



January 2020

Source-to-Lake Analysis of Plastic Waste Management in Lake Hawassa Basin



Plastic Waste Management in Lake Hawassa Basin

Report on quantitative and qualitative assessment characterizing plastic solid waste flows in the Lake Hawassa Basin from source-to-lake



Stockholm International Water Institute (SIWI)

Resource and Waste Advisory (RWA) Group



Author: Resource and Waste Advisory (RWA) Group

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Executive Summary

Hawassa, which include urban, touristic and rural areas, has a population of 403,025 and generates approximately 206 t/day of municipal solid waste (MSW), out of which, 8% (15.94) is plastic waste. Urban areas generate the majority of the plastic waste, 63.9%, followed by touristic and rural areas at 25.6% and 10.5% respectively. The types of plastic generated in Hawassa include; dense/heavy (PET, LDPE, HDPE, PP), film/light (bags and wrappers) and most interestingly fishing nets. Light plastic forms the majority of plastic waste being generated at 60.9% followed by dense plastic and fishing nets at 38.9% and 0.2% respectively. Despite the large amount of light plastic being generated, none of it is recycled since it has no market value. On the other hand, dense plastic, especially PET, has high market value in the recycling industry. Fishing nets that are illegal at the end of their life span i.e., 1 year, are often disposed directly into the lake as a convenient disposal method and also to hide them from the authorities.

Collection and management of plastic waste is similar in urban and touristic areas but there is no waste management system in the rural areas and therefore, it can only be assumed that all the plastic waste generated there ends up in the environment or water bodies and analysis beyond this is not possible. In urban and touristic areas, only 32% of all the plastic waste generated is collected either for recycling (21%) or disposal (11%). This implies that up to 68% of all the plastic waste generated in urban and touristic areas is not collected. Of the significant amounts of uncollected plastic waste 56% is left on land while 25%, 18% and 1% is burned, ends up in Lake Hawassa or in drains, respectively. Though a small percentage of plastic waste is left stuck in drains, it is important to note that drains are the main transmitters of plastic into Lake Hawassa

Inadequate plastic waste management in Hawassa has resulted in environmental, economic, ecosystem and public health impacts including but not limited to: increased cost of clean-ups, flood damage to roads and houses, increased risk of flooding due to blockage of storm drains and increased risk of malaria outbreak.

Despite the existence of policies and laws aimed at minimizing plastic pollution such as Proclamation No 62/1999 & 2007 which gives the directive on fishing and fishing nets and Proclamation No. 513/1999 which banned the production and import of plastic bags with thickness of less than 0.03 mm, there is no enforcement. Additionally, there are many development partners and financiers engaged directly and indirectly on the issue of litter prevention and conservation of the lake but their activities are not coordinated. Therefore, to improve plastic waste management and prevent pollution of Lake Hawassa, priority recommendations include;

- Harmonize the existing initiatives by GIZ, CIFA, UN-HABITAT, UN Habitat, World Bank, UNDP, USAID, SOS Sahel, SIWI, etc.;
- Find a solution for plastic film (light plastic) by facilitating the process for a levy on plastic bags, exploring technical solutions for recyclers to make durable products and introducing extended producer responsibility (EPR);
- Strengthen the already existing PET recycling system by introducing/considering a deposit and refund system and EPR; and

- Find a solution for fishing nets by introducing education awareness to fishermen, providing collection points to give back old nets anonymously and supporting the enforcement capacity of existing by-laws on fishing.

Introduction

Urbanisation and economic growth are driving a tremendous increase in demand for plastics and plastic packaging, particularly in developing economies and Hawassa, Ethiopia is no exception. A lack of proper solid waste management systems and low public awareness results in littering, illegal dumpsites and consequently increased amounts of plastic waste in the environment, canals, rivers, lakes and oceans. This threatens human health, ecosystems and infrastructure yet consumption patterns are on the rise. It is estimated that production of plastic increased from 335 million tons in 2016 to 348 million tons in 2017 and the trend is expected to increase¹. This increasing plastic production and consequently increased pollution demands new systemic solutions. However, the solutions cannot be implemented without data on quantities of waste generated and how it is currently being managed but data is not readily available in many developing countries.

Stockholm International Water Institute (SIWI)'s objective was to conduct a study to provide insights into the sources, quantities and transport pathways for plastics to enter waterways and be delivered to riverine, wetland and lake environments and the governance, behaviours, management and finance that are contributing to this pollution issue. The study will be used to increase stakeholder awareness and to provide a basis for decision makers in considering steps for self-organisation and collective action to address plastic pollution in Lake Hawassa basin.

This report is the result of the study and it uses the Source-to-Sea Framework for Marine Litter Prevention also referred to as source-to-lake in the case of Lake Hawassa. Lake Hawassa is an endorheic lake, which behaves similarly to a sea where all waters draining the surrounding land areas drain into the lake. Source-to-sea management considers the entire source-to-sea system – stressing upstream and downstream environmental, social and economic linkages and stimulating coordination across sectors and segments. The primary data collected for this report was supplemented by secondary data from previous studies such as USAID baseline surveys done in 2014² and UN-Habitat assessment done in early 2019³.

The Source-to-Sea Framework for Marine Litter Prevention has a six-step cycle⁴ but the objective of this study was focussed on the first three steps as shown in (Figure 1).

¹ PlasticsEurope. (2019). Plastics - the Facts 2018. Retrieved 2019, from PlasticsEurope: https://www.plasticseurope.org/download_file/force/2367/181

² Abegaz, t., et.al. (2015): Municipal Solid Waste Characterization and Generation Rate Determination with Future Projections for Integrated Solid Waste Management Plan of Hawassa City; Hawassa (USAID)

³ The UN Habitat study (early 2019) is not yet published, reference is made to preliminary results

⁴ Mathews, R., Tengberg, A., Sjödin, J., & Liss-Lymer, B. (2019). Implementing the source-to-sea approach: A guide for practitioners. Stockholm: SIWI

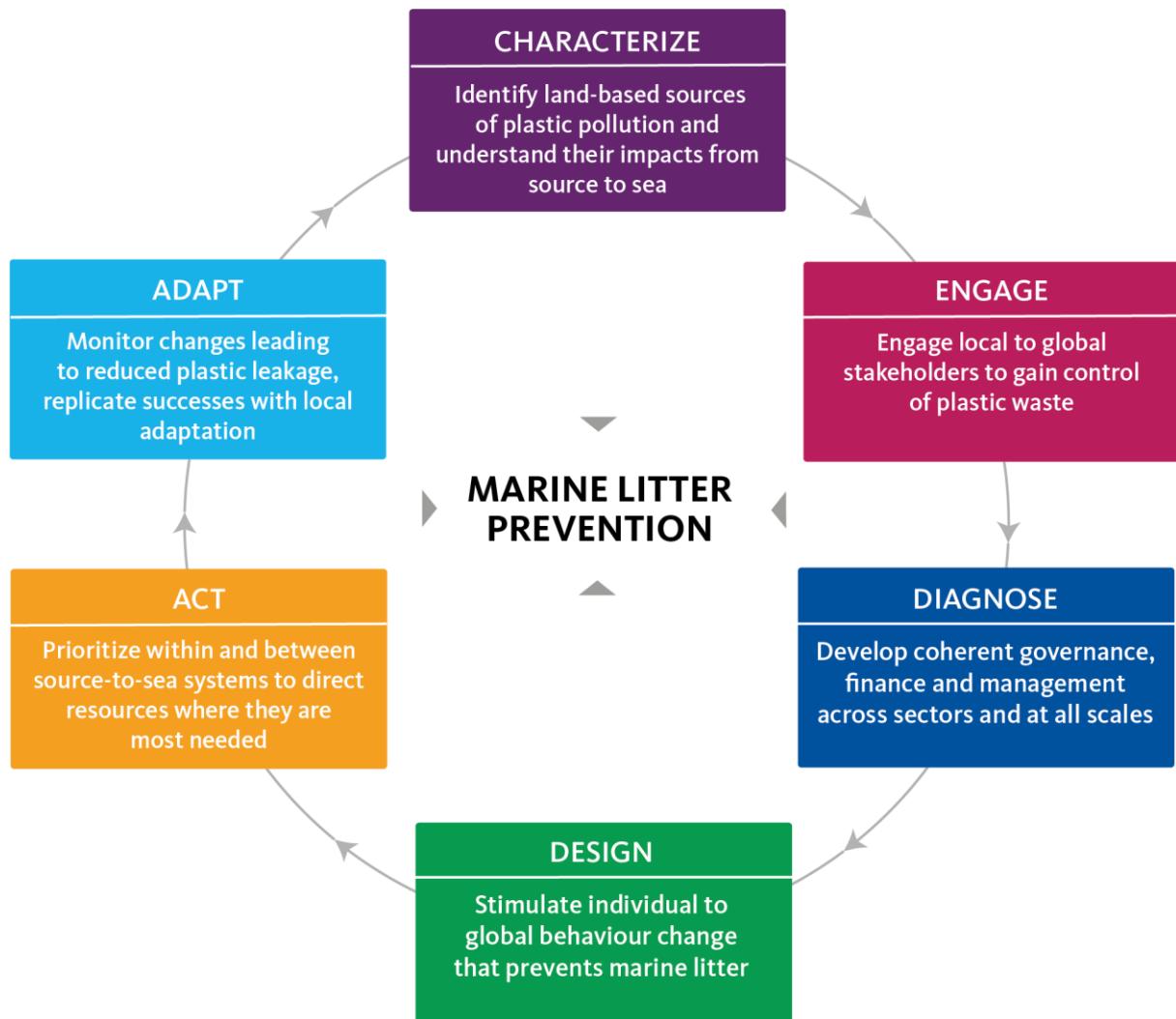


Figure 1: Six steps of Source-to-Sea Framework for Marine Litter Prevention and the study objectives in Lake Hawassa Basin

The findings of this report provide:

- The amounts of municipal solid waste (MSW) generated and collected;
- Types and amounts of plastic waste generated and the paths they follow to their final destination; impacts of plastic pollution;
- Key stakeholders (primary, targeted, enabling, supporting and external) and;
- The relevant governance system.

Methodology

The methodology is comprised of classifying the river basin into different clusters and selecting samples based on predefined guidelines, primary data collection by interviewing stakeholders and data analysis.

Classification of the study area

A detailed description and data are only available for parts of the Lake Hawassa basin i.e., Hawassa city and rural areas, which has a population of 403'025 inhabitants⁵ in an area of 157.2 km², compared to a population 839'585 in an area of 1'436 km² for the entire sub-basin⁶. Figure 2 and Figure 4 show the map of the city and the entire Hawassa basin respectively.

The city is the 6th largest in Ethiopia, located in the Southern Nations, Nationalities, and Peoples' Region (SNNP), home to Lake Hawassa and hosts over 200,000 local and international visitors yearly. The city is bordered by Lake Hawassa and Hawassa Zuria Woreda district, in the West, Oromia Region in the North, Wendo Genet Woreda in the East and Shebedino Woreda in the South. It is divided into 8 sub-cities, which are all categorized as urban except for Huwela-Tula, which is categorized as rural. Tula Town Kebele within Huwela-Tula however is considered as an urban area. See Table 1 for the population distribution in each sub-city.

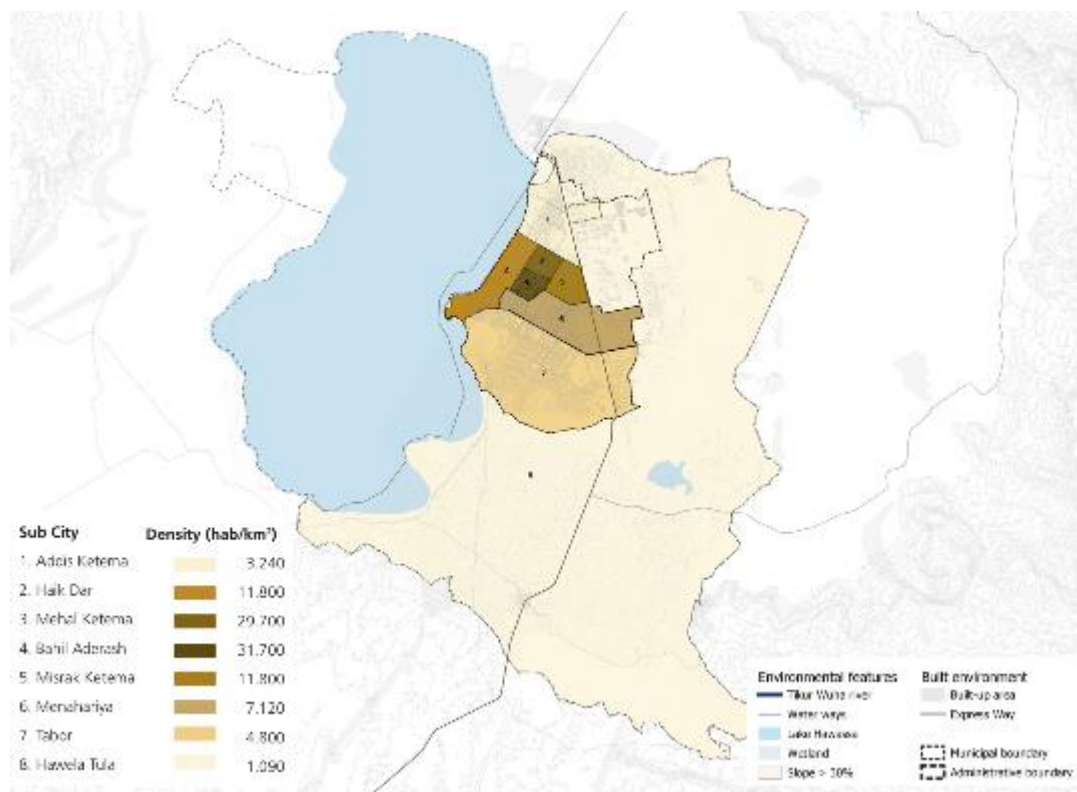


Figure 2: Administrative Map of Hawassa City Sub-Cities (Source UN-HABITAT Report)

Table 1: Population data of each sub-city and respective cluster⁵

No.	Name of Sub-cities	Population	Clusters
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⁵ Hawassa city administration, Finance and Economic Development Department ,2017

⁶ Bedilu Amare Reta, 2016: Integrated Assessments of Ecosystem Services for Sustainable Management of Natural Resources: A cases of Lake Hawassa Sub Basin (LHB), Ethiopia

1	Addis Katema	30,296	Touristic/coastal
2	Hayek Dar	29,539	
3	Mehal Katema	24,885	Urban
4	Bahil Aderash	25,237	
5	Misrak Katema	39,431	
6	Menahariya	41,645	
7	Tabor	74,057	
8	Huwela Tula: Tula Town	1,241	Urban
	Huwela Tula: Rural areas	136,694	Rural
	Total	403,025	

The table shows the names of the Hawassa's sub-cities and their respective categorisation into the three characteristic clusters of waste generation used in this study. The clusters and the criteria are described in more detail in the following chapters.

Selected sample area for each cluster

In order to describe the whole survey area a sampling approach has to be applied as resources are not sufficient to survey all sub-cities of Hawassa. In this case, three characteristic clusters have been defined as urban, rural and coastal/touristic areas. These represent the most determining characteristics in terms of waste management services, waste generation rates and consequently the likelihood of plastics to be leaked into the environment.

In more detail the selection criteria for the study area are as follows:

1. Urban centres: These are normally the areas with the highest waste generation in both per capita and total tonnage, frequently close to rivers, and with available data for waste management services. Available services tend to focus on these areas providing better service coverage and quality.
2. Low density settlements and rural areas: lower waste generation per capita, usually less waste management services, little to no data availability.
3. Coastal and/or touristic areas: Due to the proximity to the lake higher risk of direct contamination and higher sensitivity to impacts, touristic activities with a higher potential of contamination.

For this study, rural areas outside of Hawassa town could not be sampled due to time and resource limitations. Also, very limited data is available outside of Hawassa town for population densities and waste generation figures, requiring substantial baseline surveys before assessing plastic leakage potential.

Considering the selection criteria of the study clusters above, the following 5 sub-cities, (Figure 3) were selected for the survey. The selection process was supported by secondary data on waste generation rates from previous studies (see ² and ³). First mentioned in the description is the cluster to which each area is attributed to.

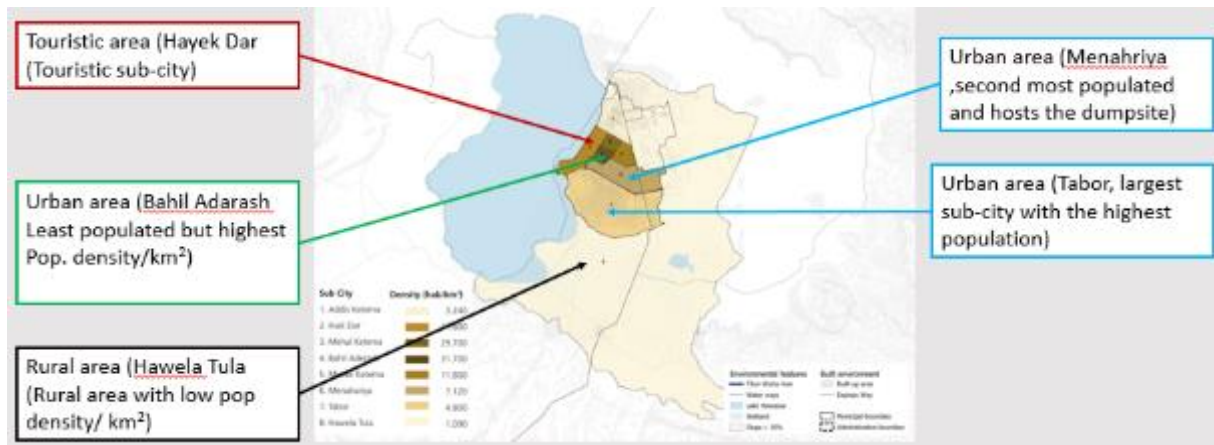


Figure 3: Sub-cities selected for the survey and their respective clusters

The initial assessment of the Hawassa Lake Basin (Figure 4) showed that the upstream communities east of Hawassa City have comparatively little impact on plastic leakage into the lake compared to the larger city. This is because these communities do not have a direct link to Lake Hawassa, due to their distance from it, and the only possibility would be direct flow of rivers/streams into the lake from these communities. However, the only river feeding Lake Hawassa from east of Hawassa city is Tikur Wuha whose source is Lake Chelekaleka located on north east side. There are no studies on plastic pollution of Lake Chelekaleka but it is assumed that the pollution would be comparatively negligible due to low population density of the lands surrounding the lake. Therefore, it is hypothesised that this river would be mainly polluted with plastic waste as it flows through the larger city into the lake.

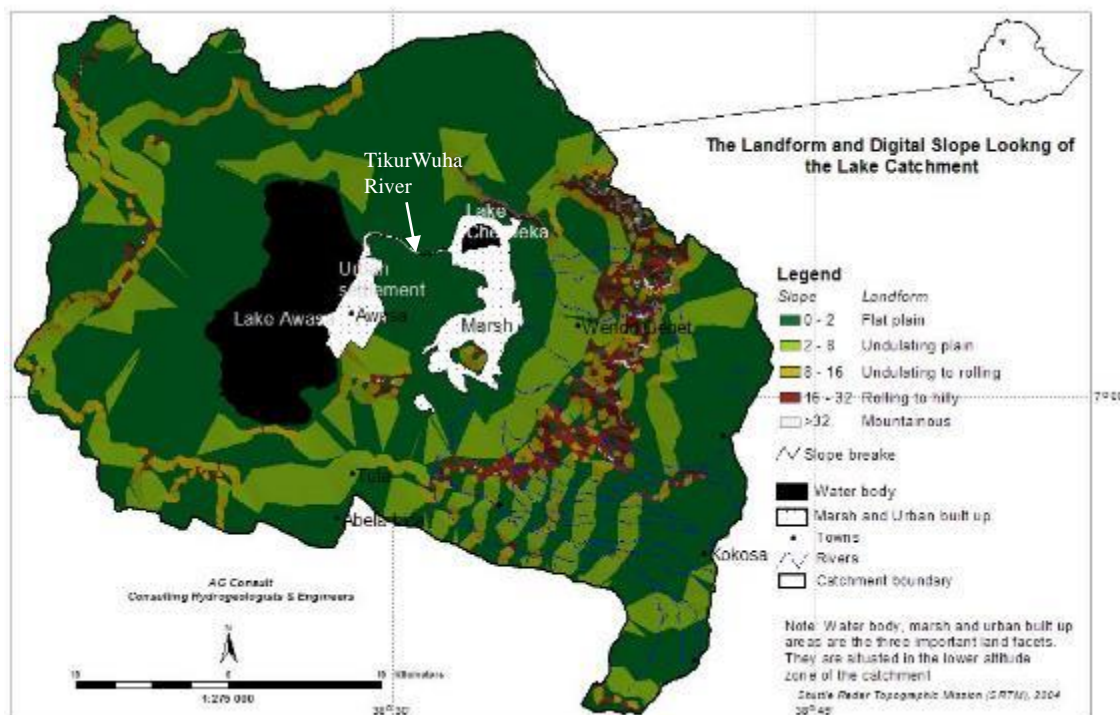


Figure 4: Map of Lake Hawassa watershed

Other waste streams such as residues from agricultural activities or medical waste are potential contributors to plastic pollution. However, during the design of the surveys no significant other sources were identified and are therefore not included in the survey. Where applicable anecdotal

and interview-based information is provided. In addition, some waste is potentially transported from rural communities to Hawassa for further processing. No detailed information about waste types and quantities could be obtained and it is assumed that quantities are negligible compared to quantities produced and processed in Hawassa city.

Data collection

The data collection exercise took place from 15 to 21 October 2019 in the selected study areas, which did not include rural Hawassa.

The selected sample areas were visited, and primary data collected through meetings and interviews with relevant categories of stakeholders:

- Primary: these include Departments of Fishery, Tourism, Health, Natural Environment and Biodiversity to determine how plastic pollution directly or indirectly affects the sectors they are responsible for.
- Targeted: these include waste collectors & transporters, businesses and recyclers (formal and informal) to determine waste collection efficiency, trends of plastic consumption and quantities of plastic waste recovered for recycling.
- Enabling: these include sub-city administration, government ministries and their regional & city representations, Rift Valley Lake Basin Authority (RVLBA) to understand the waste management system, quantities of waste generated, impacts of plastic pollution, existing policies for prevention of plastic litter and to identify hotspots of plastic pollution.

Data collected from interviews with stakeholders (Figure 5) was supplemented by observations and transect walks in various locations of sample area to identify specific potential point sources. Additionally, a waste composition survey at the landfill was conducted to determine the characteristics of waste generated in Hawassa.



Figure 5: Pictures taken during data collection exercise

Data analysis

Determining the quantities of municipal solid waste (MSW) generated

The total amount of waste generated is the sum of waste generated by households, commercial enterprises and institutions (Figure 6).

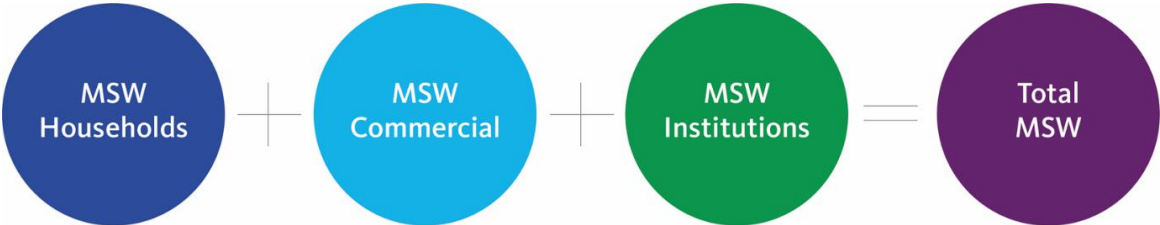


Figure 6: Components of municipal solid waste

This serves to determine the quantities of waste generated by households in the 3 cluster types in the study area; urban, rural and touristic, by multiplying the population and per capita waste generation in each category. According to the USAID (2014) baseline survey⁷, the average per-capita waste generation rate among urban residential households was found to be 0.430 kg/person/day and it is assumed that this is the same for touristic areas since they have similar conditions in terms of household waste. On the other hand, there is no study on waste generation per capita in rural Hawassa. However, the World Bank did a study, in Viet Nam, which informed that rural areas in developing countries generate approximately half of their urban counterparts⁸. Based on this, it has been estimated that rural areas in Hawassa generate approximately 0.22 kg/person/day. These are comparatively low generation rates but in line with overall tendency of low waste generation in Ethiopia. Multiplying the per capita waste generation with the population of each cluster, results in the quantities of waste generated by each as shown in the first equation below.

$$MSW \text{ by HHs in a cluster} = \text{per capita generation (kg/day)} * \text{population of the cluster}$$

In any city/area, municipal solid waste is not only generated by households but also premises which include shops & supermarkets, markets, schools, hospitals, offices, restaurants, hotels, etc. A study to determine how much waste is generated by these premises was not conducted in Hawassa. Therefore, a 30% proxy was used in calculating waste generated by commercial entities and institutions as shown in the second equation below. This is an internationally accepted methodology and has been tested in 3 cities in Kenya and Seychelles using UN-HABITAT’S SDG indicator 11.6.1 methodology.

$$MSW \text{ by premises in a cluster} = \frac{\text{Amount generated by HHs}}{1 - 0.3} - \text{Amount generated by HHs}$$

⁷ Baseline Survey On “Knowledge, Attitude, and Practice (KAP) of Communities and Institutions On Waste Management Of Hawassa City And The Lake”

⁸ World Bank, Ministry of Natural Resources and Environment and Waste-Eco Project (2004) Vietnam Environment monitor 2004. World Bank, Hanoi

Once the total waste generated was determined, per capita waste generation rate for the whole of Hawassa was determined by dividing the total waste generated and the total population for Hawassa (403,025)

Determining household (HH) waste composition at source and disposal site

In order to determine the amounts of plastic waste generated, a waste composition survey was necessary. Due to time constraints and the scope of the study, household waste composition was not conducted at the source but at the disposal site. Since the Waste Flow Diagram tool used for data analysis requires HHs composition either at source or at disposal site, data from USAID (2014)² was used for the composition at source. Noting that this dated 5 years ago, traders of plastic materials were interviewed to determine whether the consumption of plastics had changed over time.

On the other hand, it was possible to characterize the composition of household waste arriving at the disposal site. Figure 7 shows a picture taken during the exercise. The characterization was done for household waste from two of the selected clusters: urban areas (Bahil Aderash, Menahariya, and Tabor) and touristic area (Hayek Dar) Household waste from the rural cluster (Huwela-Tula) was not characterized since there is neither an established waste collection system nor a designated disposal site. The methodology used for waste composition is the quartering method from SDG indicator 11.6.1 methodology. Refer to Annex 1 for the step by step guide on how the quartering methodology works.



Figure 7: Picture taken during waste composition assessment at Hawassa Disposal site in 2019

Determining the quantities and fates of collected and uncollected plastic waste

The Waste Flow Diagram (WFD) tool, still under development through a collaboration between GIZ, the University of Leeds, Eawag and Wasteaware, was used for data analysis and to determine the amount of collected and uncollected plastic waste. This technique uses the following data sets

amongst others to determine quantities. Analyses were done based on interviews with stakeholders, field visits and expert assessment.

- Population for the study area and per cluster (StA)
- Waste composition at source/ disposal site
- Total amounts of waste disposed in landfill
- Specific data for plastic includes:
 - Total plastic waste generated (obtained from household waste composition)
 - Total plastic waste collected for recycling and disposal (obtained from interviews with recyclers; both formal and informal and waste composition at disposal site)
 - Total plastic waste uncollected (difference between total amounts generated and collected).
- Qualitative assessment of plastic leakage and fates transmission factors (by assessing the presence of plastic in the environment through observation)

These data sets are entered into the tool and it generates the desired outputs with data on quantities of managed and unmanaged plastic waste.

Description of land-based sources of lake litter

Waste generation rate

The diagram below, Figure 8, depicts the waste generation rate in Hawassa. The total waste generated is the sum of waste generated by urban, touristic and rural households (HHs) and the premises (Commercial centres and institutions).



Figure 8: Waste generation distribution per cluster in the study area

Using the methods described in the methodology section and with an estimated population of 206,496, 59,835 and 136,694 in urban, touristic and rural areas of Hawassa City, respectively, it was

determined that the total municipal solid waste generated by households is 89, 26 and 29 t/day, respectively. Thus, total waste generated by households in Hawassa is 144 t/day. It was determined that premises in Hawassa generate 62 t/day (38 t/day, 11 t/day and 13 t/day in urban, touristic and rural areas, respectively). Summing the waste generated by households and premises gives a total waste generated of **206 t/day**. With a total population of 403,025, this translates to per capita waste generation of **0.51 kg/person/day (0.61 kg/person/day in urban and touristic areas and 0.31 kg/person/day in rural areas)**. While there are other sources of waste (e.g. hospital and industrial waste) these are summarized in the estimates of waste from premises. There is no detailed quantification survey for these particular waste streams. **The results of the waste generation assessment are presented in Table 2.**

Table 2: Breakdown on quantities and per capita generation in the study area

Study area		Quantities of waste generated (t/day)			Per capita generation (kg/day)
		Households	Premises	Total	
Urban	Population 206,496	89	38	127	0.62
Touristic	59,835	26	11	37	0.62
Rural	136,694	29	13	42	0.31
Total		144	62	206	
		Weighted Average			0.51

Waste composition at the household and landfill within the study areas

Household waste composition at source in urban and touristic areas

The findings of household waste composition at source is as shown in Figure 9. At this stage, it is not possible to distinguish between composition at source for urban and touristic areas since the past studies have always clustered them as one.

The 2014 survey showed that household waste contains up to 5% plastics, and a very significant amount of ash and dust, 43%, that would probably contribute to silting of Lake Hawassa.

It is important to note that this was the composition 5 years ago and plastic consumption patterns have changed over the years. During the primary data collection survey, interviews conducted with plastic suppliers revealed that plastic consumption patterns have changed over the last 5 years. They assumed that as of today double the amount of plastics are used and discharged as waste. This was corroborated by the findings of HH waste composition at the disposal site presented in section 0. Therefore, a simulation of HH waste composition, particularly plastics, in 2019 has been developed based on expert assessment, see Figure 9.

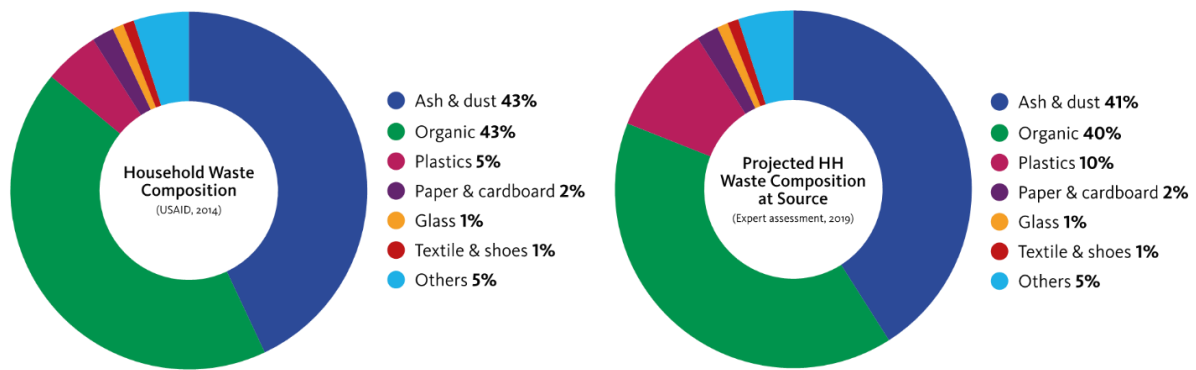


Figure 9: Household waste composition in 2014, Source, USAID and 2019

Household waste composition at source in rural areas

Data on household waste composition in rural areas of Hawassa is not available, therefore quantification is not possible. The only possibility is anecdotal qualitative data based on interviews with relevant stakeholders.

The rural kebelles, small administrative units, in Hawassa have not yet received municipality services (due to pending budget approval from Hawassa City Administration), therefore, no formal waste collection is done.

According to the local administration, the waste generated is mostly organic mirroring the rural lifestyle of the Kebeles. The organics are used as an organic fertilizer (composted or direct) and the excess is dumped. Plastic bags are the main items co-disposed of with the unused organic matter. Additionally, there are agricultural activities and plastic pesticide packaging (plastic bottles and sachets) that can be expected to be generated. Since there is neither waste collection services nor designated disposal sites, these plastic packaging materials are most likely to end up on land or in waterways that could lead to Lake Hawassa.

Household waste composition at disposal site

The results of household waste composition at the disposal site (Figure 10) indicates that plastic waste in urban and touristic areas are 8% and 11%, respectively.

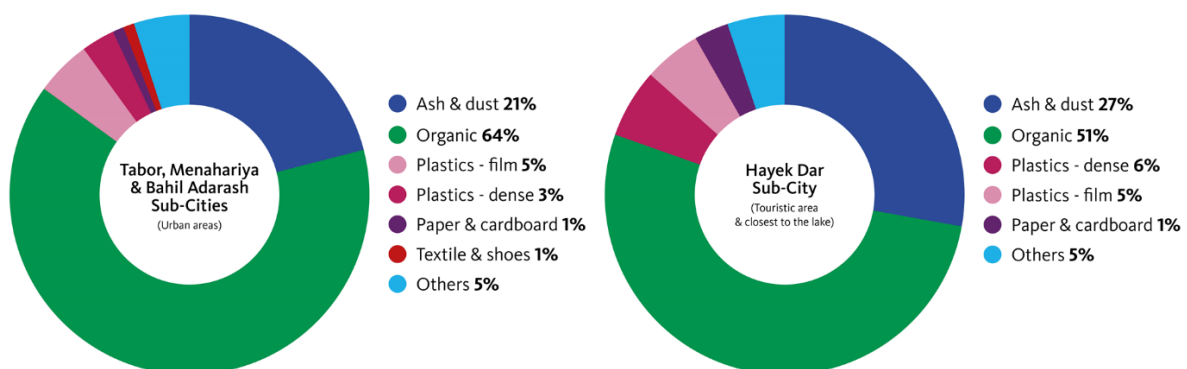


Figure 10: Results of the waste composition at disposal site

The study segregated light from dense plastic, since light plastics can easily be blown away into the environment. In urban areas, light plastics form the highest percentage of MSW for plastic waste with 5% compared to 3% heavy plastic while in touristic areas, heavy plastics are the majority at 6% compared to 5% light plastics.

Description of waste collection

Table 3 shows the amounts of waste collected per cluster. Since there is no weighing bridge at the disposal site, the values of the amount of waste collected are based on the interviews with sub-city administrators and waste collection companies.

Table 3: Quantities of waste generated and collected

No.	Name of Clusters	Category	Population	Per capita generation rate (kg/day)	Waste generated (t/day)	Collected (t/day)	Uncollected (t/day)
1	Hayek Dar	Touristic	29,539	0.62	18	10	9
2	Bahil Aderash	Urban	25,237	0.62	15	7	8
3	Menahariya		41,645		25	21	4
4	Tabor		74,057		45	13	32
5	Tula town		1,241		1	1	0
6	Huwela (Rural)	Rural	136,694	0.31	42	0	42
	Total		308413		147	52	95
						% collected waste	35%
						% uncollected waste	65%

Figure 11 presents a visualisation of the data in Table 3. Up to 53% and 49% of waste generated in touristic and urban areas, respectively, is collected while there is no collection in rural areas. Overall, the results indicate that only 35% of all the waste generated is collected while 65% is uncollected in Hawassa. Given that the total amount of MSW generated is 206 t/day, this implies that only 73 t/day of waste is collected and up to 133 t/day is not collected.

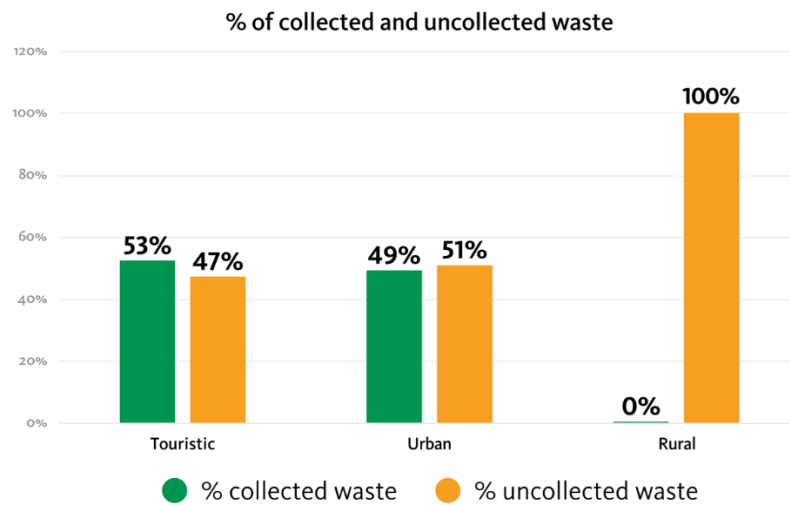


Figure 11: Percentage of collected and uncollected waste in the categories of study area

Plastic waste management

Types of plastic waste generated in Hawassa

The following types of plastic waste are generated in Hawassa; dense/heavy plastic (HDPE, LDPE, PP & PET), film/ light plastic (plastic bags, wrappers, etc) and fishing nets (Figure 12). PET is a special kind of plastic in Hawassa not only in terms of significant amounts generated but also its high market value leading to large amounts being collected and processed for recycling.





Figure 12: Photos of plastic waste types

Quantities of plastic waste generated

Using waste composition data at the disposal site, plastic waste makes up 8% of the waste disposed. This value was used to calculate the proportion of plastic waste generated in urban areas i.e., 8% of the total waste generated (127 t/day). This gives an average of 10.16 t/day of plastic waste in urban areas, out of which 63% (6.4 t/day) and 38% (3.9 t/day) are light and heavy plastics, respectively. The total waste generated in touristic areas is 37 t/day and the proportion of plastic waste is 11% (4 t/day). Out of this, 45% (1.8 t/day) and 55% (2.2 t/day) are light and heavy plastics, respectively. Since no data is available for rural areas, it was assumed that their generation rate is half that of urban i.e., 4%, 1.68 t/day, of all waste generated is plastic. Another assumption is that the majority of this plastic waste is light plastics, up to 90%, based on interviews with stakeholders. This narrative is presented in Table 4 .

Table 4: Summary on the quantities of plastic waste generated in each cluster

Cluster	Total MSW* generated (t/day)	Proportion of plastic (%)	Plastic generated (t/day)		
			Quantity of plastic	Light	Heavy
Urban	127	8%	10.16	6.35	3.81
Touristic	37	11%	4.07	1.85	2.22
Rural	42	4%	1.68	1.51	0.17
Total			15.91	9.71	6.20

* Total MSW: Households and Premises

Fishing nets also contribute to the quantities of plastic waste generated and the amounts were determined by weighing the nets and through interviews with stakeholders. For a detailed step by step guide on how the quantity of fishing nets were determined, refer to Annex 2.

The summary of the average quantities and types of plastic waste generated in Hawassa is presented in Figure 13.

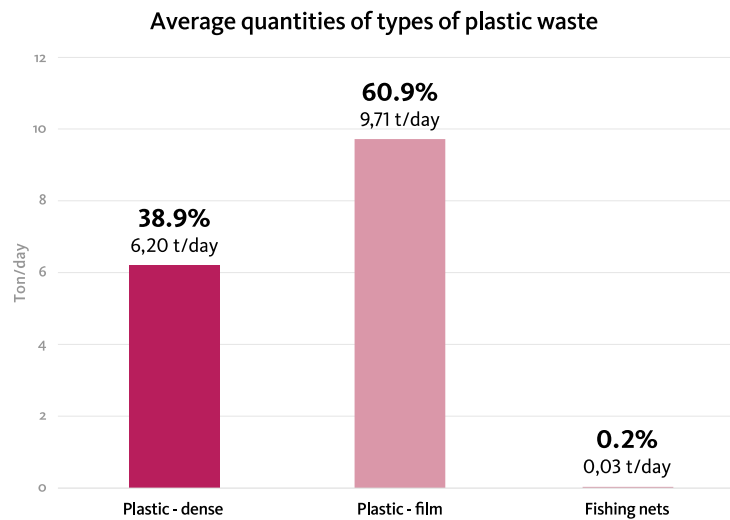


Figure 13: Summary of the average quantities of plastic waste generated in Hawassa

Managed and unmanaged plastic waste

The total plastics waste generated in Hawassa is 15.91 t/day. It is important to know how much of plastic waste generated is collected (managed) & uncollected (unmanaged) and the final destination of plastics in both scenarios. Collection and management of plastic waste is similar in urban and touristic areas and therefore it is not practical to present them separately. On the other hand, there is no waste management system in the rural areas and therefore, it can only be assumed that all the waste generated from there ends up in the environment or water bodies and analysis beyond this is not possible. Thus, the next section of the report only present results from urban and touristic areas.

In order to determine the quantities of collected & uncollected plastic waste and their final destination in urban and touristic areas, a waste flow diagram tool was used. A detailed description of this tool was presented in the methodology section. The result is presented in Table 5 and all values are in tons/year.

Table 5: Waste flow diagram-plastic waste management results

	Plastic waste	
	Urban and touristic	Unit
Waste generation	5,152	Tonnes/year
Collected waste	1,648	Tonnes/year
Percent of waste collected	32%	% of waste generation
Uncollected waste	3,504	Tonnes/year
Percent of waste uncollected	68%	% of waste generation
Waste recovered for treatment	1,098	Tonnes/year
Percent of waste recovered or exported for treatment	21%	% of waste generation
Sorted for recycling by formal sector	8%	% of waste generation
Sorted for recycling by informal sector	13%	% of waste generation
Energy from waste & SRF co-processing	0%	% of waste generation
Sorting for reprocessing managed in controlled facilities	1,098	Tonnes/year
Energy from waste managed in controlled facilities	0	Tonnes/year
Waste disposed in landfill or dumpsites	493	Tonnes/year
Percent of waste disposed in landfill or dumpsites	10%	% of waste generation

According to the waste flow diagram, 32% and 68% of all the plastic waste generated in urban and touristic areas is collected and uncollected, respectively. This translates to 4.5 t/day and 9.7 t/day of plastic waste collected and uncollected, respectively.

The fates of collected plastic

Collected plastic waste could end up in various places; disposal site, treatment/recovery facility or environment through leakage during transportation & treatment process and illegal dumping. See Figure 14.



Figure 14: Collected plastics may end up illegally dumped on the roadsides, disposal site or in recovery facilities

According to the waste flow diagram, of all the plastic waste collected, 10% and 21% end up at the disposal site and recovery facilities respectively (Figure 15). The missing amount, 1%, is leaked during collection, transportation and treatment and is taken care of under mismanaged plastic waste, presented in the subsequent section of the report.

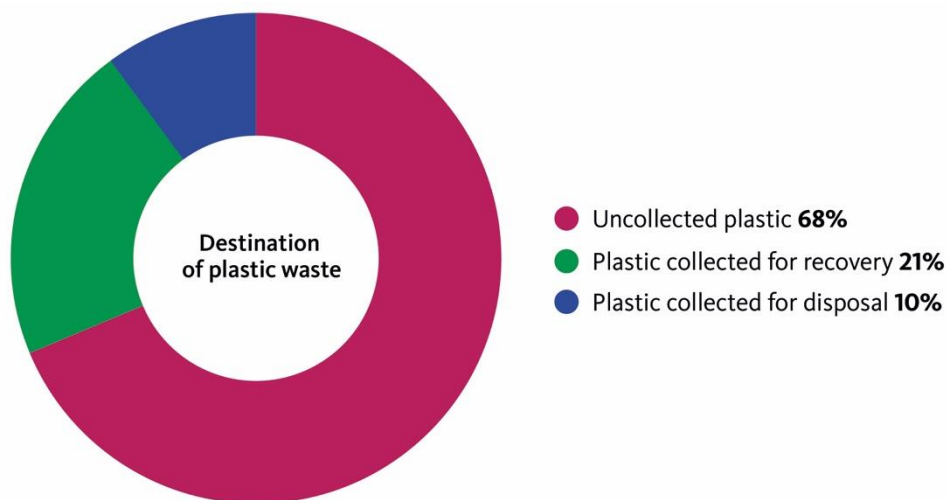


Figure 15: Destination of collected plastic waste

There are five actors in plastic recycling in Hawassa but the main ones are: Wubet Plastics, Abarcoda, and Tekie. Their collection capacity is as shown in Table 6. Approximately 3 t/day of plastic waste is collected for recovery. However, the recovery process is not 100% efficient and there is a small

amount, 4%, that is lost as rejects. The informal sector plays a key role in collection of recyclables since they collect up to 1.95 t/day, 65%, of the plastic collected for recovery.

Table 6: The types, amounts and players in plastic recycling the amount and types of plastic waste collected for recovery (Source: Interviews with stakeholders)

Material/recovery facility name	Type of plastic waste	Amount of material received (t/day)	Amount of residue (t/day)
Wubet Plastics	HDPE, LDPE, PP	0.040	0.002
	PET	1.000	0.035
Abarcorda	HDPE	0.200	0.010
	LDPE	0.500	0.025
	PP	0.014	0.001
	PET	0.003	0.000
Cool plastics	HDPE, LDPE	0.170	0.09
Shalom	PET	0.067	0.002
Luwit	HDPE, LDPE	0.013	0.001
Tekie	HDPE, LDPE	1.000	0.050
Total collected for recycling		3.01	0.13
Total actually recycled (3.01-0.13)		2.87	

The fates of uncollected plastic waste

Up to 9.7 t/day of plastic waste are left uncollected in urban and touristic areas of Hawassa. These may end up in drains, a dumpsite, land or Lake Hawassa as depicted in Figure 16.



Figure 16: Uncollected plastic waste on land, drainage and Lake Hawassa

Unlike collected plastic waste that follows a clear path towards its final destination, uncollected waste may end up in various unknown locations. Therefore, in order to quantify the destination of uncollected plastic waste, the waste flow diagram was used and the detailed narrative of results are presented in Table 7. All values are in tons/year.

Table 7: Waste flow diagram- mismanaged plastic waste results

	Plastic waste	
	Urban and Touristic	Unit
Mismanaged plastic waste (uncollected or leaked)	3,562	Tonnes/year
Percent of mismanaged plastic waste (uncollected or leaked)	69%	% of plastic waste generation
Percent contribution from uncollected waste	98.38%	% of mismanaged plastic waste
Percent contribution from formal collection leakage	0.00%	% of mismanaged plastic waste
Percent contribution from informal collection leakage	1.01%	% of mismanaged plastic waste
Percent contribution from formal treatment	0.01%	% of mismanaged plastic waste
Percent contribution from informal treatment	0.55%	% of mismanaged plastic waste
Percent contribution from transportation to disposal	0.05%	% of mismanaged plastic waste
Percent contribution from landfill or dumpsites	0.00%	% of mismanaged plastic waste
Plastic waste retained on land	2,038	Tonnes/year
Plastic waste retained on land	56%	% of mismanaged plastic waste
Plastic waste openly burnt	876	Tonnes/year
Plastic waste openly burnt	25%	% of mismanaged plastic waste
Plastic waste retained in drains	19	Tonnes/year
Plastic waste retained in drains	1%	% of mismanaged plastic waste
Plastic waste to waterways	628	Tonnes/year
Plastic waste to waterways	18%	% of mismanaged plastic waste
Percent transported overland or dumped in waterways	22%	% of plastic in waterways
Percent entering waterways via storm drains	78%	% of plastic in waterways

The results show that the main contribution to unmanaged waste is from uncollected waste (average of 98%) and that other leakages are comparatively insignificant. The above results are better explained when visualised in a sankey diagram, Figure 17.

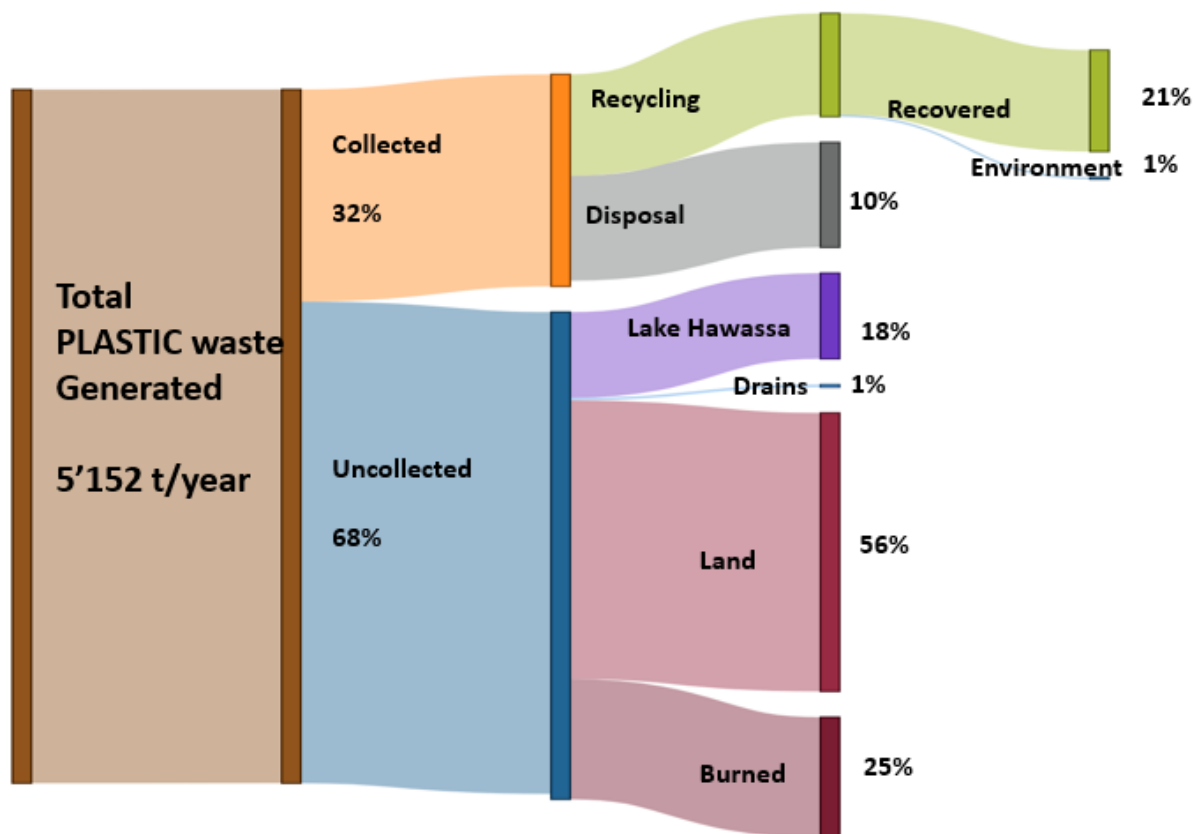


Figure 17: Plastic waste flow diagram for urban and touristic areas in Hawassa

The results indicate that significant amounts of uncollected plastic waste, 56%, are left on land i.e., it is uncollected and disposed of on land wherever convenient. Since plastics never truly decompose, it is assumed that plastic left on land would eventually break down into smaller bits which can then be washed by rainfall into the lake. It is important to notice that the waste flow diagram does not provide transport mechanisms and fates for microplastics, such as particles from larger pieces of plastic. Additionally, it was confirmed that domestic animals, e.g., cows, goats, donkeys, etc. usually consume the light plastics causing severe health problems and low productivity of milk for dairy farmers. It is also possible that some portion of plastic left on land could eventually get buried thus affecting soil fertility for agriculture.

Twenty-five per cent, 18% and 01% of plastic waste is burned, ends up in Lake Hawassa and in drains, respectively. Though a small percentage of plastic waste is left stuck in drains, it is important to note that drains are the main transmitters of plastic into Lake Hawassa.

It was hypothesised that plastic waste dumped in the disposal site of Hawassa, particularly light plastics, could be easily blown to the environment and to the lake. Interestingly, the waste flow diagram indicates that there is no leakage from the disposal site to the environment or Lake Hawassa. This is due to factors such as an existence of a boundary wall at the disposal site and the distance between the Lake and the disposal, up to 5 kms (Figure 18).

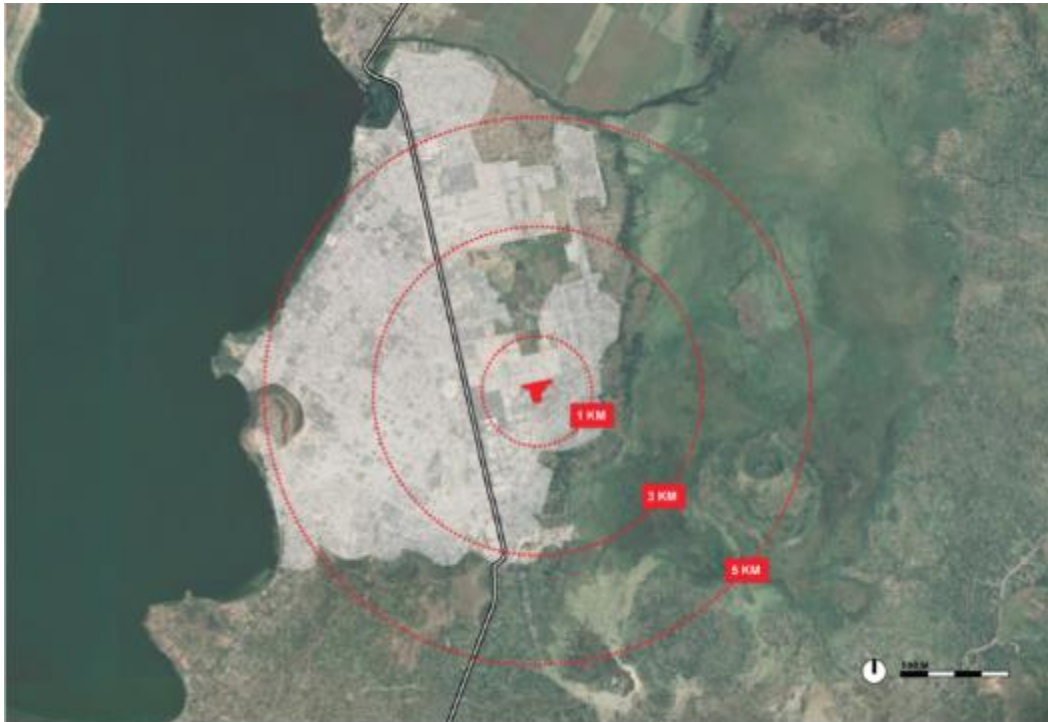


Figure 18: Hawassa municipal dumpsite location and distances map

Mapping of hotspots

As shown above, up to 12% (1.68 t/day) and 0.4% (0.56 t/day) of all uncollected plastic waste ends up in Lake Hawassa and in drains, respectively. The interviews with stakeholders indicated that the major hotspots of pollution affecting Lake Hawassa are storm water drains discharging into it. Fishermen and city/sub-city officials often identify the following four: Amora Gedel, Referral Hospital, Addis Ketema (Industry Zone) and Piazza.⁹ Related to storm drains and other discharges into the lake, the GIZ International Water Stewardship Programme IWaSP¹⁰ Solid Waste Management Joint Design Workshop relates to six “inlets” to the lake.¹¹ Of these, five stretches were identified for in-depth analysis and intervention, namely: Addis Gebeya-Referral Hospital; Mountain Snack-Amora Gedel; Gabriel Church- Medhanyalem Church; South Star Hotel-Global Garage; and Regional Finance Bureau-Shoaber.¹² On the basis of this evaluation, the Mountain Snack-Amora

⁹ Interview held with Dawit Abraha, Chairman Lake Hawassa Fishers’ Association (October 16, 2019).

¹⁰ IWaSP is an international water security programme which sought to combine global best practices in water stewardship with local know-how. It is a seven-year programme (2013-2019) which facilitates partnerships between the public sector, the private sector and civil society. The programme is active in nine countries: Ethiopia, Kenya, Uganda, Tanzania, Zambia and South Africa on the African continent, Pakistan on the Asian continent and Grenada and Saint Lucia in the Caribbean. In Ethiopia, its flagship project was “Protecting Lake Hawassa” initiative.

¹¹ Report of workshop held on February 12, 2018.

¹² The GIZ IWaSP project followed through its MSW Joint Design Workshop held on Feb 12, 2018 with a field assessment of five pre-selected sites for the SWM project in the period March 28-29, 2018. The work involved visual surveys and a comparative analysis of the sites against a set of criteria: impact; stakeholder interest; risk; and budget.

Gedel stretch was selected for intervention for 2018 as, according to the assessment, “Amora Gedel is a site of high value in terms of tourism, cultural and economic activities, and an important symbol of Hawassa city.”¹³ The illegal dumping of waste and street littering will eventually find its way into the storm drains if not collected; hence, it won’t be considered as a separate hotspot for plastics per se.

Other land-based hotspots and potential sources of direct plastic pollution into the lake are the following:

- a) **Fikir Haik and Amora Gedel:** This results from direct littering of the lakeshore and its vicinity by visitors with PET bottles, plastic bags, wrappers, etc., as was also observed by the study team during the field work.
- b) **Fishing on Lake Hawassa:** The field study found that fishing itself generates direct plastic leakage (debris) into the lake by way of end-of-life nets disposed of into the lake. The individual unit of the net measures 3m x 15m and up to 6-7 of these (on average) are attached to make, a bigger net on average of 3 m x 100 m. The big nets weigh up to 4 kg (excluding accessories such as ropes and floats). The average lifespan of the most prevalent (illegal) nets is only one year and they are abandoned in the lake at the end of their service.¹⁴ Annex 2 shows an estimate of the fishing net debris disposal rate into the lake.
- c) **Hawassa dumpsite:** Quite a substantial quantity of plastics (mainly plastic bags, PET bottles) ends up in the dumpsite as verified through visual observation, waste characterisation test and interview with waste collectors. While the valuable plastic is collected and sold to Hawassa Wubet Solid Waste Removal and Recycling Association, plastic bags, wrappers and other bits and pieces of plastics are uncollected. There is a potential for these to be blown or washed away and for some to find its way into waterways and the lake.
- d) **Plastic recyclers:** Three plastic recyclers work on or close to the dumpsite (Hawassa Wubet, Abacoda and Cool). As recyclers of post-consumer waste, they are, in the main, helping prevent plastic littering and leakage in the surrounding environment and the lake. However, as their business requires them to collect and store plastics, their sites are potential spots for plastic leakage. Of the various plastics accumulated, of immediate concern are PET bottle labels, which are removed and kept in the open. The labels weigh only 1 g on average and have a gauge size of 10 µm.¹⁵ They could easily be blown away by wind and could find their way into stormwater drains and eventually into the lake.
- e) **Plastic factories:** These are companies which are engaged in making household plastic items from virgin plastic resins. Although they normally do pre-consumer waste recycling, they also generate plastic waste that is not fit for this purpose. The way this waste is stored and transported to other recyclers can be a potential source of leakage of plastics including PP, LDPE, LLDPE and HDPE types.¹⁶

¹³ *Ibid.*

¹⁴ In a rapid assessment the Hawassa City Administration, Environment Office (Bio-diversity Unit) did in April 2019, they found 1690 illegal nets and only 240 legal nets (Interview with Rahel Sisay, October 21, 2019)

¹⁵ Courtesy of test performed by Mr. Abate Hailu, Lecturer, Water Supply and Environmental Engineering Department, Hawassa University (E-mail dated October 21, 2019)

¹⁶ The study team visited Ameze Plastic Factory on October 21, 2019 and had discussions with its technical people and got some insight about how the pre-consumer recycling works. It was learnt that the “un-fit” fraction is sold to other recyclers in Addis Ababa, which process it to get acceptable consistency and use it to make lower quality products.

The following additional sources of plastic waste were identified by participants during the RVLBDO-SIWI-GIZ workshop on “Source-to-Lake Management: Addressing Solid Waste and Plastic Litter in Lake Hawassa Basin, Ethiopia” held in Hawassa on 24 October 2019:

- Polyethylene tubes used in seedling nurseries (PE film)¹⁷
- Universities and schools
- Government offices, especially conferences and meetings held by government and political parties
- Bus stations
- Road-side markets and bazaars
- Construction sector (PVC conduits and other plastics)
- Specific localities: Kebecho market, Tikur Wuha area, Tula 01, Cheleleka springs
- Agrochemical plastic packaging (fertilizers and pesticides): PP fertilizer bags and pesticides packaging plastic sachets and bottles
- Plastic waste generated from hospitals and clinics
- Irrigation pipes and plastics from water harvesting projects

Description of impacts of plastic pollution and lake litter

Following the Source-to-Sea Framework for Marine Litter Prevention (p. 17), impacts of plastic pollution on Lake Hawassa and its surroundings are as presented in

Table 8.

Some of the impacts discussed are “real” in the sense that they have an obvious and short causal chain. For that reason, they often were mentioned by officials and experts interviewed during the field mission and get reported by various studies cited in this work. Others, such as the risk of micro-plastics to human health and bioaccumulation of toxic substances, can only be “inferred” at this stage. The basis for that argument is the observable accumulation of plastics in the lake and the soil and some sewage reportedly being discharged into the lake. This is an area that needs more scientific research as the pathways and causal chains along the food chain is rather complicated and could not be concretely established within the scope of this study. This is also a relatively new scientific research area globally. Yet another challenge relates to “attribution”. For instance, although we know MSW accumulation is blocking waterways and causing flooding and water stagnation, how much of the infrastructural damage and malaria incidences and ensuing costs, can we attribute to just plastics? For that reason, any such risks are reported in

¹⁷ This is relevant country wide, not just Hawassa. Ethiopia claimed, it planted four billion seedlings in 2011(Ethiopian calendar) and planning to plant five billion this year (2012 Ethiopian calendar). Cool Plastics Recycling in Hawassa makes these materials.

Table 8 as “potential”.

Table 8: Impacts of plastic pollution and lake litter

DIRECT	INDIRECT
Economic losses	
<p>Increase in cost of clean-up: Plastic bags and PET bottles appear in significant proportion in Hawassa city MSW. With littering and illegal dumping, the municipality (and local sub-city administrators) need to pay more for clean-ups of roads in the city.</p> <p>Direct clean-up and opportunity cost for fishermen: Fishermen of Lake Hawassa say they engage in regular clean-ups and pay money to remove the garbage collected. The Lake Hawassa Fishers’ Cooperative claims it engages its members in twice-weekly clean-ups. It estimates its monthly cost of this at about ETB 50,000 (ETB 40,000 for garbage collection and ETB 10,000 for time opportunity cost)¹⁸. The Biodiversity unit of Hawassa City Administration confirmed that up to 15 fishermen join them in the regular monthly campaign on a voluntary basis.</p>	
Biota and ecosystems	
<p>Pressure on aquatic species (potential): The MSW debris including the significant plastic waste (plastic bags and abandoned fishing nets) can cause entanglement of fish and smothering of organisms. For example, a type of fish called <i>Bilcha</i> is said to be highly affected (contaminated) as a result of pollution of the lake to the extent that fishers will throw it back if they catch it.¹⁹</p> <p>Animals (cattle, goat and donkeys) commonly forage in dumpsites on vegetable matter. This is a common sight in the Hawassa dumpsite. Animals face the risk of choking and blocking of their digestive system.</p>	<p>Bioaccumulation of toxic substances (potential): One environmental expert at the Rift Valley Lakes Supervising Authority mentioned potential bioaccumulation of toxic substances in fish</p>
Infrastructure and disaster risk	

¹⁸ The Cooperative has 495 members (fishermen)- according to Dawit Abraha, chairman of the Cooperative (October 16, 2019)

¹⁹ Participant feedback in SIWI-GIZ workshop on “Source-to-Lake Management: Addressing Solid Waste and Plastic Litter in Lake Hawassa Basin, Ethiopia” held in Hawassa on 24 October 2019.

DIRECT	INDIRECT
<p>Increased risk of flooding due to blockage of storm water drainage: This is a major risk item during the rainy season. Frequent flooding in the Tabor sub-City Administration was cited. The city municipality reported increased costs due to deployment of vacuum trucks to flooded areas and being on constant guard to respond to emergency situations.²⁰ During the rainy season, the sub-City needs to do clean-ups every week in contrast to that done quarterly during the dry season. Three of the 5 <i>Kebelles</i> are affected by flooding. The Tabor sub-City usually encounters a shortfall of budget 7-8 months into the financial year and needs to be subsidised by the city municipality.</p> <p>Higher cost of flood damage (potential): This is due to the damage done to main (tarred) road and of flooded households. This has been, for instance, reported by the Tabor sub-City administration.</p>	<p>Higher maintenance and clean-up costs for storm-water drainage: The stormwater drains and the trash traps require frequent maintenance as they get blocked by MSW (of which plastics are a part) due to littering and illegal dumping of waste in the drains.²¹</p>
Human health	
<p>Increased risk of malaria outbreak: Along with other MSW, plastics tend to block the city’s storm water drains. The stagnant water then creates a suitable breeding ground for mosquitoes resulting in malaria outbreaks.²²</p> <p>Risk of micro-plastics consumption through the food-chain (potential): The potential risk factors for these are the numerous (illegal) flimsy plastic bags that find their way into the lake and the soil, the fishing nets that are directly abandoned in the lake; sewage that reportedly finds its way into the lake from nearby hotels²³. Sewage from the high-end hotels and resorts can be expected to contain micro-plastics resulting from toothpaste, detergents, cosmetics that eventually find their way into the sewage discharged.</p> <p>Health risk to humans due to contaminated milk (potential): Urban dairy (keeping free-grazing cows) is</p>	<p>Contamination through water-based food (potential): Fish and vegetables grown along the lakeshore using the lake water can potentially be contaminated by micro-plastics.²⁵</p> <p>Higher expenses of public health (potential): Without forgetting the challenges arising from “attribution” as discussed above, public health expenses arising from malaria outbreaks caused by blocked waterways and resultant stagnant water need to be mentioned here. Flooding can also cause other water borne diseases.</p>

²⁰Interview held with Sime Se’amo, Tabor sub-City Cleaning and Beautification Coordinator

²¹ SLR Global Environmental Solutions (2018). *Stormwater contaminant removal: Techno-economic review*

²² This has been reported by some of the sub-City Administration officials we talked to (e.g. Tabor). Hawassa reportedly experienced malaria outbreak in the last rainy season (June-Aug 2019).

²³ Interview with Birru Woshe, Hawassa City, Environment Department, Impact Assessment and Pollution Control expert (October 21.2019)

²⁵ The micro-plastics could come directly from sewage discharged into the lake (containing toothpaste, cosmetic, detergent & other cleaning products) or particles arising from a process of abrasion and disintegration.

DIRECT	INDIRECT
common practice in Hawassa. This brings the risk of contamination of milk through toxins attached or found in plastics as the risk of plastic ingestion is likely. ²⁴	
Quality of life	
<p>Decreased quality of recreational services: Plastic blight on the shores of Lake Hawassa has the potential to decrease the quality of recreational services, especially in the area of “Fikir Haik”- a popular attraction. The city’s Culture, Tourism & Sports Department recognises this as one emerging problem; they rally their registered member organisations (about 15) to carry-out lakeside clean-ups three times a week.²⁶ See Annex 4 for a list of these organisations.</p> <p>In addition, open-dumping and open burning of waste (which happens in Hawassa to a certain extent) has the potential to blemish the image of Hawassa and reduce quality of life (foul air, etc.).</p>	<p>Reduction of aesthetic value and beauty of the lake: The city prides itself as a green and clean city and it has won about 6 awards in the city forum competition.²⁷ “Increase in waste and sediment loads in the stormwater runoff puts the lake, and subsequently a significant portion of Hawassa’s economic activity, in jeopardy as without the drawcard of a picturesque lake, tourism is likely to decline.”²⁸</p>

Stakeholders

The stakeholder mapping is organised based on the Source-to-Sea Framework for Marine Litter Prevention depicted in Figure 19. Identification of the stakeholders was done through interviews conducted during the field work (primary data) and review of relevant studies and reports (secondary data). The impacts on these stakeholders have been separately discussed in the previous section. A complete list of all the stakeholders interviewed is presented in Annex 3.

²⁴ This was also pointed out by participants of the SIWI-GIZ workshop held on 24.10.2019.

²⁶ Interview with Iyassu Karesso, Attraction Sites Development Expert (October 21, 2019).

²⁷ *Ibid.*

²⁸ SLR Global Environmental Solutions (2018). *Stormwater contaminant removal: Techno-economic review*

Source-to-sea stakeholders in preventing marine litter

- **Primary stakeholders:** those who are negatively impacted by plastic pollution and who will benefit from intervention strategies preventing it.
- **Targeted stakeholders:** individuals or groups whose practices are contributing to the amount of plastic pollution leaked to riverine and marine environments and whose behaviour change is directly targeted.
- **Enabling stakeholders:** institutions that provide enabling conditions for behaviour changes and benefits to occur and be sustained over time.
- **Supporting stakeholders:** development partners or financiers whose strategies are aligned with preventing plastic leakage.
- **External stakeholders:** individuals or groups outside the system boundary who share an interest in preventing marine litter.

Figure 19: The source-to-sea stakeholder mapping framework. Source: SIWI (2019). Source-to-sea framework for marine litter prevention: Preventing plastic leakage from river basins (p.19)

Primary stakeholders

According to the guide, the guiding question used to determine this information is: “Which individuals or groups are affected by plastic pollution and will directly benefit from its prevention?”

For the study area, these include communities in Hawassa city, the city municipality (Hawassa City Administration), the sub-city administrations, tourism sub-sector, fishermen and the natural environment (including biodiversity).

Targeted stakeholders

The guiding question used to determine this group is: “Which individuals or groups are contributing to plastic pollution and whose behaviours and practices must be directly targeted to prevent it?”

In the first group come **consumers** (households, pedestrians and tourists). The second group comprise **waste collectors and transporters**²⁹, which use sub-standard and outdated means of municipal solid waste transportation and disposal, mainly donkey carts³⁰. In the third category are **businesses**, which are quite diverse and need sub-classification. Foremost in this group are those

²⁹ These include about 11 formally organised garbage collection and disposal associations, the more than 45 informal associations and individual operators, which use donkey carts [Interview with Urge Alemu, Urban Development & Construction Department, Municipality Service Standards Directorate Director; October 15, 2019].

³⁰ Hawassa is estimated to have about 700 donkey carts at the time of the study [interview with Sisay Haile; Menaherya sub-City Administration Cleaning, Beautification & Green Growth Work Process Coordinator; October 16, 2019].

businesses engaged in the production, distribution and sale of bottled water, bottled beverages, and plastic shopping bags products (factories, hotels, restaurants, supermarkets, shops, & kiosks). Secondly businesses engaged in other industrial activities, which also generate plastic waste (e.g. polystyrene foam, polyethylene plastic films, plastic cones, etc.) deserve mentioning; these include textile and garment factories operating in the Hawassa Industrial Park³¹ and other factories, supermarkets and businesses operating in the industrial zone and the city at large. Thirdly, we need to be mindful of other businesses engaged in the manufacture and sale of household and commercial (durable) plastic products. Also, a relatively new problem in the making points to shops and fishermen, who use illegal fishing nets, which are reportedly imported illegally flouting the locally binding fishing net quality specifications.³²

Although their actions are to a greater extent restorative (contributes to the circular economy), **recyclers** also have their own contribution to plastic leakage during the transport and handling of waste. Of specific interest is the plastic labels removed from PET bottles, which are stored separately in the open by PET bottle recyclers, which could be easily washed away in the rainy season or blown by wind.

Enabling stakeholders

The guiding question here is: “Which institutions provide or should provide enabling conditions for behavioural changes and benefits to occur and be sustained over time?”

Foremost in this category is government including representations at the federal, regional, city and sub-city administration levels. At the **federal level**, the Environment, Forest and Climate Change Commission (ECCC)³³ is of primary importance due to its mandate in formulating and over-seeing environmental policies, regulations and guidelines. Other key government ministries including representations at regional and city level include: Urban Development and Construction; Industry; Culture and Tourism; Health; Water, Irrigation and Electricity; Health; and Agriculture.³⁴

At the **regional government and city administration levels**, the respective bureaus and departments respectively will be responsible.³⁵ One other public stakeholder is the Rift Valley Lakes Basin Authority³⁶ (RVLBA) based in Hawassa. One of the mandates of RVLBA is to protect the quality and

³¹ PvH (an international garment company) is for instance the main anchor investor which has set up a factory in the Hawassa Industrial Park. It partnered with the GIZ IWaSP initiative on the initiative, “Protecting Lake Hawassa”.

³² This came to light during the discussions held with experts working in the Bio-diversity Department of the Hawassa City Administration [interview held with Martha Assefa, Plant Biodiversity Protection expert & Rahel Sisay, Biodiversity Development & Protection Coordinator on October 18, 2019.

³³ Formerly also recognised as the Environmental Protection Agency and also, until recently, as the Ministry of Environment and Climate Change (MEFCC)

³⁴ If we take a broad perspective and forward looking into implementation of potential “policy instruments” (eco-taxes, deposit & refund systems, public procurement, etc.), we can add: Ministry of Finance & Economy (green finance), Ministry of Revenues, Ministry of Education, Ministry of Agriculture, Innovation and Technology, Planning and Development Commission

³⁵ It is important to note that the names and structure of bureaus and departments change quite frequently.

³⁶ Name has been revised to the Rift Valley Lakes Development Office.

quantity of water in the lakes it oversees and regulate water allocation to clients. It has been an active partner of donor-funded initiatives working to protect Lake Hawassa.³⁷

At the **sub-city administration level**, the Urban Planning Sanitation and Beautification units assume crucial responsibilities. They are at the forefront of challenging tasks relating to city greenery; garbage collection and disposal; law enforcement³⁸; clean-up; and importantly disaster management (flooding during the heavy rains). Together with relevant departments, such as that of environment/biodiversity, they oversee clean-up campaigns in their localities benefiting from the World Bank financed Urban Productive Safety Net Project.³⁹

From a policy maker's point-of-view, **academia** has a role to play through "informative instruments", namely carrying out "responsible education" with a view to shape future decision makers and business leaders. To that end Hawassa University can play a role as can other institutions of higher learning in Ethiopia. From a corporate sustainability (CSR, corporate governance point of view), there is also a role for **chambers of commerce and sectoral association** (both federal and Hawassa city level). The newly established **Ethiopian Corporate Governance Institute** (federal level), could play a role by facilitating good corporate citizenship and, ideally, concrete action on the prevention of plastic pollution.⁴⁰ Similarly the **Ethiopian Cleaner Production Centre (ECPC)** could help build capacity in preventative approaches and integration of circular economy concepts in industries and businesses.

Supporting stakeholders

The guiding question to identify this group is "Are there development partners or financiers whose strategies are aligned with marine litter prevention?"

The field work in Hawassa and literature review confirmed that there are many development partners and financiers engaged directly and indirectly on the issue of litter prevention and conservation of the lake.

GIZ IWaSP has been very active in the area through its "Protecting Lake Hawassa" multi-stakeholder partnership (on-going). Among others, it has organised a partnership building workshop (December 2017), a Solid Waste Management project design workshop within the ambit of the initiative (February 2018); and commissioned a Techno-economic study on "Storm-water Contaminant Removal for Hawassa" (carried out by SLR consulting in 2018).

Another development partner active in the area is the Italian NGO, **CIFA**, which has been supporting the Hawassa Wubet Waste Disposal and Recycling Association since January 2018. They supported this association through capital support with which the recycler built a shed and storage facility. CIFA mobilized for their partner (Coba Impact, buyer) to provide the recycler with a bailing machine

³⁷ It was co-partner to IWaSP to the "partnership building workshop held in December 2017 (workshop report).

³⁸ For instance, on illegal dumping & burning of waste; working hours for donkey carts [05:30- 7:30 AM], etc.

³⁹ Beneficiaries of the Urban Productive Safety Net Project usually put (about 10 hours of street cleaning work per week, which needs to be coordinated with the respective sub-Cities, who employ regular municipal workers (street sweepers & tractor trailer drivers).

⁴⁰ This could be the starting point to initiate voluntary, Extended Producer Responsibility initiatives by the bottling companies and the major supermarkets and other plastic waste generating businesses.

(2t/day capacity). They also supported the association by facilitating market lineage with the buyer of the PET plastics in Addis Ababa, Coba Impact Manufacturing PLC. Coba buys PET bottles from collectors and does the washing, sorting and shredding and exports the product to European buyers. CIFA recommends the next good step will be to facilitate financing of a plastic crusher for PET bottles of about 500kg/hr capacity to add value and reduce transport costs (which stands at ETB 0.2/kg (from Hawassa to Addis)).⁴¹

The World Bank is a major stakeholder which fits this group. Although it does not directly work on plastic recycling per se, it has a few projects, which are contributing to better urban infrastructure management capacity. Its two important projects often cited in Hawassa during our interviews were: The Urban Productive Safety Net Project (UPSNP) and the Urban Institution and Infrastructure Development Project (UIIDP).⁴² Through UPSNP, up to 60,000 people are regularly mobilised in Hawassa for urban cleaning, greenery and clean-up campaigns (including lakeside clean-ups). Beneficiaries of the Urban Productive Safety Net Project usually put about 10 hours of street cleaning work per week. Once a month, up to 800 beneficiaries put two hours of work each to clean three hotspots of pollution along the lakeside.⁴³ UIIDP seeks to finance various infrastructures such as skip loaders, a sanitary landfill site, compactors, public toilets, storm water drains and artificial wetland systems.⁴⁴ The World Bank also finances the Green Industry Ethiopia project, which seeks to support the Hawassa Industrial Park in its endeavour to develop as an eco-industrial park.

UNDP is another development partner with initiatives on the ground. The first one is the Nationally Appropriate Mitigation Action NAMA compost project, which UNDP supports through market facilitation, capacity building and training.⁴⁵ Another one was a Global Environment Facility (GEF) supported reforestation initiative (2013-2018) which supported afforestation projects managed by Community Based Organizations CBOs.⁴⁶

Other development partners working the solid-waste management space and protection of Lake Hawassa include SOS-Sahel, Irish Aid and USAID. Among others, these organisations have supported studies on solid waste management; and supported the city municipality's efforts in the provision of dust bins in the recreational shores of Lake Hawassa.

Potentially, a few bilateral and multilateral donors, organisations or initiatives could have interest from the perspective of advancing green growth objectives in industry and in cities. These include USAID, UN Habitat, SOS-Sahel, Irish Aid, DfID, 2030 Water Resources Group, Alliance for Water

⁴¹ Interview held with CIFA experts, Silvia Vanzetto and Frew Bekele (October 17, 2019).

⁴² More on UIIDP: <https://www.worldbank.org/en/news/loans-credits/2018/03/14/ethiopia-urban-institutional-and-infrastructure-development-program>

⁴³ During this period, up to six tractor trailer load of garbage was collected, of which plastics make a visually significant part (Interview held with Rahel Sisay, Biodiversity Development & Protection Coordinator; October 18, 2019).

⁴⁴ According to interview with Urge Alemu (October 15, 2019), the UIIDP budget is worth about ETB 100m/year.

⁴⁵ Interview with Urge Alemu, Urban development and Construction Department (October 15, 2019). More information on NAMA: <https://www.et.undp.org/content/ethiopia/en/home/projects/urban-nama-compost.html>

⁴⁶ Interview with Rahel Sisay, Biodiversity Development & Protection Coordinator (October 18, 2019).

Stewardship, Water Witness International, World Recourses Institute and UNEP (Switch Africa Green project). All of these have some level of engagement in Ethiopia.

To the above list we could add volunteers mobilized by different organisations and which are engaged in clean-up campaigns.

External stakeholders

The guiding question here is: “Are there individuals or groups outside the system boundary who share an interest in marine litter?”

Key stakeholders that fall under this category include the Ethiopian Tourism Organization, the Ethiopian Tour Operators Association (and its members)⁴⁷, Ethiopian Airlines and the inter-city bus companies operating between Addis Ababa and Hawassa. These organizations and companies stand to benefit from a clean and thriving Lake Hawassa as it is the main tourist attraction of the town.

Governance for preventing lake plastic litter

The guiding questions as provided in the Source-to-Sea Framework for Marine Litter Prevention (p. 22) will be used to organise this section. In addition, the principles of environmental policy making, which are used in the effort to bring about sustainable production and consumption, are used as an additional analytic lens. In practice, the transition from the take-make-waste (linear) system of production and consumption to sustainable (circular) economy calls for the design, packaging and enforcement of environmental policy instruments, from within regulatory, economic, informative and voluntary alternatives.⁴⁸ With that in mind, we could borrow the concept of “Carrot, Stick and Sermon” from Bemelmans-Videc et al. (1998, 2003) as an additional tool to guide the discussion.⁴⁹

Just recently, the African Ministerial Conference on the Environment in its seventeenth session drafted a declaration that consolidates key policy messages on circular economy and on plastic pollution in particular, calling for “...coherence among and coordination of activities undertaken by existing regional and international instruments while highlighting the importance of technology

⁴⁷ More information on this could be found from: <https://www.ethiopiantourassociation.com/>

⁴⁸ For more on the principles and practices of environmental policy making, see for instance Field, B. (2007). *Environmental policy: An introduction*. Literature abound on the principles of environmental policy making with the objective of internalising or correcting market and institutional failures.

⁴⁹ Bemelmans-Videc et al. (1997). *Carrots, sticks & sermons: Policy instruments and their evaluation*

transfer, research on alternatives to plastic, and adequate financing to enable African countries to deal with plastic pollution”⁵⁰.

Based on the above, Table 9 summarises the findings and some pointers towards good governance as it applies to preventing plastic leakage into Lake Hawassa. Here is what we can draw from that assessment.

Institution, legal and regulatory frameworks: Ethiopia has made commitments at the highest level to advance economic development that is socially and environmentally sustainable. Importantly, mention can be made of the Ethiopian Constitution itself, the Environmental Policy, the Climate Resilient Green Economy Strategy and the Growth and Transformation Plan, which put a premium on the concept of sustainability and green growth. Closer to waste management itself and particularly plastics, a number of proclamations, standards and guidelines have been issued pertaining to environmental pollution control, solid waste management, allowable plastic bag gauge thickness, and on fishing and fishing net material. Box 1 below provides an overview of some of the regulations and proclamations broadly related to the issue. This issue will be revisited again in the “governance” section with a focus on those regulations relevant to plastics. The most important institutions overseeing these policies, strategies, regulations, standards and guidelines are: Environment Forest and Climate Change Commission, Ministry of Urban Development & Construction; Ministry of Trade and Industry; Agriculture; and Ministry of Culture and Tourism.

Gaps in governance: The main challenge here is poor **coordination** amongst the various ministries (at the federal level) and their representations at the Regional Government and City Administration levels (namely bureaus and departments/offices).⁵¹ An even bigger problem is weak **enforcement capacity** of the regulations, proclamations, standards and guidelines. For instance, enforcement of Proclamation No. 513/1999 (ban on the production and import of plastic bags with thickness of less than 0.03 mm) became so difficult that government has recently been considering a push for a total ban.⁵² Similar challenges surround the regulation of fishing nets, both in terms of allowable specifications and numbers as per the sustainable carrying capacity of the lake.

In addition to hard policy instruments (e.g. regulations, proclamations, by-laws, enforceable standards), there are **no market-based instruments** to enable sustainable production and consumption of single-use packaging materials such as PET water bottles and plastic shopping bags. The effectiveness of deposit and refund systems (on non-return bottles) and levies/eco-tax (on single-use plastic bags) has been satisfactorily tested in a number of countries around the world.⁵³ There is, therefore, a need to experiment with market based (economic) instruments to complement command-and-control regulation and standards.

⁵⁰ African Ministerial Conference on the Environment Seventeenth session, Ministerial segment, “Draft Durban Declaration on taking action for environmental sustainability and prosperity in Africa”, Durban, South Africa, 11–13 November 2019

⁵¹ Concerning public source of finance, the federal government allocates budget to the regional government, which in turn is further allocated to the Woreda and City Administration levels.

⁵² Capital (News Paper). *Plastic bag ban imminent*. October 7, 2019

⁵³ The Irish plastic bag tax is a global best practice. South Africa also has a plastic bag levy. Germany and Sweden lead on efficient recycling on non-returnable bottles and aluminium cans with the deposit and refund system as one (financial) driving instrument.

In the same vein, **businesses, as part of their good corporate citizenship (sustainability) strategy, could exercise concrete voluntary action**, e.g. set-up voluntary programs for collection and recycling of post-consumer packaging. An efficient and well-meaning voluntary action can help reduce regulatory burden and help achieve environmental objectives at a lesser cost to society (government, business and communities). The purpose here is not to replace good regulation and market-based instruments but rather to support them with “soft” instruments (informative and voluntary instruments) with a view to enable better enforcement and results at optimal cost.

On **informative instruments** and **partnerships** per se (education, awareness campaigns, and partnership projects) there is a need for donors, civil society and academia to coordinate and harmonize their activities. Sustainability is a tough goal and calls for multi-stakeholder collaboration- as for instance clearly advocated in the Sustainable Development Goals e.g., Goal 17 is on partnerships. Specifically, on the issue of preventing plastic litter in Hawassa and into the lake, there is a need for initiating and sustaining effective multi-stakeholder partnerships.

By streamlining the above approaches, it is believed that a better-governance system for prevention of plastic litter can be established. In so doing, it will be possible to re-dress the current market and institutional failures that have been driving non-sustainable production and consumption of plastic products, which is evidenced in the form of profligate consumption, irresponsible disposal, littering, illegal dumping, open burning, poor collection and recycling of post-consumer plastics.

Table 9: Governance for preventing lake plastic litter – Findings and pointers for action

Guiding Questions	Findings & Pointers
<p>1- What are the institutions, legal and regulatory frameworks, rights, ownership, informal agreements that define the framework for preventing plastic leakage at each step of the cycle of plastic production, consumption and disposal?</p>	<p><u>Institutions:</u></p> <p>A detailed description of this is already provided in the “enabling stakeholders” section. To recap: The main institution at the federal level is the Environment, Forest and Climate Change Commission. Other federal ministries of relevance to the issue are: Ministry of Trade and Industry; Ministry of Urban Development & Construction; Agriculture; and Ministry of Culture and Tourism. Representations of these line ministries at the SNNP Region, and Hawassa City Administration levels are also key stakeholders. Closer to Hawassa, The Rift Valley Lakes Basin Authority is an additional actor given its mandate in regulation and protection of the lakes in the Rift Valley. In Ethiopia’s federal government system, the national (federal) government allocates budget yearly to the regional governments, which is further allocated to woredas and city administrations.⁵⁴</p> <p><u>Regulatory Frameworks:</u></p> <ul style="list-style-type: none"> – The Constitution of Ethiopia (1995) – The Environmental Policy of Ethiopia (1997) – Proclamation 299/2002: Environmental Impact Assessment – Proclamation 300/2002: Environmental Pollution Control – Proclamation 513/2007: Solid Waste Management – Integrated Solid Waste Management Strategy (2017) – Ethiopian National Urban Solid Waste Management Standards (2014) – Solid Waste Management and Handling Standard Number MUDHC 07/2007: Ministry of Urban Development, Housing and Construction. – Proclamation No. 513/1999: Ban on the production and import of plastic bags with thickness of less than 0.03mm. – Solid Waste Management Plan for Hawassa City (2018-2028)

⁵⁴ For more on the Ethiopian budget preparation and allocation process, have a look at: <https://hahuzone.com/budget-preparation-ethiopian-context>.

Guiding Questions	Findings & Pointers
	<ul style="list-style-type: none"> – SNNP Regional Government Fisheries Development, Management & Control Regulation (Proclamation No. 62/1999; 78/2004) & Directive (2007)
<p>2- Are these in conflict with or complementary to one another and where are the gaps in governance that lead to plastics leaking to riverine and marine environments?</p>	<p><u>Stick:</u></p> <ul style="list-style-type: none"> – Poor enforcement capacity of Proclamation No. 513/1999. Conversely, better enforcement of this proclamation, implies improved solid waste management at the national and local level. For that to happen, the technical, financial and human resources capacities at the national and local level need to improve as well to implement, among others pertinent strategies, by-laws and good-practice guidelines on solid waste management. – Weak enforcement of existing by-laws on illegal dumping and burning of solid waste in Hawassa city.⁵⁵ Determining the actual cost arising from littering and illegal dumping of waste is difficult to do. However, in the foregoing sections, anecdotal evidence of time spent by fishermen, urban safety net beneficiaries, and other community members (for clean-up campaigns) have been discussed. – Poor enforcement of Proclamation No 62/1999 & 2007 Directive on fishing and fishing nets leading to use of illegal fishing nets beyond the sustainable carrying capacity of the lake and importantly disposal of the nets at the end of their life. – No enforcement of the polluter pays principle, which is enshrined in the Environmental Policy of Ethiopia (1997). Some other “progressive” documents make a passing remark to the polluter pays principle, often citing the Environmental Policy itself. These include: The Environmental Pollution Control Proclamation (No. 300/2002); The Solid Waste Management Manual (Ministry of Urban development and Planning, 2012); – The Urban Wastewater Management Strategy (MoWIE, 2017); and the National Integrated Water resources management Program, Ethiopia (MoWIE, 2018). Conversely, the Solid Waste Management Proclamation (no. 513/2007) does not explicitly advance the polluter pays principle- importantly how that could apply to post-consumer packaging and one-way plastic bottles and bags. <p><u>Carrot:</u></p> <p>No eco-taxes on plastic bags; no deposit and refund systems to incentivise PET bottle recycling</p>

⁵⁵ The Consultants were able to see illegal dumping of garbage in Hawassa during their mission.

Guiding Questions	Findings & Pointers
	<p><u>Sermon:</u></p> <p>No voluntary take-back systems by producers, which could be a precursor for advanced extended producer responsibility (EPR) initiatives.⁵⁶</p>
<p>3- In addition to the public sector, are there other actors, e.g., companies or non-governmental organizations that can improve governance related to plastics and what is the relative capacity of each to prevent marine litter?</p>	<p><u>Business- Voluntary space/ self-regulation:</u></p> <ul style="list-style-type: none"> – PvH⁵⁷ has partnered with GIZ in the “Protecting Lake Hawassa Initiative” – “Producers” (bottling companies, hotels, supermarkets, factories) are not taking responsibility – Development partners/ donors: – CIFA & GIZ, DfID (and now SIWI) are in the forefront; but harmonization and further action need to improve <p><u>Civil society:</u></p> <ul style="list-style-type: none"> – Environmental NGOs exist but technical capacity (to drive Circular Economy) is limited. A few of the prominent environmental NGOs (local & international) are: SOS Sahel Ethiopia, Concern for Environment; Association of Friends of Lake Hawassa (AFLaH); World Vision International; Green Initiative Ethiopia Development Association (GIEDA); Green Thinkers Youth Association.⁵⁸ <p><u>Others:</u></p> <ul style="list-style-type: none"> – Academia, local chamber not active; do not address “good corporate governance” issues

⁵⁶ The most advanced of EPR schemes for packaging are to be found in developed countries such as Germany, Sweden and Canada. South Africa is also experimenting with this approach, which can provide some learning for Ethiopia.

⁵⁷ PVH is an American fashion and lifestyle multi-national company. Its brand portfolio includes the iconic CALVIN KLEIN, TOMMY HILFIGER, Van Heusen, IZOD, ARROW and Speedo. PVH was the major (anchor) investor, which did set shop in the Hawassa Industrial Park in 2017. PVH was one of the key partners of the IWaSP programme in the “Protect Lake Hawassa” initiative along with the Rift Valley Lakes Basin Authority (IWaSP Annual report 2017).

⁵⁸ Most of these are mentioned in the “stakeholder mapping and analysis study”, which GIZ IWaSP did in 2017 for the Protecting Lake Hawassa Initiative.

Guiding Questions	Findings & Pointers
4- Is the behaviour of the targeted stakeholders in line with the governance framework or is there a failure in enforcement?	<p>No!</p> <ul style="list-style-type: none"> - Market failure - Institutional failure
5- Are there mechanisms for stakeholders to be involved in decision making, are there procedures in place for resolving conflicts that may arise between stakeholders and are these being effectively applied?	<ul style="list-style-type: none"> – Donor funded projects such as IWaSP allow stakeholders to participate in initiatives such as “protecting Lake Hawassa”. Donors have also supported studies and workshops on MSW management and prevention of litter. This could be considered as one means of stakeholder involvement and consultation. IWaSP focussed on facilitating a multi-stakeholder partnership approach involving government, private sector and civil society. – However, according to the Urban Development & Construction Department, Municipality Services Directorate, “Municipality, Community & Environment Office tried to form a platform to create awareness and facilitate collective action around waste management. However, that it did not fare well so far due to weak capacity (technical and financial) and funding and support could help achieve that objective.”⁵⁹

⁵⁹ Interview with Urge Alemu, Urban Development & Construction Department, Municipality Service Standards Directorate Director; October 15, 2019.

The Constitution adopted by Ethiopia in 1995 provides the guiding principles for environmental protection and management in Ethiopia. The concept of sustainable development and environmental rights are enshrined in article 43, 44 and 92 of the Constitution of GOE.

The Environmental Policy of Ethiopia was approved by the Council of Ministers in April 1997. It has 10 sectoral and 10 cross-sectoral components one of which addresses “Human Settlements, Urban Environment and Environmental Health”, and was based on the findings and recommendations of the National Conservation Strategy of Ethiopia. The policy document contains elements that emphasize the importance of mainstreaming socioecological dimensions in development programs and projects.

The National Conservation Strategy was developed through a consultative process over the period 1989 to 1995. It takes a holistic view of natural, human made and cultural resources, and their use and abuse and seeks to present a coherent framework of plans, policies and investment related to environmental sustainability. The document consists of five volumes i.e., the Natural Resource Base, Policy and Strategy, Institutional Framework, the Action Plan and Compilation of Investment Programme.

Environmental Impact Assessment Proclamation No. 299/2000 contains provisions designed to ensure sustainable development. Proclamation 299/2000 makes an environmental impact assessment mandatory not only for development projects but also for policies, plans and programs.

Environment:

Proclamation 299/2002, Environmental Impact Assessment

Proclamation 300/2002, Environmental Pollution Control

Proclamation 513/2007, Solid Waste Management

Integrated Solid Waste Management Strategy (2017)

Proclamation No. 513/1999: Ban on the production and import of plastic bags with thickness of less than 0.03mm.

Proclamation 159/2008, Prevention of Industrial Pollution

Guideline for Environmental Management Plan, 2004

Waste Handling and Disposal Guideline, 1997

Health:

Public Health Proclamation (200/2000)

National Hygiene and Sanitation Strategy (Ministry of Health, 2005)

Fisheries

Proclamation No. 315-2003: Fisheries Development and Utilization

Recommendations

Strategic and mid-term actions

- a) **Multi-stakeholder process facilitation:** The issue at hand calls for effective coordination and collaboration amongst the public sector, business, academia, civil society and donors. This is particularly true for the successful identification, packaging and implementation of policy instruments (See below). SIWI together with GIZ could help with an effective facilitation for the set-up and running of a multi-stakeholder platform.
- b) **Coordinate various efforts:** There is an immediate need to harmonise the existing initiatives on the ground, amongst bilateral and multi-lateral donors, i.e. GIZ, CIFA, UN-HABITAT, UN Habitat, World Bank, UNDP, USAID, SOS Sahel, SIWI, etc.
- c) **Facilitate policy interventions:** There is a need, amongst the multi-stakeholder partners, to clearly identify, package and implement policy instruments from within available options, namely informative, economic, regulatory and voluntary approaches with a view to transition from a linear culture of production and consumption to one that is circular as it applies to plastics. For plastic bags, there is a need to closely monitor the impending full ban on the manufacture and import of these items. If the full ban is enforced on plastic bags, then, in principle, it does not make sense to consider other policy approaches such as a levy or voluntary collection and recycling by supermarkets. Rather, the main question that needs to be addressed is if the full ban is approved, is there technical capacity to enforce it effectively? Have alternatives to plastic bags available? Does the ban have support from consumers, shops, markets and supermarkets?
- d) **Financing/investment:** While Ethiopia has committed to an ambitious Climate Resilient and Green Economy strategy, this is not matched by the necessary investment and finance.⁶⁰ Importantly, access to finance is a serious constraint, especially to green businesses, e.g. recyclers and waste management companies. As confirmed through interviews with officials of Hawassa City Administration and the sub-City Administrations, the public waste management system is severely under-funded. There is a need to upgrade to modern equipment for the transportation, handling, sorting of MSW including, obviously, for a modern sanitary landfill site. Hence, there is an urgent need to address the finance/investment issue by working with government (including stakeholders such as the Ministry of Finance, Ministry of Trade and Industry, Ethiopian Investment Commission, Development Bank of Ethiopia, National Bank of Ethiopia) and donors. There is also a need to look into the role that the local financial sector could play to catalyse the green economy. For instance, plastic recyclers are constrained by lack of finance to buy recycling equipment and machinery, whereas, the local commercial banks usually request collateral before approving loans. Plastic recyclers usually cannot meet these collateral criteria as they have little in fixed assets such as buildings or trucks. While micro-finance institutions, play a positive but limited role in the green economy commercial banks have a negligible role in that sector. Mostly they cater for less-risky and established businesses, which could provide collateral for loans

⁶⁰ Ethiopia's CRGE has called for annual spending of USD 7.5 billion to respond to climate change. The national budgetary resources for climate change-relevant actions are estimated to be USD 440 million per year, and international sources adding several tens of USD million per year. If the strategy is to be delivered, additional resources need to be mobilized both domestically and externally. Source: Eshetu et al. 2014. *Climate finance in Ethiopia*

requested.⁶¹ In support of that argument, the manager of Hawassa Wubet recycling association, pointed out access to finance as a key binding constraint to his business as he was asked for collateral to get commercial loans to buy a plastic crushing machine. In addition, the role that preferential, investment incentives could have in stimulating the green economy sector is another area that could be explored by engaging the Ethiopian Investment Commission. While this is an area that needs separate and in-depth study, Ethiopia could learn from the experience of other countries which have actively worked to gear their financial sector to the green economy. For instance, Bangladesh has introduced a preferential refinancing terms for guided credit in which 5% of loan portfolio is allocated to finance green projects, an initiative overseen by the Bangladesh Central Bank. Even developed countries have worked to align their financial sector to the green economy. A good example is the UK which has a dedicated Green Investment Bank founded in 2012 by the UK government.⁶²

- e) **Technical capacity building:** Human capacity building in MSW management and partnering skills is another area for intervention if sound management of municipal solid waste is to be achieved. Transitioning to a true green (circular) economy calls for a much more advanced management and partnering capacity. This is particularly the case within the concerned ministries at the federal level but as well the regional government and city-administration counterparts.

Priority actions

Find a solution for plastic bags and PET labels:

- Monitor and evaluate (with CEFCC) the likelihood of enactment and impact of the impending plastic bag ban.
- If the ban is not likely to come through, facilitate the process (with CEFCC, Ministry of Finance, Ministry of Trade and Industry) for a levy on plastic bags.
- Explore technical solutions for recyclers to make durable products (e.g. plastic lumber) from plastic bag and other plastic waste ignored by traditional recyclers.

Strengthen the PET recycling system: As a pilot, roll-out an intervention and test the viability of voluntary EPR systems for PET bottles by starting with multinational companies (e.g. Coca Cola Sabco, which is expected to start operations in Hawassa) and other local bottlers with markets in Hawassa. The main purpose here is to incentivise the waste collectors through a deposit and refund system. It should be taken into account that an advanced EPR system (such as the ones in Germany and Sweden) might be difficult to implement in Ethiopia.

Find a solution for fishing nets

- **Immediate:** Introduce education awareness to fishermen and provide collection points to give back old nets anonymously.
- **Long term:** Support the enforcement capacity of (the environment department) on implementation of existing guidelines and by-laws on fishing (recommended number and type of nets).

⁶¹ For instance, see Amha et al. (2017). Transition to a green economy in Ethiopia: Going green in rural finance through the support of microfinance institutions

⁶² Starting from 2017, the Green Investment Bank operates under a new name, i.e. the Green Investment Group. More information can be found from: <https://greeninvestmentgroup.com>.

Annex 1: Steps to conduct Waste Characterization

- 1) **Prepare the sorting area.** Place a large tarpaulin onto a flat piece of ground, with easy access for trucks.
- 2) **Brief the survey team.** Gather together the survey team and explain the purpose of the characterisation, and how the work needs to proceed.
- 3) **Emphasise Health and Safety.** Give clear instructions that if any medical or other hazardous waste is spotted in the sample, the sorting must immediately stop. Health and Safety is the first priority.
- 4) **Choosing the trucks.** Check with the truck drivers (or the landfill manager) where was the waste they are transporting collected. Choose at least one truck for each study area.
- 5) **Discharge the waste.** Ask the truck driver to drive to your site and to deposit there at least 200 kg of MSW.
- 6) **Mix the waste:** make sure the waste discharged is well mixed
- 7) **Quartering technique:** if your waste amounts to more than 150 – 200kg, you will have to take a representative sample of around 50 kg for analysis. The most commonly used technique for this is called “The Quartering Technique”. You will do this by
 - 2.1 First mixing all the waste as thoroughly as possible. You can use your shovels for this.
 - 2.2 Then expand the waste on a flat hard surface so that it forms a flat layer.
 - 2.3 Divide the waste layer into four parts: ABCD (see A-1 left).
 - 2.4 From those four portions, discard two opposing quarters, say B and D.
 - 2.5 Combine the remaining two quarters.
 - 2.6 Repeat steps 1 to 4 until approximately 50 kg are left.



Figure A-1: Quartering technique (left) and sorting (right)

- 8) **Sort the waste:** bring the representative sample of 50kg to the sorting site
 - 5.1 Prepare the labelled containers (as many containers as fractions) around the sorting area.
 - 5.2 Sort all the waste into the containers (see A-1 right).
- 9) **Weigh the waste fractions:**
 - 6.1 Weigh each fraction and record it on the spread sheets.

Important:

Remember to subtract the weight of the empty container from your results!

10) **Calculate waste characterization:** With information on amounts weighed for each fraction of waste, the percentage of each fraction over the total amount can be calculated.

Annex 2: Estimation of end-of-life fishing net disposed of into Lake Hawassa

Item	Unit	Amount	Source	Remark
Weight of one net	kg	4	Test, interview	
Average life-span	days	456	Interview	Weighted/geometric average based on data provided by the Environment/Biodiversity department, i.e.: Average lifetime= $((1690*365)+(240*3*365))/(1690+240)= 456\text{days}$
No of nets used per day	No	3000	Interview	Legally allowed based on carrying capacity= 750 nets; Fisheries department estimates conservatively that at least up to 3000 nets could be cast every day
Weight of net used per day	kg	12000	Calculated	
Weight of net disposed	kg/day	26	Calculated	

Annex 3: List and contacts of stakeholders interviewed

No	Name	Organisation	Position	Contact details	Date interviewed
1.	Abate Hailu	Hawassa University	Lecturer, Environmental Management Department	E: abatehailu@yahoo.com M: +251913406998	15.10.2019
2.	Abebe Nigatu	Ameze Plastic Factory	Production Manager	M: +251912148234	21.10.2019
3.	Ablante Tadesse	Bahil Adarash sub-City Administration	Cleaning & Beautification Process Coordinator	M: +251989474366 E: ablantetadesse@gmail.com	17.10.2019
4.	Addisu Lembebo	Faya Folle Cleaning and Beautification Association	Founding member		21.10.2019
5.	Amelework Gebru	HCC, Environmental Pollution Control	Core Process Team Leader	M+ 251910070708 E: am22gb27@gmail.com	17 & 21.10.2019
6.	Ashenafi Kassa	Mercado Supermarket	Salesman		25.10.2019
7.	Asmerom Tekie	Tekie Plastic Recycling	Manager	M:+251916581821	22.10.2019
8.	Aynaddis Seife	Hawassa City Administration, Fisheries Development Department	Fisheries Development Expert	M: +251911066748	23.10.2019
9.	Berhanu Hailu	Central Statistics Agency	Hawassa Statistics Branch Manager	M: +251911335201 E: yoneberhanu@gmail.com	22.10.2019
10.	Birru Woshe	Hawassa City Administration, Environment Office	Impact Assessment and Pollution Control Expert	M: +251916333282	21.10.2019
11.	Daniel lyassu	Time Cafe	Manager	M: +251934795899	25.10.2019
12.	Dawit Abraha	Hawassa Haik Fishers Primary Cooperative			16.10.2019
13.	Elias Edao	Habela Tula sub-City Administration	Cleaning & Beautification Process Coordinator	M: +251916066770	17.10.2019
14.	Ferew Bekele	Urban Development & Construction Department,	CIFA	E: ferewbekeleamenu@gmail.com M: +251913929578	17.10.2019
15.	Fitsum Tenaye	Fitsum Tenaye Plastic Recycling Factory	Manager	M: +251911608387	22 & 23.10.2019

No	Name	Organisation	Position	Contact details	Date interviewed
16.	Geremew Gebru	Rift Valley Lakes Basin Authority	Environmentalist	E: geremewgebru@yahoo.com M: +251949650191	18.10.2019
17.	Getachew Tsehay	WSSE	Deputy General Manager, Water Supply & Scheme Administration Department	M: +251916078868	18.10.2019
18.	Henock	Hawassa Wubet Solid Waste Disposal and Recycling Cooperative	Manager	+251916035521	15.10.2019; 25.10.2019
19.	Hirut Abate	Hayk Dar sub-City Administration	Cleaning & Beautification Process Coordinator	M: +251910602552	16.10.2019
20.	Iyasu Karesso	Hawassa City Administration, Culture, Tourism and Sports Department	Attraction Sites Development Expert	M: +251916861457	21&23.10.2019
21.	Martha Assefa	HCC, Plant Biodiversity Production & Protection	Expert	E: danielfitamo@gmail.com M: +251931560956	17.10.2019
22.	Mengistu	Hawassa Industrial Park (IPDC)	Integrated Services Expert	M: +251912390473	22.10.2019
23.	Rahel Sisay	Hawassa City Administration, Environment Office	Biodiversity Development & Protection Coordinator	M: +251911712714	21.10.2019
24.	Selamawit Tomas	Cool Plastic Recycling Enterprise	General Manager	M: +251930506632 E: selamawite.tomas@gmail.com	16.10.2019
25.	Shitaye Chebula	HCC Trade & Market Development Department	Head	E: shitachebula@yahoo.com M: +251927014817	18.10.2019
26.	Silvia Vanzetto	CIFA ONLUS	Project Manager	E: pmhawassa.eth@cifaonng.it M: +251926942631	17.10.2019
27.	Sime Se'amo	Tabor sub-City Administration	Cleaning and Beautification Process Coordinator	M: +251916050485	18.10.2019
28.	Sisay Haile	Menaherya sub-City Administration	Cleaning & Beautification Process Coordinator	M: +251926120654	16.10.2019
29.	Tesfaye Getu	Dagim Fishers Primary Cooperative	Fisher	M: +251916028104	21.10.2019
30.	Teshale Wonte	Hawassa City Council	Deputy Manager & Process Coordinator	M: +251912137820 E:	15.10.2019

No	Name	Organisation	Position	Contact details	Date interviewed
				teshale197@gmail.com	
31.	Urge Alemu	Urban Development & Construction Department,	Municipality Services Standards, Directorate Director	M: +251912094464 E: urgowami@gmail.com	15.10.2019
32.	Zewdie Abebe	Abacoda Waste Removal & Recycling Enterprise		E: zewdieabebe36@gmail.com M: +251954723062	17.10.2019

Annex 4: List of primary cooperatives registered with the Hawassa tourism office and operating around Fikir Haik⁶³

<ol style="list-style-type: none"> 1. Hawassa Fikir Haik Cooperative 2. Meklit Recreation and Boat Assembly Cooperative 3. Fidel Recreation Services Cooperative 4. Haik Dar Wubet Parks and Recreation Cooperative 5. Oasis Cooperative 6. Lembo Cleaning and Beautification Cooperative 7. Haik Dar Kale Hiywot Church Youth Recreational Services Cooperative 8. Dagim Fishers' Cooperative 9. Andinet Environmental Protection Youth Cooperative 10. Sunset Youth Recreational Services Cooperative 11. Green Environmental Protection and Beautification Cooperative 12. Mosaic Landmark Area Tour Operators Cooperative 13. Amora Gedel Fishers' Cooperative 14. Zed Daniel and Family Fish and Fish Products Shop 15. Kidist Geremew and Family Fish and Fish Products Shop 	<ol style="list-style-type: none"> 16. Zinash Yohannes and Family Fish and Fish Products Shop 17. Huriye Petros Fish and Fish Products Shop 18. Daniel Muda Fish and Fish Products Shop 19. Degnesh Dansa Fish and Fish Products Shop 20. Kassech Addis Fish and Fish Products Shop 21. Marsamo Mengistu and Family Fish and Fish Products Shop 22. Shema and Family Fish and Fish Products Shop 23. Tigist Benera Fish and Fish Products Shop 24. Dessalech Daka Fish and Fish Products Shop 25. Kenene Tena Fish and Fish Products Shop 26. Seble Hussein Fish and Fish Products Shop 27. Alemayehu Mekuria Boat Recreation Services Cooperative 28. Tamirat Motor Boat Recreation Services Cooperative 29. Addise Ashana and Family Fish and Fish Products Shop
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⁶³Report compiled by the Hawassa City Administration Tourism Office dated March 2018 (*Yekatit 2010 Ethiopian Calendar, in Amharic*)