1 Conduct a census/study of number and types of commercial, institutes and household with income level and composition of waste Action 4.2.2. Conduct a survey on current collection, coverage, technique, equipment, vehicles used, fuel consumed and data on burning and open dumping. Action 4.2.3. Develop a website portal with regular updates on statistics and information on waste Action 4.2.4. Introduce a Grievance sharing platform	2020-2025	MoFAGA Province Municipality Heads Mayor, DM Admin. Head	IWM focal points, municipality and ward focal points Ward LEAD Nepal	Survey completed and MIS updated	2020: 10% 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%
	4.3. Mitigating climate change by improving and expanding the waste collection with priority to environmentally friendly technologies. Action 4.3.1. Develop municipal waste collection standards on waste collection fee, penalty fees, collection zoning, collection route mapping, collection schedule, types of collection services etc. Action 4.3.2. Expand waste collection services to the entire municipal area Action 4.3.3. Ensure sufficient environmentally friendly waste collection vehicle Action 4.3.4. Introduce buy-back or take-back mechanisms so that consumers can return products to manufacturers/ producers and introduce financial mechanisms for customers purchasing new products based on EPR Action 4.3.5. Enforce the use of enclosed collection vehicles Action 4.3.6 Ensure good road condition in the collection and final disposal sites route.	2020-2025	MoFAGA Province Municipality Heads	IWM, Admin, Finance, ward and tole representative, Business houses LEAD Nepal/ NGOs	SOP prepared Meeting with business houses conducted Action Plan Prepared	2020: 10% 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%

	4.4. Mitigating climate change by institutionalizing source segregation Action 4.4.1. Make source separation of waste mandatory (organic and inorganic categories) Action 4.4.2. Distribute 2 buckets each HH (red for inorganic and blue for organic waste) Action 4.4.3. Conduct mass information campaign with a participatory approach. Action 4.4.4. Practice award and punishment schemes based on performance between toles and wards	2020-2025	MoFAGA Province Municipality Heads	Admin, Finance, Planning, Ward, Tole, IWM focal points, LEAD Nepal/NGOs	Mass Awareness conducted 2 buckets distributed to each HH Award & Punishment announced in the wards, toles, Newspaper and radio	2020: 10% 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%
	4.5. Mitigating climate change by developing an action plan for sound legacy waste management Action 4.5.1. Ward SWM team to identify location of legacy waste in their area and document it. Action 4.5.2. Ward SWM team to plan a legacy clean-up campaign 2 hours a week with participation from 1 member from each household. Action 4.5.3. Ward SWM team to submit the progress of the clean-up campaign to the municipality quarterly for the competition award for the cleanest ward of the year. Action 4.5.4. Municipality SWM board to award the cleanest ward during special occasions such was WED, WRD, Earth day etc. Action 4.5.5. Municipality SWM board to develop municipality plan for the sound management of legacy waste.	2021-2035	Mayor/ DM, SLRM focal point	Ward heads, community	Cleanest ward identified and award given Number of award certificates SOP for sound management of legacy waste developed by the municipality	Short Term: 30% Mid Term: 30% Long Term: 40%
	4.6 Mitigate climate change through resource recovery & establishing recycling educational park Action 4.6.1. Establish an Integrated Resource Recovery Center (IRRC) at both secondary and tertiary levels. Action 4.6.2. Develop standard operation plan for the IRRC including guidelines on health, safety and hazardous waste. Action 4.6.3. Develop SOP and guidelines for identification, selection, procurement and transfer of appropriate, affordable, and environmentally sound technologies for waste management Action 4.6.4. Take measures in rural areas for organic waste diversion through material recovery options like household or community level composting Action 4.6.5. Promote various wastes to energy recovery options such as biogas production and Refuse Derived Fuel. Action 4.6.6. Encourage recycling industries in the country through favourable policies and incentive like tax rebates, discounts, zero-cap loans, waste banks, exempt custom duties etc. Action 4.6.7. Advertise, promote and distribute information on recyclable waste, collection centres, locations and purchase rates of recyclable materials Action 4.6.8. Establish a recycling educational park.	2020-2030	MoFAGA Province Municipality Heads	Ward, Tole, IWM, IRRC focal points, LEAD Nepal, Business houses	IRRC SOP completed Secondary IRRC established Tertiary IRRC established Biogas Plant and home-based composting introduced Plastic Recycling Plant established Refused Derived Fuel plant for non-recycling items established Waste Combustion established Educational Park & Learning Center established	2020: 5 % 2021: 10% 2022: 10% 2023: 10% 2024: 10% 2025: 10% 2026: 10% 2027: 10% 2028: 10% 2029: 10% 2030: 5%

	4.7. Mitigate SLCP through scientific management of disposal sites Action 4.7.1. Set an aggressive temporary dumpsite/landfill waste diversion goals Action 4.7.2. Ban unauthorized and uncontrolled open dumping and open burning of waste through vigilance and strict punitive measures Action 4.7.3. Plan and operate shared sanitary landfill facility from nearby municipalities Action 4.7.4. Impose Landfill taxes to discourage disposal of the waste Action 4.7.5. Close and rehabilitate open dumps with methane destruction	2020-2035	MoFAGA Province Municipality Heads	IRRC focal points Wards, toles, civilians MoFAGA, LEAD Nepal, Social groups/I/NGOs	Mapping of vulnerable sites completed. (Dumpsite, drains, riverside, streams, streets etc.) Temporary dumpsites closed and rehabilitated. Opening of blocked drainages	Short Term: 30% Mid Term: 30% Long Term: 40%
	4.8 Mitigate climate change by creating, communicating and establishing a strong link between waste and climate change Action 4.8.1. Train municipal, ward and tole officials to conduct waste assessments inclusive of GHG emission estimation and projection for the waste sector Action 4.8.2. Empower to prepare a database of the municipal waste and GHG inventory to track the reduction in the emissions using SWEET tool	2020-2035	MoFAGA Province Municipality heads	IRRC focal points, Ward, tole representative, LEAD Nepal	Training on SWEET Tool completed Training on waste assessment completed	Short Term: 30% Mid Term: 30% Long Term: 40%
STRATEGIC OBJECTIVE 5: PROMOTE SOCIAL JUSTICE AND EQUITY OF WASTE MANAGEMENT						
5	5.1. Ensure gender and social groups are mainstreamed in all waste management activities Action 5.1.1. Collect and record gender and social groups disaggregated data to assist evidence-based gender-sensitive waste management policies. Action 5.1.2. Review and revise policies with gender-sensitive action plans (ensure gender representation in decision making roles). Action 5.1.3. Allocate sufficient budget to gender and social groups sensitization training. Action 5.1.4 Encourage and enable women participation in specific jobs such as truck driving, engineering, planning, running waste entrepreneurial businesses etc. Action 5.1.5 Develop educational and awareness materials and deliver training on mainstreaming gender in the waste sector at all levels to avoid the presumption that waste is a gender-neutral subject	2020-2025	MoFAGA Province Municipality Heads	Environment, Disaster Management, Health, Education, Industry, Planning, Admin, Finance, Business houses LEAD Nepal I/NGOs	Taskforce formed Policy documents and Action Plan revised or developed Budget allocation done Number of Capacity building conducted Gender-sensitive policy and plans mainstreamed in all IWM activities	2020: 20% 2021: 20% 2022: 20% 2023: 20% 2024: 10% 2025: 10%

	5.2 Improve the conditions of the informal waste sector, recognize and build a mutually beneficial partnership. Action 5.2.1. Conduct a detailed survey of the informal waste workers and study the informal supply-chain. Action 5.2.2. Enhance the entrepreneurial capacities of informal sector workers and build a mutually beneficial partnership working modality. Action 5.2.3. Remove the stigma associated with waste-related work and improve social acceptance of waste-related job holders as a dignified livelihood option through formalizing the informal waste sector as Cooperatives/Associations/ CBO/MSEs or individual contractors and engaging them in waste-to-resource initiatives Action 5.2.4. Improve the working and living conditions of the informal sector by providing health facilities, providing child-care facility to waste pickers, and ensure their wage is as per the national minimum wage standard	2021-2025	MoFAGA Province Municipality Heads	IRRC focal points Scrap collectors & dealers, Business houses, LEAD Nepal, I/NGOs	Survey of Informal sectors completed Mutual beneficial partnership developed. Included them into the waste supply chain framework	2020: 10 % 2021: 20% 2022: 20% 2023: 20% 2024: 15% 2025: 15%
	5.3 Protect the health and safety of the waste management workers Action 5.3.1 Develop and adhere to the Occupational Health and Safety Guideline for personnel working in waste management service provision both in municipalities and in the private and corporate sector Action 5.3.2 Ensure safety gear and equipment and health facilities (immunization and accident/injury insurance) to the workers and provide sensitization training on using those safety gears	2020-2024	MoFAGA Province Municipality heads	IRRC focal points social welfare, industry, health section, LEAD Nepal/ MOFAGA	Health and safety guidelines completed Safety gear distributed Number of Capacity building done	2020: 30% 2021: 20% 2022: 20% 2023: 20% 2024: 10%
STRATEGIC OBJECTIVE 6: DESIGN & ADMINISTER AWARENESS, ADVOCACY, RESEARCH, PARTNERSHIP, CAPACITY DEVELOPMENT AND TRANSPARENCY IN IWM						
6	6.1 Develop an integrated waste management communication, advocacy, and awareness strategy and plans. Action 6.1.1. Develop information, education and communication (IEC) materials on waste minimization, waste segregation, 3Rs, Waste Management Act, Policy and Regulations etc. to a different audience Action 6.1.2. Use of media work on raising awareness and disseminating best practices on waste management using multi-media platforms (radio, television, print media, social media) Action 6.1.3 Organize door-to-door awareness drives with practical trainings on sorting, recycling and reusing waste Action 6.1.4 Include integrated waste management issues and activities in schools, colleges and support and extend waste recycling initiatives in some pilot schools	2021-2035	MoFAGA Province Municipality Heads	IRRC focal points, Education, Social Welfare Division, Ward, tole, Civilians, LEAD Nepal, I/NGOs	Communication Strategy prepared IEC materials prepared Working modalities with Media prepared Number and types of Mass information campaign done Number of pilot projects in schools IWM in school curriculum established	Short Term: 30% Mid Term: 30% Long Term: 40%

	6.2 Conduct research for evidence-based interventions on new waste streams linking to GHG and SLCP emission Action 6.2.1 Conduct scientific and social research on different waste streams connecting it to GHG and SLCP emissions Action 6.2.2 Conduct training on SWEET tool to local government and waste stakeholders	2021-2035	MoFAGA Province Municipality Heads	IRRC focal points, Environment, Health, Water Sanitation, Industry, Statistics	Number of trainings completed Use of SWEET Tool established	Short Term: 30% Mid Term: 30% Long Term: 40%
	6.3 Mobilize the public and build effective partnerships for integrated waste management Action 6.3.1 Build partnership mapping and a database by identifying stakeholders, institutions, informal sectors, NGOs/CBOs, private sector, volunteer groups working in the waste management sector Action 6.3.2 Form and facilitate community leaders, mobilizers, clean-up ambassadors to participate and develop a sense of ownership of the waste management programmes in their locality Action 6.3.3 Conduct public meetings, mass campaigns, demonstrations or marches, petition signing to mobilize public Action 6.3.4 Announce competitive clean-up campaigns, clean ward/municipality awards encouraging effective participation and drive for cleanliness.	2020-2035	MoFAGA Province Municipality Heads Mayor, DM Admin. Head	IRRC focal points, Environment, Health, Industry, Disaster Management, Social Welfare sections, business houses, schools, colleges, social groups, citizens, LEAD Nepal, I/NGOs	Partnership mapping completed IWM or Clean up Ambassador identified Number of mass campaign, activities held Number of awards announced Number of punishment announced	Short Term: 30% Mid Term: 30% Long Term: 40%
	6.4 Enhance the capacity of the lead waste management entities. Action 6.4.1 Conduct capacity needs assessment of various stakeholders Action 6.4.2 Develop standardized training modules and training of trainers for SWM Action 6.4.3 Conduct regular SWM trainings to capacitate stakeholders in different aspects of the functional elements of solid waste management.	2020-2035	MoFAGA Province Municipality Heads	IRRC focal points, LEAD Nepal	Capacity needs assessment completed Training material prepared Number of training imparted	Short Term: 30% Mid Term: 30% Long Term: 40%
	6.5. Develop and Implement a Monitoring and Evaluation Framework Action 6.5.1. Formulate a M & E Committee Action 6.5.2. Periodically audit all collection vehicles and processing plants Action 6.5.3. Review of the Integrated Waste Strategy document every 5 years.	2021-2035	MoFAGA Province Municipality Heads	Planning & monitoring division, IRRC/ focal points, Social Welfare Council, External Auditor, MOFAGA, LEAD Nepal	M & E Committee established Biannual Audit conducted Integrated Waste Strategy reviewed	Short Term: 30% Mid Term: 30% Long Term: 40%

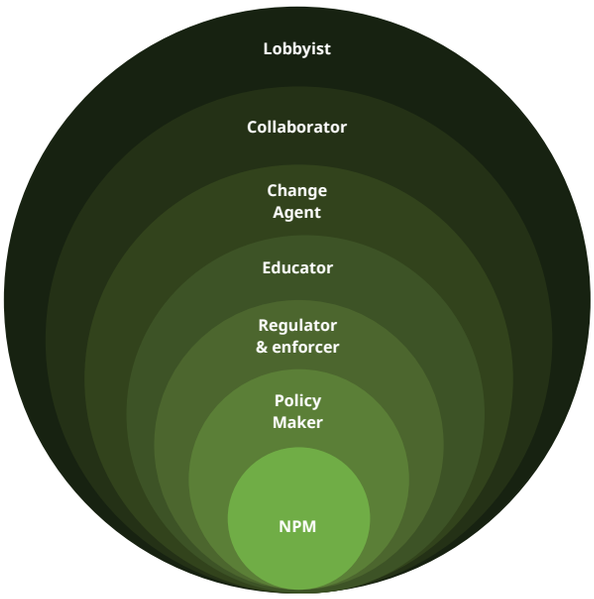
07 CHAPTER IMPLEMENTATION MECHANISMS

Implementation Mechanisms

Proper implementation arrangements are critical for ensuring the effectiveness of any strategy. Implementation of the strategic plans requires partnership, commitment, resources, and an effective monitoring and reporting mechanisms in place.

The NNIWMS envisages that the MoFAGA, Province and Municipal Heads will assume the lead responsibility for strategy implementation. Achieving zero waste is a shared responsibility. It requires coordination and cooperation from other line agencies, development partners, NGOs/CBOs, and most importantly the community themselves. The Heads of MoFAGA, Provinces and the Municipalities thus have the responsibility of coordinating and acquiring resources as well as trickling the strategy action plan to the ward and tole level.

Figure 69. National, Provincial & Municipal (NPM) Role in Zero Waste Ecosystems



Formal adoption of the Strategy

Successful implementation of the strategies and action plans begins with the formal adoption and endorsement by the government of Nepal. This will add a valuable boost to implement the strategy by all relevant stakeholders.

Implementation

To kick-start the implementation of the strategic plan a detailed operational plan will be required to develop monitoring, reporting and communication mechanisms, strengthen human resources/staffing, and plan financial resources etc. Such an implementation action plan will build upon the strategic actions identified in this Strategy document by expanding and laying out the time-bound activities of different departments/divisions and identifying and securing resources required.

Establishing legal instruments

Supportive legislation and associated regulatory requirements are a necessary criterion for the realization of the strategies and action plans illustrated in the NNIWMS .

Institutional structure, coordination mechanisms, and partnership mapping

Effective implementation of the Strategy requires several institutional and organizational

structures in place at provincial and local level governments. These, in particular, include establishing a dedicated waste management division within the institutional structure, strengthening of resources for the implementation of the Strategy, improving the capacity for monitoring and enforcement, development of regulations, development of guidance documents and so forth.

The implementation of the NNIWMS is a shared responsibility among multiple lead agencies and stakeholders. The responsible line agencies as identified in the implementation matrix will be communicated with their roles and responsibilities and planning. Similarly, a partnership mapping involving beneficiaries, private sector, NGOs/CBOs, and municipal/bi/multi-lateral agencies is required.

Monitoring, reporting and adjusting the strategy

A robust monitoring and reporting system will be needed to track the implementation of the Strategy. Improved delivery, documentation of results, and mobilizing political support for the sustainability of the strategy programme is also required. As the Strategy is set in three phases, a periodic review every five-year is anticipated. Such reviews are the opportunities to incorporate lessons learned and new changes observed over the previous implementation period. Also, such monitoring activities should be taken as an opportunity for the improvement and adaptation of the existing data collection, validation and reporting system at the local level.

Annex 1. List of the 35 municipalities

S.N	Province No.	Region	District	Municipalities	Description of local authority	Total no.of wards	Population (2011)	Total area (sq.km)	Major water bodies
1	1	Mountain	Solukhumbu	Solududhkunda	Municipality	11	20,399	565.06	Solukhula
2		Hill	Dhankuta	Dhankuta	Municipality	10	38629	110.80	Tamor River, Pattle River, Tankhuwa River
3		Hill	Sunasari	Itahari	Municipality	20	140,517	93.78	Bhudikhola, Tanghara River, Taltaliya Lake
4		Terai	Jhapa	Damak	Municipality	10	75,102	67.85	Betani River
5	2	Terai	Rautahad	Chandranigahapur	Municipality	10	72,059	249.96	Bagmati river
6		Terai	Dhanusha	Janakpur	Sub-metropolitan	25	153,614	99.99	Jalada river
7		Terai	Rauthat	Gaur	Municipality	9	72,059	31.91	Barahwa Lake, Adalat Pond, Bakaiya River, Shivalaya Lake
8		Terai	Bara	Jeetpur Simara	Municipality	24	118,398	311.67	Halkhoria Lake, Kamini Lake, Dudhora River, Pasaha River, Balganga River
9		Terai	Siraha	Lahan	Municiplaiity	24	92,040	167.17	Balan / Banu / Jhirjhir / Surrey River, Mutani Lake, Khutti / Betna Lake
10	3	Hill	Kathmandu	Kathmandu	Metropolitan	32	975,453	49.45	Bagmati River, Bishnumati River, Tukucha River, Rudramati River
11		Hill	Kavrepalanchowk	Banepa	Municipality	14	57,722	54.59	Punyamata River, Rudramati River, Ganesh Pond
12		Hill	Kathmandu	Kirtipur	Municipality	19	67,171	14.76	Bagmati River, Balkhu River, Bosan River
13		Hill	Dolkha	Bhimeshwor	Municipality	9	33,324	132.50	Kuthali River, Tamakoshi River, Mahadev River
14		Hill	Bhaktapur	Suryavinayak	Municipality	10	78,490	42.45	Hanumante River, Charkhandi River
15		Hill	Lalitpur	Mahalaxmi	Municipality	10	62,172	26.51	Godawari River, Boje Pond , Kamal Pond, Mayalpani Pond
16		Terai	Makwanpur	Hetauda	Sub-metropolitan	19	152,875	261.59	Rapti river
17	4	Hill	Kaski	Pokhara Lekhnath	Metropolitan	33	414,141	464.24	Seti river

S.N	Province No.	Region	District	Municipalities	Description of local authority	Total no.of wards	Population (2011)	Total area (sq.km)	Major water bodies
18		Hill	Gorkha	Gorkha	Municipality	14	49,272	131.86	Daraudi River, Rani Pokhari, Hile Pokhari
19		Hill	Syangja	Walling	Municipality	14	24,006	133.85	Adhi River, Armadi River
20		Hill	Gorkha	Palungtar	Municipality	10	38,244	158.62	Marsyangdi River, Cheppe River, Thati Pond, Tal Pond
21	5	Hill	Palpa	Tansen	Municipality	14	50,405	108.00	Tinau Khola. Ridi Khola. Purwa Khola. Jhumsa Khola. Dovan Khola.
22		Hill	Pyuthan	Pyuthan	Municipality	10	52,538	128.96	Jhimruk River, Jumri River, Majuwa River
23		Terai	Rupandehi	Lumbini-Sanskriti	Municipality	13	72497	112.21	Khusandihawa Pond, Tarkihliya Pond, Moharbadi Pond
24		Terai	Kapilvastu	Buddha Bhumi	Municipality	10	64,949	366.67	Chaini Lake, Purauni Lake
25	6	Mountain	Dailekh	Dullu	Municipality	13	41,540	156.12	Chamghat, Karnali, Paduka River
26		Mountain	Mugu	Chhayanath Rara	Municipality	14	20,078	480.37	Karnali River, Hulumad River, Jalekh Tauka Waterfall
27		Mountain	Kalikot	Raskot	Municipality	9	16,272	59.79	Tusar Stream, Ghatta Stream, Sera Stream
28		Hill	Surkhet	Gurbhakot	Municipality	14	43,765	228.60	Bheri River, Goche River, Golara River
29		Hill	Surkhet	Lekhbesi	Municipality	10	30,295	180.92	Bheri River, Gangate River, Rate River, Jhupre River, Gam River
30		Hill	Surkhet	Bheriganga	Municiplaity	13	1,15,451	256.20	Bheri River, Goche River, Golara River
31		Terai	Surkhet	Birendranagar	Municipality	16	100,458	245.85	Bulbul Lake, Bheri River, Neware / Ittram / Khorke River
32	7	Mountain	Doti	Sikhar	Municipality	11	31,801	285.37	Seti River, Coral Stream, Kadathar Stream
33		Mountain	Bajhang	Jay Prithivi	Municipality	11	22,191	166.79	Seti River, Bowli Stream, Oilghat Stream,
34		Terai	Kailali	Dhangadi	Sub-Metropolitian City	19	47,449	261.75	Mohana River, Kailali River Setopul Nala River, Kani Khola River, Kanari River, Jakhor Lake, Beheda Baba Lake and Tilke Lake
35		Terai	Kanchanpur	Bhimdatta	Municipality	19	104,599	196.50	Mahakali River, Bhajela River, Rani Lake

Annex 2. MSW (HH, institutional & commercial) waste generation in 35 municipalities

Municipality	Avg. HH size	Avg. HH waste (Kg/HH/day)	Avg Capita HH waste (Kg/ capita/day)	Total HH waste (tons/day)	Total Commercial Waste (tons/ day)	Total Institutional waste (tons/ day)	Avg per Capita MSW (kg/capita/ day)	Total MSW generation (tons/day)
Banepa	4.49	1.36	0.30	25.15	1.24	0.81	0.33	27.20
Bheriganga	4.81	0.35	0.07	3.13	3.26	0.27	0.15	6.66
Bhimdatta	5.08	0.64	0.13	16.20	15.82	1.01	0.26	33.02
Bhimeshwor	3.83	1.90	0.50	16.11	2.53	0.59	0.59	19.23
Birendranagar	4.33	0.57	0.13	15.20	23.87	0.83	0.35	39.90
Buddhabhumi	5.14	0.74	0.14	23.84	3.01	0.49	0.17	27.34
Chandrapur	5.22	0.92	0.18	16.56	3.78	0.30	0.22	20.64
Chhayanath Rara	6.00	0.30	0.05	1.20	0.55	0.04	0.07	1.80
Damak	4.15	0.53	0.13	17.79	7.00	0.71	0.18	25.49
Dhangadhi	4.94	0.71	0.14	21.23	22.03	1.98	0.31	45.25
Dhankuta	3.93	0.83	0.21	9.71	26.26	2.66	0.84	38.62
Dullu	5.35	1.02	0.19	8.74	1.68	0.18	0.23	10.60
Gaur	6.27	1.25	0.20	6.97	3.72	0.47	0.32	11.15
Gorkha	4.13	0.90	0.22	13.36	4.81	0.68	0.31	18.85
Gurbakot	4.81	1.02	0.21	9.28	3.19	0.15	0.29	12.62
Hetauda	4.27	0.71	0.17	30.41	25.67	3.18	0.32	59.26
Itahari	4.20	0.80	0.19	26.77	73.89	25.97	0.90	126.63
Janakpur	5.10	1.19	0.23	44.95	21.02	2.76	0.36	68.73
Jay Prithivi	5.78	1.05	0.18	3.86	1.94	0.17	0.28	5.97
Jitpur Simara	6.28	1.18	0.19	22.08	11.05	0.61	0.29	33.74
Kathmandu	4.74	1.05	0.22	297.81	259.30	29.09	0.4360	586.20
Kirtipur	3.45	0.89	0.26	23.79	12.90	28.22	0.70	64.90
Lahan	5.23	0.91	0.17	15.97	6.55	3.43	0.28	25.95
Lekbesi	4.77	0.56	0.12	3.56	0.89	0.14	0.15	4.58
Lumbini Sanskriti	6.01	0.79	0.13	9.53	11.65	2.38	0.32	23.56

Mahalaxmi	4.39	0.69	0.16	12.72	13.47	1.17	0.34	27.36
Palungtar	3.84	0.71	0.18	4.16	5.03	0.40	0.43	9.59
Pokhara	3.74	1.10	0.29	176.27	51.18	5.75	0.39	233.20
Pyuthan	4.78	0.66	0.14	5.31	9.14	5.98	0.53	20.43
Raskot	5.95	0.51	0.09	1.39	0.26	0.08	0.11	1.73
Sikhar	4.99	1.71	0.34	12.63	1.19	0.21	0.38	14.03
Solududhkunda	4.45	0.87	0.20	4.69	0.47	0.17	0.22	5.33
Suryabinayak	4.63	0.94	0.20	20.27	9.16	0.92	0.30	30.36
Tansen	5.22	0.30	0.06	5.74	7.12	0.78	0.14	13.64
Waling	4.06	0.68	0.17	8.57	4.12	0.42	0.26	13.10

Annex 3. MSW (HH, institutional & commercial) waste compositions in 35 municipalities

	1. Composition of Waste generated by Household (%)							
Municipality	**Organic Waste**	**Plastics**	**Paper/ Paper Products**	**Glass**	**Metals**	**Textiles**	**Chemical/ Hazardous**	**Others**
Banepa Municipality	69.63	12.15	10.08	2.20	2.20	2.05	1.18	1.00
Bheriganga Municipality	93.04	2.30	1.62	1.33	0.91	0.64	0.00	0.17
Bhimdatta Municipality	49.08	19.43	16.86	4.61	0.30	8.47	0.14	1.11
Bhimeshwor Municipality	0.00	33.25	41.79	0.00	-	0.00	24.96	0.00
Birendranagar Municipality	58.28	14.44	19.40	2.50	0.48	3.73	0.27	0.90
Buddhabhumi Municipality	96.67	1.61	1.08	0.12	0.00	0.00	0.51	0.00
Chandrapur Municipality	65.22	8.70	0.00	13.04	0.00	4.35	4.35	4.35
Chhayanath Rara Municipality	65.40	9.95	9.11	4.56	3.30	3.32	3.37	1.00
Damak Municipality	58.57	13.15	7.83	14.06	0.00	2.11	0.00	4.29
Dhangadhi Sub-Metropolitian City	68.12	13.11	10.07	2.67	1.08	0.00	2.30	2.65
Dhankuta Municipality	60.59	18.83	12.87	0.00	2.25	4.02	1.22	0.22
Dullu municipality	62.07	9.56	18.55	9.30	0.00	0.00	0.51	0.00
Gaur Municipality	79.47	5.20	4.98	2.99	3.00	3.38	0.00	1.01
Gorkha Municipality	66.45	12.06	10.87	5.63	2.95	0.83	0.71	0.50
Gurbakot Municipality	47.46	9.79	15.87	7.78	9.58	5.19	3.33	1.00
Hetauda Sub-Metropolitan City	50.51	15.40	28.61	1.46	0.39	0.00	1.67	1.97
Itahari Municipality	61.23	12.56	19.35	1.49	3.32	2.05	0.00	0.00
Janakpur Municipality	35.38	22.48	16.09	8.62	3.71	4.49	9.23	0.00
Jay Prithivi Municipality	51.79	4.23	4.32	13.16	23.59	2.66	0.24	0.00
Jitpur Simara Municipality	69.11	6.87	7.89	3.44	3.00	5.65	2.92	1.10
Kathmandu Municipality	78.60	7.73	10.31	1.31	0.65	0.00	0.13	1.26
Kirtipur	74.73	15.14	8.05	0.10	0.23	1.48	0.27	0.00
Lahan Municipality	84.53	7.93	5.61	0.10	1.04	0.00	0.65	0.14
Lekbesi Municipality	87.06	7.60	2.94	0.06	0.03	2.32	0.00	0.00
Lumbini Sanskriti Municipality	0.00	16.63	83.37	0.00	0.00	0.00	0.00	0.00

Mahalaxmi Municipality	73.79	10.37	5.36	4.09	0.00	5.18	1.21	0.00
Palungtar Municipality	0.00	16.63	83.37	0.00	0.00	0.00	0.00	0.00
Pokhara-Lekhanath Metropolitan City	92.46	1.34	2.63	1.46	0.61	1.34	0.15	0.00
Pyuthan Municipality	64.21	11.33	8.64	3.19	3.95	4.80	2.93	0.94
Raskot Municipality	50.78	9.79	15.87	7.78	9.59	5.19	0.00	1.00
Sikhar Municipality	49.70	13.00	11.26	1.58	0.88	15.72	3.93	3.93
Solududhkunda Municipality	47.95	5.08	5.16	13.13	22.53	3.67	1.48	0.99
Suryabinayak Municipality	50.04	8.66	15.23	5.34	4.75	13.80	2.18	0.00
Tansen Municipality	72.74	17.20	8.00	0.00	0.96	0.00	0.00	1.10
Walling Municipality	50.22	14.26	13.51	8.12	5.59	7.31	0.00	0.99
	2. Composition of Waste generated by Institution (%)							
Municipality	**Organic Waste**	**Plastics**	**Paper/ Paper Products**	**Glass**	**Metals**	**Textiles**	**Chemical/ Hazardous**	**Others**
Banepa Municipality	45.12	15.87	30.91	1.67	2.58	2.15	1.71	0.00
Bheriganga Municipality	26.09	22.08	35.27	0.00	1.79	11.56	2.24	0.99
Bhimdatta Municipality	3.7	20.6	35.2	2.7	1.6	7.4	4.71	1.3
Bhimeshwor Municipality	38.11	14.32	40.48	1.30	1.35	1.42	2.01	1.01
Birendranagar Municipality	33.44	24.40	39.31	0.08	0.56	1.98	0.24	0.00
Buddhabhumi Municipality	11.7	11.8	13.2	0.7	0	59.8	0	2.8
Chandrapur Municipality	25	10.5	20.9	42.1	0	0.5	1	0
Chhayanath Rara Municipality	23.89	20.12	54.79	0.00	0.86	0.34	0.00	0.00
Damak Municipality	32	28	40	0	0	0	0	0
Dhangadhi Sub-Metropolitian City	31.24	14.88	33.97	5.27	6.02	7.64	0.00	0.98
Dhankuta Municipality	25.10	32.37	34.50	2.31	0.03	1.65	0.70	3.35
Dullu municipality	34.9	2.7	44.6	2.7	0.3	0	4	10.8
Gaur Municipality	30.70	14.87	39.68	0.00	0.00	0.00	0.00	14.75
Gorkha Municipality	53.2	15.5	10	0	5.3	10.4	0	5.6
Gurbakot Municipality	30.56	16.92	49.63	0.00	0.00	0.00	0.00	2.89
Hetauda Sub-Metropolitan City	15.4	21	56.6	0	0	0	7	0
Itahari Municipality	84.52	4.07	8.45	0.04	0.57	0.00	0.00	2.35
Janakpur Municipality	16.9	35.6	47.5	0	0	0	0	0
Jay Prithivi Municipality	51.79	4.23	4.32	13.16	23.59	2.66	0.24	0.00

Jitpur Simara Municipality	55.61	6.66	33.38	0.12	0.25	0.00	0.00	3.98
Kathmandu Municipality	48	25.1	23.2	0	3.7	0	0	0
Kirtipur	33.39	14.93	41.99	2.07	2.07	2.07	2.46	1.03
Lahan Municipality	58.03	7.91	15.89	3.81	3.81	5.56	4.01	0.99
Lekbesi Municipality	11.23	34.81	51.29	0.85	0.05	0.03	0.03	1.69
Lumbini Sanskriti Municipality	34.88	11.60	48.13	4.61	0.00	0.00	0.00	0.78
Mahalaxmi Municipality	19.3	19.1	52.1	0	0	0	9.5	0
Palungtar Municipality	34.34	22.37	37.22	5.06	0.00	0.00	0.00	1.02
Pokhara-Lekhanath Metropolitan City	26.19	8.14	48.05	0	0	17.3	0	0.32
Pyuthan Municipality	40.29	16.48	42.47	0.00	0.00	0.44	0.31	0.00
Raskot Municipality	13.76	10.31	59.41	5.17	5.45	5.29	0.00	0.62
Sikhar Municipality	52.6	14.7	22.1	0	10.6	0	0	0
Solududhkunda Municipality	17.96	17.44	57.39	0.91	4.16	0.79	0.07	1.28
Suryabinayak Municipality	37.5	12.5	26.3	5	10	0	3.7	0
Tansen Municipality	21.5	20.1	47.9	2.4	1.8	2	4.3	0
Walling Municipality	18.27	33.14	39.95	0.00	3.58	3.88	1.19	0.00

3. Composition of Waste generated by Commercial (%)

Municipality	Organic Waste	Plastics	Paper/ Paper Products	Glass	Metals	Textiles	Chemical/ Hazardous	Others
Banepa Municipality	46.86	12.04	24.49	4.09	4.66	3.46	3.41	1.00
Bheriganga Municipality	62.20	9.74	9.38	15.54	1.12	0.82	0.54	0.67
Bhimdatta Municipality	44.2	15.5	22	5.5	0.9	5.3	1.7	4.9
Bhimeshwor Municipality	89.05	3.44	2.37	4.41	0.14	0.37	0.23	0.00
Birendranagar Municipality	69.66	5.12	8.59	5.55	2.30	5.57	2.19	1.01
Buddhabhumi Municipality	52.4	8.7	12.1	6.1	0	15.7	0	5
Chandrapur Municipality	40.8	18	32.7	4.3	0.9	0	0	3.3
Chhayanath Rara Municipality	63.42	14.07	18.05	0.00	1.78	1.72	0.00	0.97
Damak Municipality	55.4	12	18.7	9.3	0	0	0	4.6
Dhangadhi Sub-Metropolitian City	72.51	6.83	5.62	1.92	3.60	0.90	0.03	8.58
Dhankuta Municipality	46.09	18.22	14.51	5.03	7.56	3.26	0.14	5.20
Dullu municipality	55.9	4	7.2	26.4	1	0	2.4	3.1
Gaur Municipality	65.72	4.94	8.81	10.37	1.48	0.01	0.22	8.46

Gorkha Municipality	74.3	11.3	9	1.8	0	0	0	3.6
Gurbakot Municipality	57.69	5.74	6.27	25.77	1.88	1.61	0.34	0.69
Hetauda Sub-Metropolitan City	22.5	9.9	55.8	11.8	0	0	0	0
Itahari Municipality	80.28	6.54	4.34	4.51	1.79	0.52	1.00	1.01%
Janakpur Municipality	48.9	19.7	31.4	0	0	0	0	0
Jay Prithivi Municipality	36.48	18.79	16.55	9.84	4.31	10.29	3.73	0.00
Jitpur Simara Municipality	65.44	13.38	14.60	4.64	0.22	1.11	0.62	0.00
Kathmandu Municipality	57	18.02	23.68	1.2	0.1	0	0	0
Kirtipur	30.04	19.71	25.77	17.48	5.99	0.00	0.00	0.99
Lahan Municipality	52.46	9.84	16.00	5.21	6.60	4.79	4.12	0.98
Lekbesi Municipality	59.33	12.74	7.89	4.03	7.52	3.50	3.85	1.14
Lumbini Sanskriti Municipality	64.40	9.00	13.91	8.04	2.01	1.45	1.18	0.00
Mahalaxmi Municipality	54.4	20.4	16.5	0	0	0	8.7	0
Palungtar Municipality	47.31	12.98	12.54	11.90	6.70	7.58	0.00	0.99
Pokhara-Lekhanath Metropolitan City	47.22	12.6	24.68	6.14	1.44	6.95	0.13	0.84
Pyuthan Municipality	39.58	11.02	15.63	7.71	7.04	11.79	6.21	1.02
Raskot Municipality	30.88	15.30	26.81	12.99	5.92	8.11	0.00	0.00
Sikhar Municipality	28.4	12.1	8.4	23.2	7	0	7.9	13
Solududhkunda Municipality	45.53	5.24	5.15	28.23	9.40	3.53	1.95	0.97
Suryabinayak Municipality	50.8	15.5	10.3	17.5	0	0	0	5.9
Tansen Municipality	65.2	2.2	7.3	21.2	0.7	0	0	3.4
Walling Municipality	36.13	17.68	24.25	14.99	0.00	5.95	0.00	1.01

Annex 4. Comparison of current baseline results on MSW quantity and composition with SWMRMC 2004, ADB 2012 and SWMTSC 2016 surveys

YEAR	2004 (SWMRMC)	2012 (ADB)	2016 (SWMTSC)	LEAD Nepal (2018)
Municipalities surveyed	58	58	60	35
Population of surveyed Municipalities (In million)	3.48	4.5	2.07	4.56
Total surveyed Establishments				
Household	4,234	3,233	3,330	1,603
Institution		627	600	720
Commercial		627	600	1071
Data Collection period				
Dry Season (March, April, May August)	2003- 2004	2012	2016	2018-2019
Average MSW generation rate (Kg/Person/Day)	0.34	0.317	0.18	0.37
Total estimated MSW generation (Ton/Day)	1,369	1,435	419	1706.66
Total annual MSW generation (Ton/Year)	499,685	524,000	153,113	622,930.9
Source of waste				
Household waste (average of all studies municipalities- Kg/Capita/Day)	0.25 (75% of MSW)	0.176 (50-75% of MSW)	0.12 (60-75% of MSW)	0.180 Kg/ Household/day
Commercial waste	-	1.4 kg/shop 5.7 kg/hotel	1.1 kg/shop 3.1 kg/hotel	3.325Kg/ Commercial/day
Institution	-	1.4 kg/office 4 kg/school	3.25 kg/school 0.95 kg/office	2.694 Kg/ Institution/day
Average composition of MSW (in %)				
Organic	61.95	56	61	53.12
Plastic	7.34	16	12	13.04
Paper and paper products	8.21	16	11	20.04
Metals	1.18	2	2	2.76
Glass	2.38	3	6	5.35
Textile	1.91	2	1	3.13
Rubber	0.59	1 (rubber & leather)	1 (rubber & leather)	
Leather	0.32			
Medical	0.39	-	-	
Inert	9.32	-	-	
Chemical/Hazardous				1.49
Other	6.42	4	6	1.10

Annex 5. List of recycling companies operating in Nepal and India

List of the recycling companies			
Nepalese companies			
1	R & B traders	28	Beer Companies
2	Jagdamba Iron and Steel Udhyog	29	Maruti scrap centre
3	B & B traders	30	Bageshwori Iron and Steel Industries
4	Egg factory	31	Western liquors
5	Ambe traders/Steels	32	Amrit Liquors
6	Laxmi steels	33	Rainbow Distillery
7	Mahabir Kawad	34	Aman Plastics
8	Karna steel udhyog	35	Iron companies
9	Siddarth Baba bottle Supplier	36	Badrulin Kawad Centre
10	Shiva Shakti Bottle Suppliers	37	Panchakanya Steels
11	Ashok steel	38	Maruti paper
12	Baba steel	39	Subhorn trading
13	Janaki Plastic factory	40	CP traders and suppliers
14	Tuborg Factory	41	Mt. Everest Distillery
15	Sankha steels	42	Arbin paper
16	Baba Paper Mill	43	Bajrang Glass House
17	Doko recyclers	44	Mineral water bottle
18	Jhulnepur Kawad	45	Fattebahadur, Riya Suppliers
19	Doko recyclers		
20	Kiran suppliers(glass)		
21	Patan paper mill		
22	Anta Paper mill		
23	Kapilvastu kabad		
24	Siddharth shivam kawad center		
25	Everest Paper Mills		
26	Hulas steels		
27	Kathmandu Plastic Udhyog		
Indian Companies			
1	Shasi Distillery	4	Bajaranga Paper Mill
2	Rajesh kawadi collection centre	5	Gupta Steel factory
3	Bajaranga Paper Mill	6	Hanuman Paper Mill

Annex 6. Final MSW disposal sites in 35 municipalities

	General Details of Disposal Site							Waste details		Technical Facilities in Disposal Sites				Condition of Land site (Management)			
Municipalities	Number	Sanitary Landfill/ authorized dumpsite	Name	Location	Year Estab-lish-ment	Estim-ated life-span	Distance from main city (km)	Amount of waste disposed (tons/ day)	Average waste depth (m)	Existing (or planned) type of leachate control/ treatment	Existing or planned active gas extraction	Active gas extraction start-up year?	Existing gas-to-energy project	Scav-enger/ waste pickers	Ani-mals	Leac-hate	Others (Fecal Sludge / Area Extension)
														Yes/ No	Yes/ No	Yes/ No	Yes/ No
Buddhabhumi Municipality	1	Dumpsite	NIA	Ward no.1, community forest	2015	No	No	0.05	No	No	No	No	No	No	No	No	No
Damak Municipality	1	Sanitary Landfill	Damak Landfill	Community Forest, Damak-2	2014	2019	9	13	3-4	No	No	No	No	No	No	No	No
Hetauda Sub-Metropo-litan City	1	Controlled Dump Site	Hetuda Sanitary Park	Rapti River	1998	2024	3	8	1.5	No	No	No	No	Yes	Yes	No	No
Kathmandu Municipality	1	Sanitary Landfill	Sisdol Landfill	Ward No. 4-Sisdol, Okha-rpauwa Sisdol	2005	2008 (stillru-nning)	26	750	40	No	No	No	No	Yes	No	Yes	Yes
Pokhara-Lekh-anath Metrop-olitan City	1	Sanitary Landfill	Bachch-hibudu-wa Sani-tary Landfill	Pokhara-14, Bache Baduwa	2004	2024	16	13	16	Yes	Yes	No	No	Yes	Yes	No	No
Sikhar Municipality	1	Dumpsite	Rampur dumpsite	Rampur ward no 6	2019	NIA	3	NIA	NIA	No	No	No	No	No	No	No	No
Waling Municipality	1	Landfill	Waling Sarsafai Kendra	Adhi Khola	2018	No	5	0.5	No	No	No	No	No	No	No	No	No
Bhimeshwor Municipality	1	Controlled dumpsite	NIA	Biruwa	2008	2023	18	8	7	No	No	No	No	Yes	No	No	No

	General Details of Disposal Site							Waste details		Technical Facilities in Disposal Sites				Condition of Land site (Management)			
Municipalities	Number	Sanitary Landfill/ authorized dumpsite	Name	Location	Year Establ-ishment	Estim-ated life-span	Distance from main city (km)	Amount of waste disposed (tons/ day)	Average waste depth (m)	Existing (or planned) type of leachate control/ treatment	Existing or planned active gas extraction	Active gas extraction start-up year?	Existing gas-to-energy project	Scav-enger/ waste pickers	Ani-mals	Leac-hate	Others (Fecal Sludge / Area Extension)
														Yes/ No	Yes/ No	Yes/ No	Yes/ No
Dhankuta Municipality	1	Controlled dumpsite	Solid waste managem-ent centre	Saraswoti chowk-06, Dhankuta	2009	2031	5	13	A-12 B-9 C-7 (compa-rtments)	No	No	No	No	No	No	No	No
Lahan Municipality	1	Controlled dumping site	Solid waste management centre	Lahan - 04	2016	2031	3	62.67	30	Still in design	No	No	No	Yes	No	No	No
Solududhkunda Municipality	1	Controlled dumpsite	Thapatole dumpsite	Thapatole Ward No. 6	2074	Temp-orary in opera-tion	1	2	5	No	No	No	No	No	No	No	No
Birendranagar Municipality	1	Controlled Dumpsites	Bheribahi-rani, Taravir	Tarevir, Gothari	2010	2020	6,5	7	10	No	No	No	No	Yes	Yes	Yes	Yes
Chandrapur Municipality	1	Dumpsite	Chandrapur dumpsite	Jungle Tole	2014	NIA	3.5	2	Not known	No	No	No	No	No	No	No	No
Dhangadhi Sub Metropolitian City	1	Dumpsite	NIA	LN Chowk, Chauraha	2018	NIA	0.5	14	NIA	No	No	No	No	No	No	No	No
Gorkha Municipality	1	Dumpsite	Laxmi Bazar Dumpsite	Near City	1997	2047	5	6	50	No	No	No	No	No	No	No	No
Suryabinayak Municipality	No landfill/dumpsite - shares Sisdole landfill site for now																
Tansen Municipality	1	Dumpsite	Deurali Samurdayk	Deurali	2007	NIA	1	8	NIA	No	No	No	No	Yes	Yes	No	No

Municipalities	General Details of Disposal Site							Waste details		Technical Facilities in Disposal Sites				Condition of Land site (Management)			
	Number	Sanitary Landfill/ authorized dumpsite	Name	Location	Year Establ-ishment	Estim-ated life-span	Distance from main city (km)	Amount of waste disposed (tons/ day)	Average waste depth (m)	Existing (or planned) type of leachate control/ treatment	Existing or planned active gas extraction	Active gas extraction start-up year?	Existing gas-to-energy project	Scav-enger/ waste pickers	Ani-mals	Leac-hate	Others (Fecal Sludge / Area Extension)
														Yes/ No	Yes/ No	Yes/ No	Yes/ No
Banepa	No Landfill site and practice riverside dumping, Illegal dumping and open burning																
Bheriganga	No Landfill site and practice Illegal dumping and open burning																
Bhimdatta	No landfill/dumpsite and practice Illegal dumping and open burning																
Chhayanath Rara	No Landfill site and practices, Illegal dumping and open burning																
Dullu	No landfill/dumpsite and practice open burning, illegal dumping																
Gaur	No Landfill site but practices illegal dumping and open burning																
Gurbakot	No Landfill site and practices illegal dumping, open burning and riverside dumping																
Itahari	No Landfill site and practices illegal dumping and open burning																
Janakpur	No landfill/dumpsite and practice illegal dumping and open burning																
Jay Prithivi	No Landfill site and practice riverside dumping, illegal dumping and open burning																
Jitpur Simara	No Landfill site and practice illegal dumping open burning and riverside dumping																
Kirtipur	Uses Sisdole, Okkharpauwa Landfill Site																
Lekbesi	No Landfill site and practice riverside dumping, illegal dumping and open burning																
Lumbini Sanskriti	No landfill/dumpsite and practice illegal dumping and open burning																
Mahalaxmi	No landfill/dumpsite and practice illegal dumping and open burning																
Palungtar	No Landfill site and practice illegal dumping and open burning																
Pyuthan	No Landfill site and practice illegal dumping and open burning																
Raskot	No Landfill site but follows illegal Open dumping and Open Burning																

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