South Africa – Waste classification report

Summary and analysis of waste generation and disposal data collected in eThekwini and the City of Cape Town, South Africa

The Commonwealth Litter Programme

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Image 1: Early morning waste collection, source: APWC, 2019

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Executive summary

The project

The Commonwealth Litter Programme (CLiP) is an initiative delivered by the Centre for Environment Fisheries and Aquaculture Science (Cefas) and funded by the United Kingdom's Department for Environment, Food and Rural Affairs. It supports developing countries across the Commonwealth in preventing plastics entering the oceans.

As much as 90% of marine litter is made up of plastics. Plastics enter the waterways from both land and sea. Poor waste management on land is a major contributor to marine litter.

In 2019, CLiP contracted Asia Pacific Waste Consultants (APWC) to study waste management practices in two municipalities, Cape Town and eThekwini in South Africa. This report presents the data, analysis and recommendations to address gaps in the management of solid waste in South Africa following a series of household and commercial waste audits, including household interviews, conducted during August and September 2019.

What are the major waste management issues for South Africa?

South Africa has robust regulations, strategies and legislation for waste management when compared with its neighbours, however many sources suggest implementation lacks efficacy and enforcement is inadequate. Waste service delivery across demographics is often inequitable and anchored in the historical legacies of colonialism and Apartheid. Collection services vary significantly between provinces, municipalities and often between adjacent suburbs.

Problems are exacerbated by increasing population in cities. High rates of informal housing mean fewer ratepayers to finance waste management services. Communities in all major urban centres frequently protest for improved waste and sewage disposal systems.

There are complex socio-political challenges to overcome in order to improve land-based waste management in South Africa. Increasing numbers of people are coming to cities and living in informal housing. (Weghmann and Van Niekerk, 2018)

In 2016, it was reported that 33% of South African households disposed of their own waste, while 61% households had their waste collected by the municipality collection service. Estimates put the backlog of solid waste service provision at around 2 million households, with some 900,000 households not receiving any service (DEA, 2016a, 2016c).

South Africa is estimated to be eleventh in the world for mismanagement of plastic waste which could potentially enter the oceans (Jambeck et al., 2015).

A staggering 82% of rural households rely on their own refuse dump compared with 10.6% in urban areas, and 4.5% in metro areas (most likely in informal households). These figures are true for most

rural households in South Africa with the exception of the Western Cape, where 20.9% use their own dump (Stats SA, 2016c).

The ongoing disposal of waste to landfill is largely due to 'under-pricing' of waste management costs by municipal governments. Under-pricing waste disposal services essentially incentivises waste generators and waste producers to continue to dispose of waste to landfill rather than re-using, recovering or recycling materials. While landfill might be perceived as a more cost-effective and short-term solution, it does not consider the environmental cost of resource extraction or degradation nor the health impacts of this waste disposal method.

South Africa relies heavily on dumps and landfills as a means of disposal of end-of-life materials. (World Bank, 2012).

What audit methodology did APWC use?

APWC conducted audits in the City of Cape Town in the Western Cape and eThekwini Municipality in KwaZulu-Natal province to estimate the amount of household waste generated and to make comparisons with previous studies. Three hundred household and 45 commercial samples were collated to interpret waste generation and composition. Household samples included low, middle- and upper-income brackets and included serviced areas, poorly serviced areas, and unserviced households.

Waste in an emotive issue. Interviews allowed participants to express their opinions candidly.

Household interviews were used to ascertain what is currently happening to waste not collected by municipal waste services and tried to identify how waste management in South Africa differs between communities.

The APWC methodology assesses the amount of waste that is currently being managed, that is, the waste being placed in bags or drums. It also assesses household behaviours, based on interviews, in order to understand what happens to uncollected waste or why refuse is not placed in bags, including the reason for these behaviours. The participation rate for interviews was low in formal and high-income areas in South Africa, and where a resident was not home or not willing to participate, interviewers surveyed the adjacent or nearby house.

What were the results?

Results indicate low-income communities in Cape Town and eThekwini have a household waste generation rate of around 1 kg per household per day; middle-income communities have a generation rate of around 1.5 kg per household per day; and high-income communities of around 2 kg per household per day.

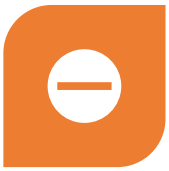
The largest component of the waste stream for commercial premises and households in Cape Town and eThekwini is organics. A range of materials was identified during the APWC audit process as being areas for increased focus, including paper and cardboard, nappies, plastics other than PET and HDPE.

Data sourced from 150 households found approximately 0.8 kg of organic waste is generated per household per day in Cape Town; 50% of this is food waste.

Both municipalities suffer from mismanagement of waste. As expected, 100% of the households that don't have access to waste collection services improperly manage their waste. Of interest, however, is what happens to waste that is improperly managed. In Cape Town 77% of households dump waste to land and 23% of households burn their waste. In eThekwini, around 40% of improperly managed waste is being dumped into waterways, the remainder in burnt, dumped on land or buried.

Data indicates that despite an ongoing commitment to improving waste services in South Africa, much effort needs to be put towards education and improving waste collection infrastructure.

Waste composition at a glance



Organics dominate all waste collected – 53% of household waste in Cape Town and 44% in eThekwini was organic in nature

Hygiene items (including nappies and feminine hygiene) form 6% of the household waste stream in Cape Town and 10% of the waste in eThekwini

Cape Town and eThekwini respectively have 13% and 14% **paper** in their household waste.

11% of household waste in both eThekwini and Capte Town falls in the category **"other plastics".** These include single use plastics.

Organics, paper and carboard and other plastics also make up the highest percentage of materials in commercial waste. Interestingly, 98% of the litter in Cape Town was organic in nature, made up of grass clippings, indicating cleaner streets than eThekwini where litter consisted of only 13% organic matter; the remainder being PET (24%), paper and cardboard (26%), other plastic (22%) as well as glass and HDPE. The report offers solutions for the materials present in highest quantities in both Cape Town and eThekwini.

Recommendations

APWC notes there is a significant amount of recycling currently being undertaken through the informal sector and the recycling centres. Currently, financial incentives for recovery of plastics, glass and metal are minimal. The introduction of financial mechanisms such as a deposit legislation could regulate the price paid to pickers and help improve the financial conditions for the informal sector. Integrating the informal sector could play a key role in unlocking growth in waste diversion and employment.

POLICY & LEGISLATIVE FRAMEWORK

APWC recommends a whole-of-system assessment to be conducted internally, with a focus on improving enforcement of existing legislation.

Increased national human resources capacity, as well as, clear delineation of enforcement roles in the municipalities would help with the enforcement capability.

RECYCLING

A range of materials has been identified through data collected by APWC clearly showing focus areas for South Africa – organics, paper and cardboard, nappies, plastics other than PET and HDPE.

CAPACITY BUILDING

More accurate and comprehensive data required on waste generation, collection, disposal and recycling.

Encourage greater collaboration between organisations requiring data and those collecting data so that collection is standardised and data comparable across organisations.

WASTE MANAGEMENT FINANCING

Under-pricing waste management a key driver in behaviour and management practices on all levels (household, government, industry), resulting in low levels of separation at source. Collaboration between all sectors (household, producers) will improve recycling rates and decrease contamination in the waste stream.

Financial instruments, such as container deposit legislation (CDL), would help strengthen the informal sector, which is instrumental in current recovery efforts.

INFORMAL SECTOR

Integrating the informal sector could play a key role in unlocking growth in waste diversion and employment opportunities.

Introduction of financial mechanisms such as CDL might lend itself to improved financial security for the informal sector.

COLLECTION SERVICE

Both municipalities suffer from mismanaged waste despite adequate infrastructure and access to a range of skilled staff providing maintenance services. APWC believes there may be an opportunity to introduce alternative collection measures rather than providing the same level of collection services to different communities – for example, pre-paid bags for informal communities rather than collection points.

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Acronyms

ACRONYMS	
APWC	Asia Pacific Waste Consultants
CoCT	City of Cape Town Municipality
BCM	Buffalo City Metro Municipality
Cefas	Centre for Environment, Fisheries and Aquaculture Science
CLiP	Commonwealth Litter Programme
CoJ	City of Johannesburg Municipality
DAFF	Department of Agriculture, Forestry and Fisheries
Defra	Department for Environment, Food and Rural Affairs
DEA	Department of Environmental Affairs
DTI	Department of Trade & Industry
DEA&DP	Department of Environmental Affairs and Development Planning
EMM	Ekurhuleni Metro Municipality
ETH	eThekwini Metro Municipality
FS	Free State Province
GT	Gauteng Province
HDPE	high-density polyethylene
IWMP	Integrated Waste Management Plans
IndWMP	Industry Waste Management Plans
IWS	Informal Waste Sector
IPWIS	Integrated Pollutant and Waste Information System
KZN	KwaZulu-Natal Province
LP	Limpopo Province
MAN	Mangaung municipality (Bloemfontein)
MARPOL 73/78	The International Convention for the Prevention of Pollution from Ships (Marine Pollution), 1973 as modified by the Protocol of 1978
MINTECH	Ministerial Technical Committee
MINMEC	Minister and Members of Executive Councils
MP	Mpumalanga Province
MRF	Material Recovery Facility
MSW	Municipal Solid Waste
NC	Northern Cape Province
NMB	Nelson Mandela Bay Metro Municipality
NSWMS	National Solid Waste Management Strategy
NW	North West Province
PET	polyethylene terephthalate
QHSE	Quality, health, safety and environment
SALGA	South African Local Government Association
SoWR	State of Waste Report
SWM	solid waste management
SWMS	safe work method statements
SAWIC	South African Waste Information Centre

TSH	City of Tshwane (Pretoria)
WC	Western Cape Province
WCRAG	The Western Cape Recycling Action Group
WEEE	Waste Electrical & Electronic Equipment
WMO	waste management officer

1 Background

The Commonwealth Litter Programme (CLiP) is an initiative delivered by the Centre for Environment, Fisheries and Aquaculture Science (Cefas) and funded by the United Kingdom's Department for Environment, Food and Rural Affairs (Defra). The initiative supports a number of developing countries across the Commonwealth in preventing plastics from entering the oceans.

CLiP's main objectives are as follows (Figure 1):

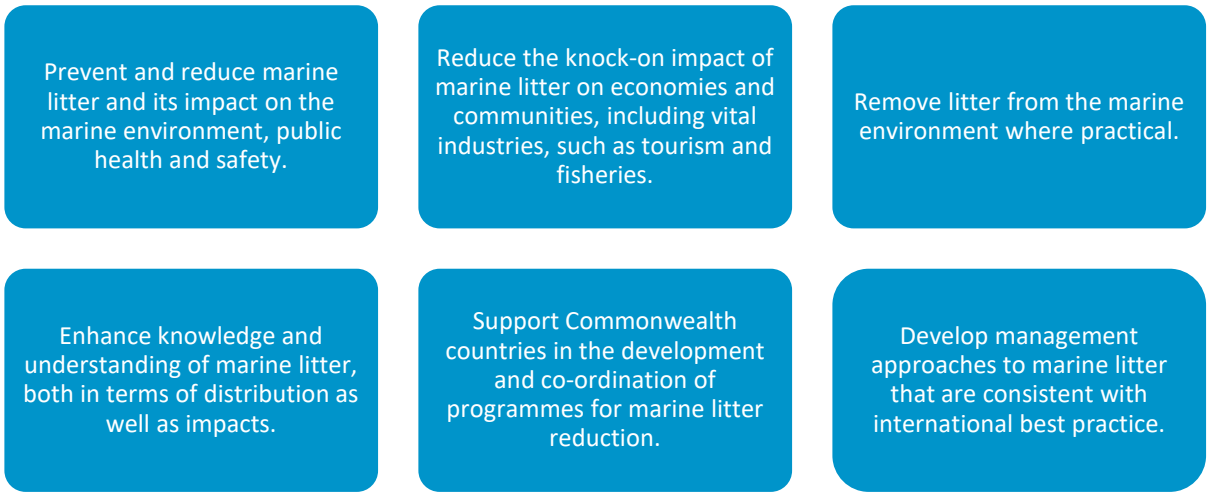


Figure 1: CLiP objectives (Source, APWC compiled from CLiP documents)

In August and September 2019, CLiP contracted Asia Pacific Waste Consultants (APWC) to carry out data collection in collaboration with local and national organisations in South Africa. The objective is to understand land-based sources of marine litter, as well as the systems that are currently in place to collect, transport and manage these wastes.

The activities undertook assessments of the following:

- waste generation rates and composition, collection and transport systems, disposal systems, in-country recycling of resources;
- management of organic waste, plastics waste and nappies;
- litigation, enforcement, compliance, monitoring and prosecution in relation to waste legislation.

2 Scope

This report provides a background review of the current 'state of waste' in South Africa, the legislative regime, the current available data, as well as the status of infrastructure and human resources within the waste sector in South Africa.

The background review is followed by a summary of the activities conducted by the APWC team during late August to mid-September 2019 and outlines the findings of the data collection and gap analysis conducted on the effectiveness of waste collection, disposal services and infrastructure, focusing on the City of Cape Town municipality and the eThekwini Municipality.

The analysis provides an overview of the waste generation rate in South Africa, and the infrastructure and service provision for waste collection, transport and disposal. The report identifies gaps in the management of specific waste streams, including (but not limited to) organic waste, plastics and nappies. The report provides recommendations on how these gaps can be addressed. Modelling has been performed using data collected by the APWC team.

Data was collected from the municipalities of Cape Town and eThekwini with particular focus on serviced households, poorly serviced areas and un-serviced households. The study also focused on the role of informal recyclers, paying attention to the influence of these recyclers in relation to the data collection. The data presented here is representative of the individual municipalities but does not reflect the composition of waste in the whole country.

Image 2: Sorting activates being undertaken by APWC staff at Athlone Refuse Transfer Station, Cape Town, 2019

3 Country Profile

3.1 Introduction to South Africa

South Africa is positioned on the southern tip of Africa, bordered in the northwest by Namibia, the north by Botswana and Zimbabwe and in the northeast and east by Mozambique and eSwatini (formerly Swaziland). The country is bounded by two oceans: the Atlantic, with its associated cold, nutrient-rich oceanic upwelling on the west coast moving up the coast towards Namibia; and the Indian Ocean and its associated warm Agulhas Current on the east coast carrying water down the coastline from the tropics. (Branch et al., 2007).

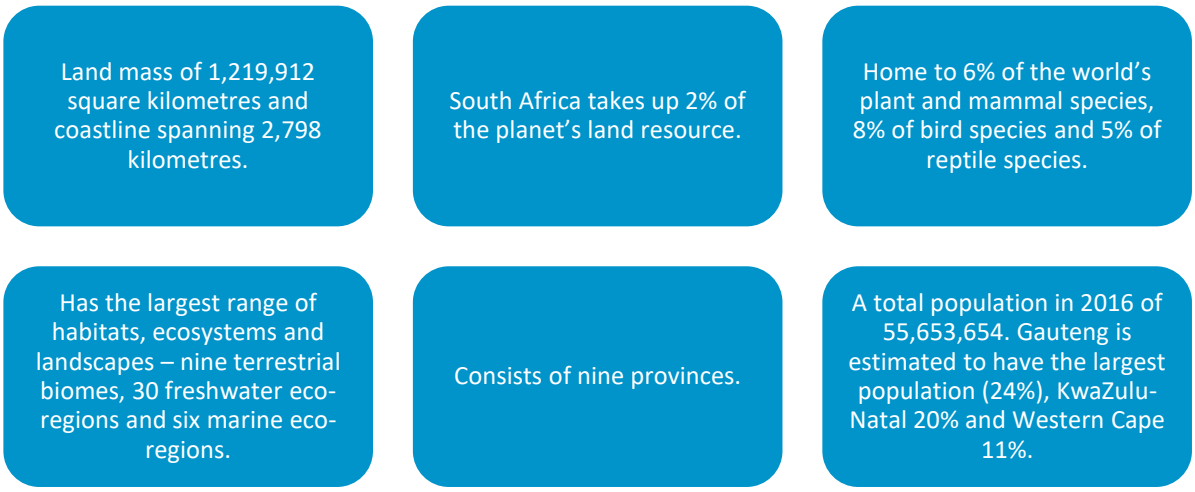


Figure 2: Background to South Africa, source: NBA, 2011. Stats SA, 2016a 2016b.

Although much of the country experiences warm and sunny daytime conditions, with temperatures ranging from 25°C to 30°C followed by cool nights, climatic conditions vary significantly between the east and west of the country, most notably in air temperatures and rainfall. The Western Cape province experiences Mediterranean-like climate with warm to hot and dry summers and mostly mild and rainy winters. The KwaZulu-Natal province experiences warm, often humid conditions, with most rainfall occurring from October to January. Due to these location-specific rainfall patterns and episodic events such as flooding, municipalities across the country need to manage land-based sources of marine litter in different seasons. For example, the City of Cape Town has to manage stormwater litter sources during the winter, while e-Thekwini manages stormwater litter sources during summer, which also coincides with an influx of beach litter during Durban's peak tourist season (see Image 5).

South Africa is a constitutional democracy with a three-tier system of government including national, provincial and local levels, all of which have legislative and executive authority within their own spheres. The National Government is comprised of Parliament, Cabinet and numerous departments responsible for implementing legislation and providing services to the public.

By any measure, South Africa has wide-ranging inequality. According to World Bank definitions, South Africa has a high concentration of low-income earners and few very high-income earners (the affluent or elite), but only a small number of middle-income earners, resulting in a high level of income polarisation (World Bank, 2018).

Stats South Africa (Stats SA) indicates that 40% of all South Africans have no income at all. Social grants play a vital role in South Africa's social safety net, with grants being the second most important source of income after salaries, and the main source of income for 20% of households nationally (Stats SA, 2018). Nationally, 22% of households are classified as indigent.

The World Bank's five class sizes, as well as geographic class sizes, are described in Figure 3 and Figure 4, below.

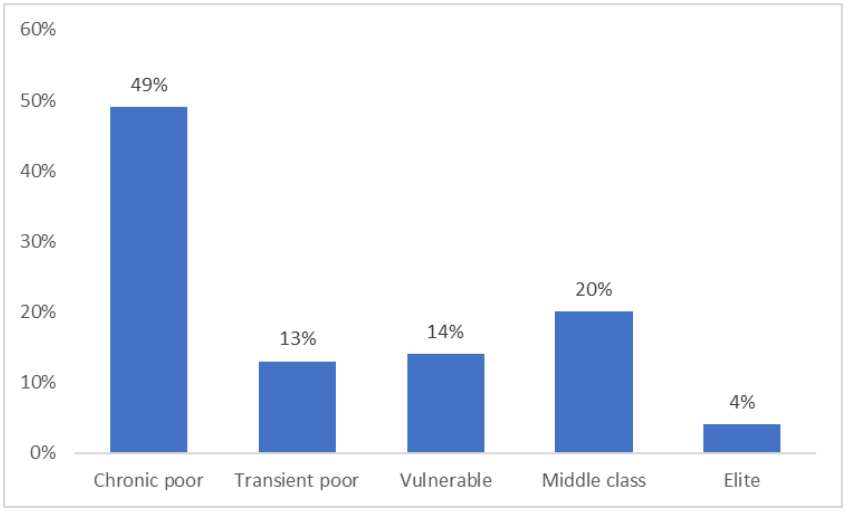


Figure 3: Class sizes in South Africa, 2008–2015 (Source: World Bank, 2018)

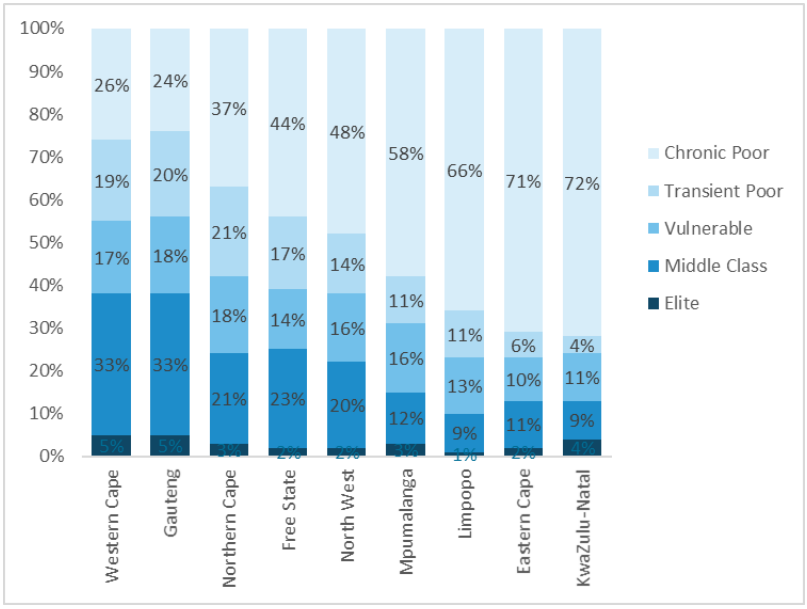


Figure 4: Geographic distribution of South Africa's five social classes, 2008–2014/15 (Source: World Bank, 2018)

There is a strong correlation between social classes and a geographical split in South Africa, with the highest levels of poverty concentrated in previously disadvantaged areas (World Bank, 2018), namely KwaZulu-Natal, Eastern Cape, and Limpopo (Figure 4) (Stats SA, 2011). Overall, in post-Apartheid South Africa, broadening access to basic public services has seen a decline in poverty. However, this has stagnated in recent years (World Bank, 2018). Key challenges are high unemployment rates, particularly for African youth, high wage gaps between two extreme job markets, struggling attempts at land reform, high crime rates, and inequality in education, service delivery and standards of living (Gilson and McIntyre, 2007).

Image 3: Bloubusrand in Johannesburg, a middle-class area with larger houses and pools (left); Kya Sands informal settlement (right), visually showing inequality. (Source: CNN, 2019)

In terms of waste, there is a strong correlation between income level, the consumption of goods and services, and the amount of waste generated (World Bank, 2012). In 2015, Fiehn and Ball suggested South Africa's waste generation rates amounted to 0.41 kg per person per day for low-income households, 0.74 kg/pp/pd for middle-income households, and 1.29 kg/pp/pd for high-income households (Fiehn and Ball, 2015).

In South Africa, history remains an important determinant of urbanisation, spatial trends and patterns. Although definitions of what constitutes urban and rural areas are not resolved, Table 1 presents a summary used by Collinson et al. (2007) using 2001 national census data.

Table 1: Categories of urban and rural settlement types in South Africa. (Source: adapted from Stats SA, 2001; Atkinson 2014).

Area	Characteristic	Category	Description
Urban	Typically defined as densely settled and developed	Metropolitan formal	Including large townships joined to metropolitan areas
		Urban formal	The non-metropolitan urban areas, such as secondary and tertiary towns, including townships
		Urban informal ('informal settlements')	Can sit alongside formal urban residential areas, or on the peri-urban fringe, or in spread-out rural areas. If they are adjacent to an existing urban area, they are classified as part of the urban node, be it town, city or metro
Rural	Characterised by a scattered distribution of population	Tribal areas or former homeland areas	This category is highly simplified since it contains a rural-urban continuum in which people farm or depend on natural resources including 'dense rural settlements', as well as formal 'dormitory townships' (which depend on migratory labour and remittances as well as government social grants for their survival), small towns, agricultural villages, and small farms
		Commercial agriculture	This category contains the rural-industry settlement type, which is often but not exclusively based on large, white-owned farms and black or coloured farmworkers

Across South Africa, however, many municipalities and settlements have both urban and rural characteristics. For example, eThekwini metro contains areas that are functionally rural (Treasury, 2011), while formal small towns are referred to as both 'urban' and 'rural' towns. Dense rural settlements can be considered urban (referring to population density) but in other ways are rural (they lack an urban economic core) and are often strongly linked with the surrounding villages and farms (Atkinson, 2014).

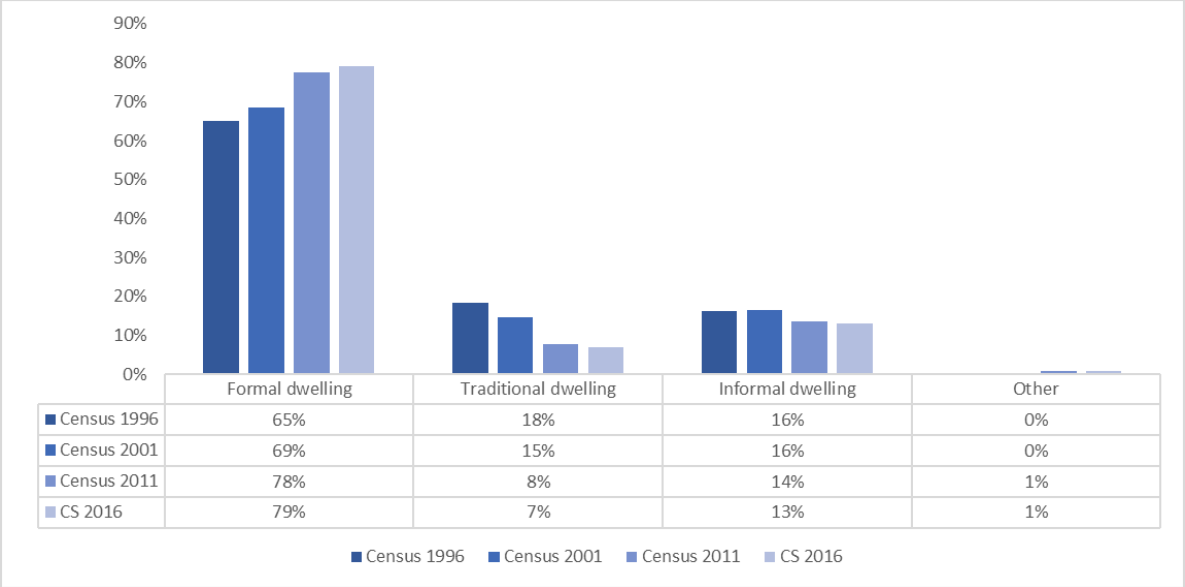
With continued migration of people into cities, service provision has become increasingly important, with most of the urban and peri-urban settlements in South Africa faced with the challenge of an increase in informal housing, illegal electricity connections, safety concerns and contested land tenure (DEA, 2016a).

Interestingly, in South Africa the growth in the number of households is outpacing the growth of the population. This has resulted in a larger percentage of South African households comprising of a single person (25%), compared with the global average of single person households (15%) (Stats SA,

2018). As households are the basic units for service delivery including waste management, this growth adds strain to already over-burdened and under-resourced municipalities.

In terms of household configuration, 37% of households in South Africa on average are headed by females, almost 20% of children live with neither of their biological parents, and 11% of children were orphaned (one or both parents) (Stats SA, 2016c).

The change in the three main types of dwellings in South Africa is presented in Figure 5 below, showing an increase in formal dwellings, with more 13% of households living in informal shacks (Stats SA, 2016c).



	Formal dwelling	Traditional dwelling	Informal dwelling	Other
Census 1996	65%	18%	16%	0%
Census 2001	69%	15%	16%	0%
Census 2011	78%	8%	14%	1%
CS 2016	79%	7%	13%	1%

Figure 5 Percentage distribution of households by type of main dwelling and dwelling definitions (Source: Census 1996; Community Survey 2016)

Note: *Formal dwelling includes – formal dwelling/house or brick concrete block structure on a separate stand or yard or on a farm; flat or apartment in a block of flats, cluster-house complex; townhouse (semi-detached house in a complex), semi-detached house, formal dwelling/house/flat/room in backyard, room/flatlet on a property or larger dwelling/servants' quarters/granny flat/cottage).*
Informal dwelling includes – informal dwelling/shack in backyard; informal dwelling/shack not in backyard (e.g. in an informal/squalor settlement or on a farm).
Other dwelling includes – caravan/tent and other.

Unequal waste management services are a significant challenge in South Africa with collection varying significantly between provinces, municipalities and often between suburbs adjacent to each other (Resnick, 2014; Stats SA, 2016c). Inequitable service delivery across demographics is anchored in the historical legacies of colonialism and Apartheid (Christopher, 1990; Maylam, 1995; Pieterse, 2006), which municipalities have not managed to overcome.

Image 4: Alexandra township next to the Jukskei River (Photo: Mujahid Safodien)

It is further exacerbated by increasing numbers of people coming to the cities and living in informal housing and a lack of prioritisation of services in informal communities (Weghmann and Van Niekerk, 2018) and high levels of inequality including a large population with a low number of people within the tax-paying income bracket. Due to the complex socio-political nature of the challenge, communities in all major urban centres frequently protest for improved waste and sewage disposal systems.

Tourism plays a major role in South Africa's economy (Figure 6), with beach destinations in both Cape Town and Durban key for international and domestic tourists.

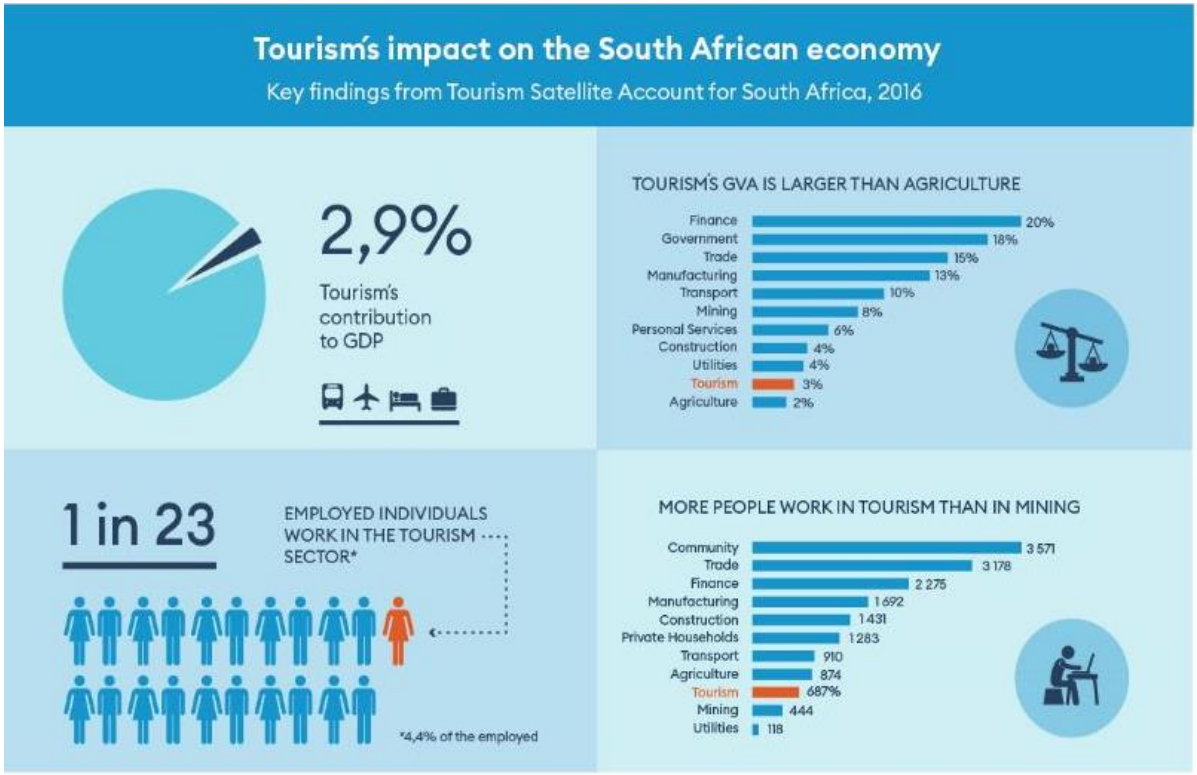


Figure 6: Tourism's impact on the South African economy (Source: Stats SA, 2019, Infographic - APWC)

Internationally, Cape Town is one of South Africa's most visited tourist destination, with 16 million international visitors supporting an estimated 300,000 jobs (Stats SA, 2019). Three out of Cape Town's top five tourist destinations are located on the coast, namely Boulders Beach, Cape Point and Robben Island. A survey conducted on the impact of clean beaches in Cape Town indicated that 85% of tourists and residents would not visit beaches if they experienced more than two items of debris per metre (Ballance, Ryan and Turpie, 2000).

On the east coast, eThekwini Municipality in KwaZulu-Natal (KZN) sees a huge influx of people over the Christmas holiday season. In 2014/2015 it was estimated that 124,700 visitors were on the Durban Central's beachfront on Christmas day alone (see image 5), while in 2017 between 23–25 December it was estimated that 1,686,174 people visited the eThekwini's 101-kilometre stretch of coastline (Times Live, 2017). Although generating high incomes, such influxes put strain on the municipal resources. In 2019 the municipality employed 200 additional temporary litter pickers, with officials from Durban Solid Waste working in three shifts over 24 hours to deal with the litter impacts of the crowds (eThekwini Municipality, 2019). The number of tourists in Durban is expected to continue increasing with construction beginning on Durban's new 200 million rand cruise terminal. The number of luxury cruise tourists will be increasing 29.4% between 2017 to 2019, and during 2019/2020 cruise season it is expected that 17 out of the 23 luxury cruise liners visiting South Africa will dock in Durban (Bizcommunity, 2019).

3.1.1 Regional profiles

Image 5: People flocking to the Durban beachfront on 16 December 2016 (Photos: South African Police Force 1)

The following section presents a profile on the two audit areas that are the focus of this study.

While this report includes country-wide data including all nine provinces, the study focuses on Cape Town in the Western Cape and eThekwini in the KwaZulu-Natal for the following reasons:

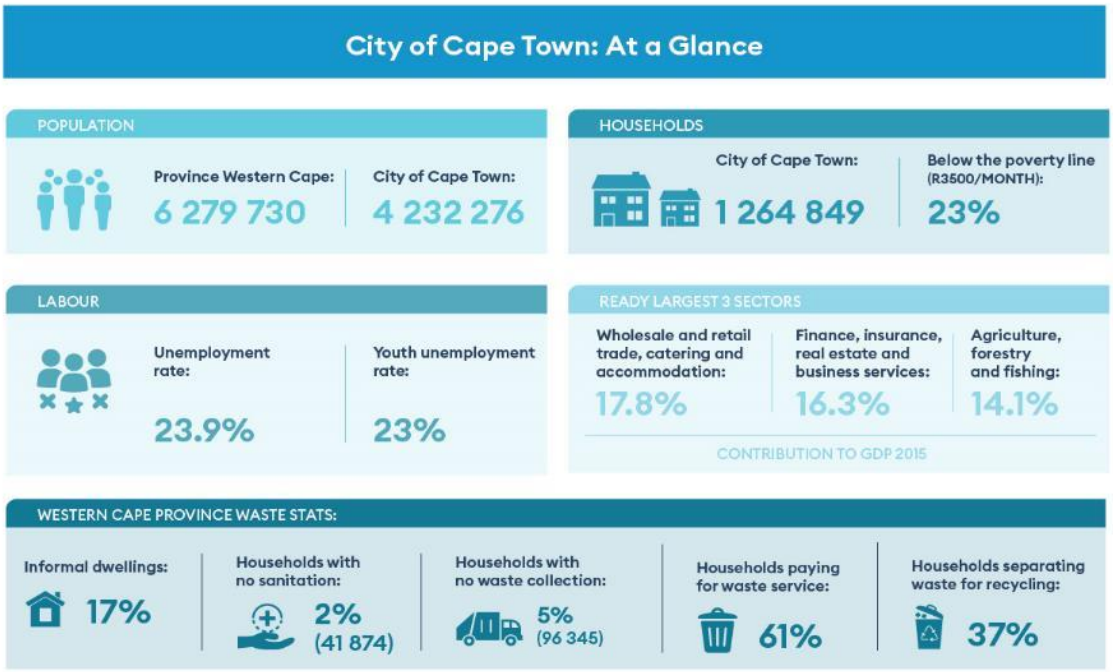
Western Cape:

- academic centre on marine litter monitoring (macro litter);
- coastline with a large population.

KwaZulu-Natal:

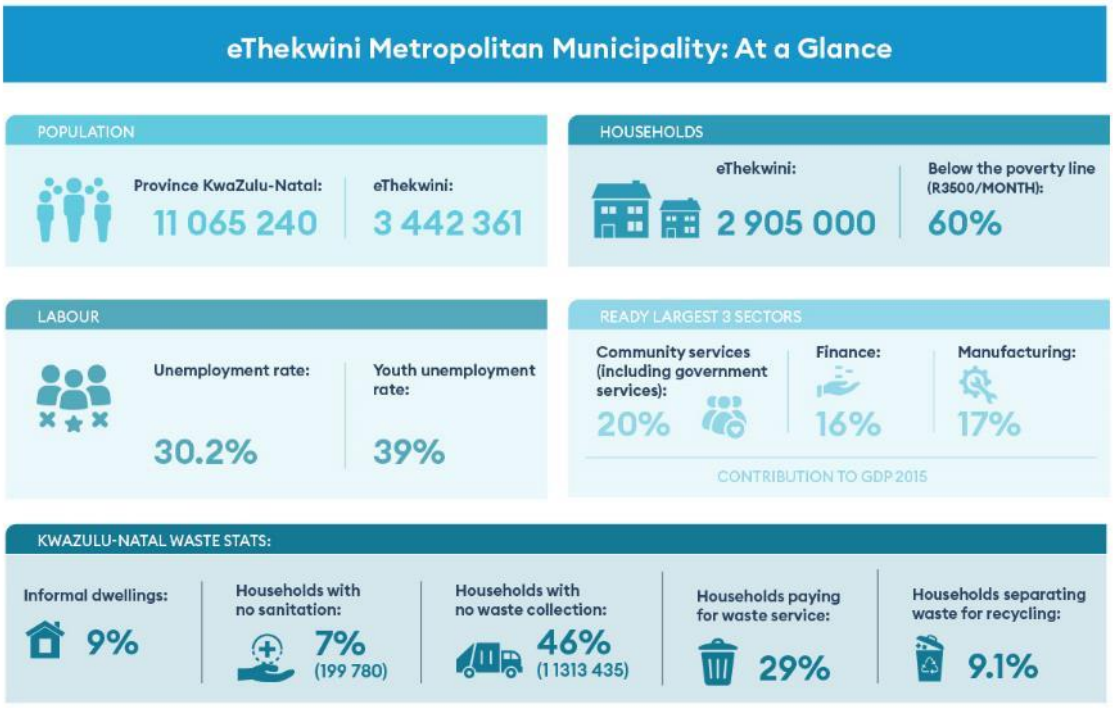
- long coastline with the second biggest population centre (Stats SA, 2016a; 2016b);
- busiest port in Africa (Stats SA, 2016b);
- Durban, its largest city, is a rapidly growing urban area (Stats SA, 2016b);
- highest number/diversity of local tourists over December/January (2016) out of the coastal provinces.
- High number of rivers with episodic events
- Support of the Department of Environmental Affair's (DEA) Source to Sea Initiative

3.1.2 City of Cape Town Metropolitan Municipality snapshot



Data compiled from DEA 2018; StatsSA, 2016a, 2016b, 2018; WCG, 2018.

3.1.3 eThekwini Metropolitan Municipality snapshot



Data compiled from DEA 2018; StatsSA, 2016a, 2016b, 2018; WCG, 2018.

3.2 Institutional framework for solid waste management in South Africa

3.2.1 Membership to regional organisations

South Africa currently retains membership of the following regional organisations.

African Union

The African Union is a continental body consisting of the 55 members states that make up the countries of the African continent. It was officially launched in 2002 as a successor to the Organisation of African Unity (1963–1999).

SWM focus areas:

Work with relevant international partners in the eradication of preventable diseases and the promotion of good health on the continent. Promote co-operation in all fields of human activity to raise the living standards of African peoples.

African Union Development Agency (AUDA-NEPAD)

Development agency of the African Union, co-ordinating and executing priority regional and continental development projects to promote regional integration.

SWM focus areas:

Programme for Infrastructure Development in Africa.

Southern African Customs Union

The economic structure of the union links the member states by a single tariff and no customs duties between them. The member states form a single customs territory in which tariffs and other barriers are eliminated on substantially all the trade between the member states for products originating in these countries; and there is a common external tariff that applies to non-members of SACU. Movement of commodities are important for the success of all solid waste operations.

Southern African Development Community

Inter-governmental organisation whose main objectives is to achieve development, peace and security, and economic growth, to alleviate poverty, enhance the standard and quality of life of the peoples of southern Africa, and support the socially disadvantaged through regional integration, built on democratic principles and equitable and sustainable development.

SWM focus areas:

SADC Water Sector – sanitation and waste management

Environment and natural resources management – waste management programme included in sustainable development.

World Environment Day 2018 – called on member states to improve waste management systems to address plastic pollution.

3.2.2 International agreements

Table 2 below highlights all multilateral agreements ratified by South Africa relevant to waste management for consideration by government.

Table 2: Multilateral agreements and conventions in South Africa (Source: APWC compiled from various)

Multilateral agreements and conventions	Status
Abidjan Convention for the cooperation in the protection and development of the marine and coastal environment of the West and Central African region	Ratified
Basel Convention addresses the need to control transboundary movements of Hazardous Wastes and their disposal	Ratified
Rotterdam Convention promotes and enforces transparency in the importation of hazardous chemicals	Ratified
Stockholm Convention on Persistent Organic Pollutants requires that member countries phase out POPs and prevent their import or export	Ratified
Bamko Convention specifically controls the movement of hazardous wastes within Africa	Ratified
Convention on Biological Diversity (CBD) to encourage sustainable development that considers biodiversity	Ratified
Montreal Protocol protects the ozone layer by phasing out specific substances	Ratified
MARPOL 73/78: International Convention for the Prevention of Pollution from Ships, 1973 as modified by the Protocol of 1978 (Annexes I, II, III, IV, V, and VI)	Ratified
Protocol to the International Convention on Civil Liability for Oil Pollution Damage of 29 November 1969 (1976)	Ratified
International Convention on Civil Liability for Oil Pollution Damage 1969 (renewed 1992)	Ratified
International Convention on the Protocol of 1976 to Amend the International Fund for Compensation for Oil Pollution Damage, 1971	Ratified
Protocol of 1992 to Amend the International Convention on the Establishment of an International Fund for Compensation for Oil Pollution Damage, 1971	Ratified
International Convention on Civil Liability for Bunker Oil Pollution Damage (BUNKER) 2001	Ratified
Cotonou Agreement - aimed at the reduction and eventual eradication of poverty while contributing to sustainable development and to the gradual integration of ACP countries into the world economy	Ratified
Nairobi Convention – regional cooperation of health rivers coasts and seas for the Western Indian Ocean region	Ratified
United Nations Convention of the Law of the Sea – regulates activities carried out in the ocean, requires states to actively prevent, reduce and control pollution of the marine environment	Ratified
London Convention of Marine Pollution by Dumping of Wastes and Other Matter	Ratified
Conventions on Migratory Species and on Biological Diversity – prevent harmful impact of marine debris and microplastics	Ratified
Vienna Convention for the Protection of the Ozone Layer	Ratified
United Nations Sustainable Development Goals 2015–2030	Ratified
United Nations Framework Convention on Climate Change (UNFCCC)	Ratified
Kyoto Protocol to the United Nations Framework on Climate Change	Ratified
Paris Agreement	Ratified
RAMSAR international co-operation and national action to protect wetlands and their resources	Ratified

Further to international conventions, South Africa has shown commitments to addressing marine litter through the following commitments and actions outlined in Table 3 (DEA, 2018).

Table 3: Marine litter specific commitments (Source: DEA, 2018)

Commitment	Focus
G20 Action Plan on marine litter (July 2017)	Promoting the socio-economic benefits of establishing policies to prevent marine litter; waste prevention and resource efficiency; sustainable waste management; effective wastewater treatment and stormwater management; awareness, education and research, supporting removal and remediation action and strengthening stakeholder engagement.
United Nations' Clean Seas Campaign (December 2017)	Engagement to find solutions to plastic litter and reduction of non-recoverable and single-use plastic. Through this campaign the Department of Environmental Affairs (DEA) is introducing a 'Source to Sea initiative' (initiation date: 31 March 2019), concentrating on removal of litter from rivers, increasing litter collection, and promoting community involvement in waste sorting at source and recycling.
Western Indian Ocean Strategic Action Programme (WIO-SAP), under the Nairobi Convention	This project intends to reduce land-based sources of marine pollution on critical coastal and marine ecosystems with partnerships that jointly implement strategies that cut across the region and also activities to provide essential goods and services on sustainable basis.
Marine Plastics and Coastal Communities (MARPLASTICCS) Project	A regional project under the Nairobi Convention has also been announced by the International Union for the Conservation of Nature.
Plastic Material Flows and End-of-Life Management Study.	In preparation in dealing with land-based sources of marine litter, the DEA collaborated with industry, the South African Bureau of Standards, the National Regulator of for Compulsory Specifications, National Treasury and the Department of Health. The study assessed the current status of production and management of plastics, identifying barriers to improving the diversion of plastics from landfill sites and to significantly improve recycling rates (DEA, 2018).
Micro-beads	Currently, a consultation process with the Cosmetics and Fragrance Association of South Africa (CFASA) is underway, looking at a voluntary phase-out of micro-beads (Department of Enviornmental Affairs, 2018), such as introduced by Australia.

3.2.3 National regulation, strategy and legislation

South Africa has robust waste regulations, strategies and legislation in place when compared with neighbouring countries. However, many sources suggest their implementation and enforcement is weak and lacking efficacy (Treasury, 2001; DEA, 2018). The timeline below (Figure 7) outlines key waste management legislation over the past 30 years from 1989 to 2017.

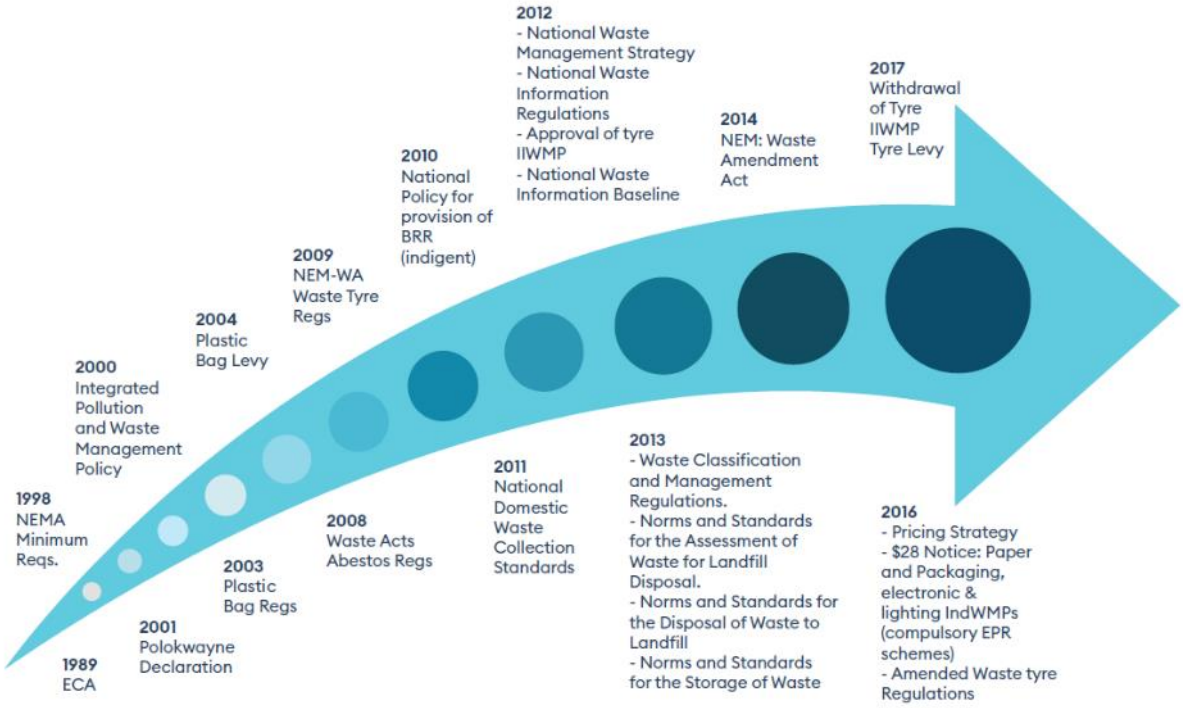


Figure 7: Legislative timeline (Source: DEA, 2018)

3.2.3.1 National Environmental Management: Waste Act 2008

Fundamental to South Africa's solid waste management and the control of pollution is the *National Environmental Management: Waste Act 2008* (NEM:WA), known as the 'Waste Act'. The purpose of the Waste Act is to regulate waste management within South Africa across all levels of government, including national, provincial, municipal and local through:

- licensing
- integrated waste management plans
- waste reduction, compliance and enforcement
- co-operative governance and coordination between departments.

The following Table 4 highlights a number of key amendments, regulations, strategies, norms and standards in relation to the Waste Act, in addition to specific regulations and strategies that are pertinent to this study.

Table 4: Key components of the *National Environmental Management Waste Act 2008 (Compiled by APWC)*

Amendments to *National Environmental Management: Waste Act 2008*

- *National Environmental Management Laws Amendment Act, No. 14 of 2013*
- *National Environmental Management Laws Amendment Act, No. 25 of 2014*
- *National Environmental Management: Waste Amendment Act, No. 26 of 2014*

Regulations

- Regulations regarding the control of the import or export of waste (2019)
- Regulations regarding the exclusion of a waste stream or a portion of a waste stream from the definition of waste (2018)
- Waste Tyre Regulations (2017)
- Waste Classification and Management Regulations (2013)
- National Waste Information Regulations (2012)
- National Waste Information Baseline, 2012
- Regulations to phase-out the use of Persistent Organic Pollutants (September 2019)
- Plastic carrier bag and plastic flat bag regulations (2003)

Strategies, policies & plans

- National Waste Management Strategy NWMS (2011) and revised and updated NWMS (03 December 2019)
- Municipal Waste Sector Plan (2012)
- The National Pricing Strategy for Waste Management (2016)
- National Policy on Thermal Treatment of General and Hazardous Waste (2009)
- The National Policy for the Provision of Basic Refuse Removal Services for Indigent Households (2011)
- White Paper on Integrated Pollution and Waste Management Policy, 2000

National norms & standards

- The National Domestic Waste Collection Standards (2011)
- National Norms and Standards for the Disposal of Waste to Landfill (2013)
- National Norms and Standards for the Assessment of Waste for Landfill Disposal (2013)
- Norms and Standards for the Storage of Waste, 2013
- National standards for the scrapping or recovery of motor vehicles
- National standards for the extraction, flaring or recovery of landfill gas
- Norms and standards for the remediation of contaminated land and soil quality (2 May 2014)
- Norms and standards for the sorting, shredding, grinding, crushing, screening, or bailing of general waste (2017)

Waste Management Plans

- REDISA Waste Tyre Management Plan (30 November 2012) – has been withdrawn (29 September 2017)
- Notice in terms of section 28(5) of the Act for the Paper and Packaging Industry, the Electrical and Electronic Equipment Industry and the Lighting Industry to submit waste management plans (12 August 2016)
- Notice in terms of sections 28(1) and 28(5) of the Act to require the tyre industry to prepare and submit an industry waste tyre management plan to the Minister for approval (31 March 2017)
- Industry Waste Management Plans (IndWMP)
- Extended Producer Responsibility (EPR) schemes – Minister prescribes how a waste stream should be managed and the required funding mechanism to do so. Mandatory EPR schemes can be declared when voluntary schemes provided for by IndWMPs have failed to effectively manage a waste stream
- Plastic Bag regulations, 2003 and Plastic bag levy, 2004
- Asbestos regulations, 2008

Draft Regulations and Notices

- Proposed new list of waste management activities that have or are likely to have a detrimental effect on the environment (17 March 2017)
- Draft national norms and standards for the sorting, shredding, grinding, crushing, screening or baling of general waste (17 Mach 2017)
- Draft regulations to exclude waste streams from the definition of waste (2 June 2017)
- Consultation on the intention to consider the withdrawal of the approval for the Integrated Industry Waste Tyre Management Plan of the Recycling and Economic Development Initiative of South Africa (1 June 2017)
- Proposed Waste Tyre Regulations (17 August 2017)
- Proposed regulations for the control of the import or export of waste (30 October 2017)
- Call on the tyre industry to prepare and submit an industry waste tyre management plan to the Minister for approval (30 October 2017)
- Notice to the Paper, Package Industry, Electrical & Electronic Industry and Light Industry to Prepare & Submit to the Minister Industry Waste Management Plans for Approval (December 2017)
- Proposed regulations to exclude a waste stream or a portion of a waste stream from the definition of 'waste' (12 January 2018)
- Draft norms and standards for validation of treatment efficacy and operation of a on-combustion treatment technology used to treat healthcare risk waste (30 April 2018)
- Proposed healthcare risk waste management regulations (30 April 2018)
- Consultation on the proposed industry tyre waste management plans (7 May 2018)
- Proposed amendments to the National Waste Information Regulations, 2012 (6 July 2018)
- Consultation on intention to require a person who conducts a waste management activity on the date of coming into effect of this Act, and who immediately, before that date, lawfully conducted that waste management activity under Government Notice No. 91 of 1 February 2002 to apply for a waste management licence under this Act (5 April 2019)
- Consultation on applications received for the exclusion of waste streams or a portion of such waste stream from the definition of 'waste' for the purposes of beneficial use (16 August 2019)
- Draft norms and standards for organic waste composting (4 September 2019)
- National Healthcare Risk Waste Regulations (GN 463 of 2018)
  The draft regulations are intended to regulate the management of healthcare risk waste (HCRW). the draft regulations propose a set of norms and standards (GN 464 of 2018) that prescribe minimum requirements for the efficacy testing and operation of a non-combustion treatment technology used to treat HCRW (2018)

3.2.4 Other acts and legislation relevant to waste management

In addition to the Waste Act, there are a number of laws and legislation which apply to solid waste management within South Africa (DEA, 2018; Jambeck et al., 2018). Table 5 below highlights those pertinent to the delivery of waste services and prevention of pollution across the country.

Table 5: Related acts and legislation (Source: APWC compiled from various)

National regulation, strategy and legislation	Description
The South African Constitution (Act 108 of 1996)	The supreme law of the Republic of South Africa. It provides the legal foundation for the Republic by setting out the rights and duties of its citizens and defining the structure of the Government.
The National Environmental Management Act (Act 107 of 1998)	Establishes principles for decision-making on matters affecting the environment and institutions that promote co-operative governance and procedures for co-ordinating environmental functions, while providing aspects of administration and enforcement of other environmental management laws.
National Environmental Management: Air Quality Act (No. 39 of 2004)	Introduced to reform the law regulating air quality in order to protect the environment. This act provides measures for the prevention of pollution and ecological degradation and securing ecologically sustainable development, while promoting economic and social development. It provides for national norms and

National regulation, strategy and legislation	Description
	standards regulating air quality monitoring, management and control by all spheres of government.
A National Climate Change Response Strategy for South Africa 2014	The National Climate Change Response Policy of South Africa focuses on prioritising responses that have mitigation and adaptation benefits, but importantly those that also contribute to economic development, job creation and improved public health.
Hazardous Substances Act (Act 5 of 1973)	Controls the production, import, use, handling and disposal of hazardous substances.
National Water Act (Act 36 of 1998)	The purpose of this Act is to ensure that the nation's water resources are protected, used, developed, conserved, managed and controlled in ways which take into account promoting equitable access to water; redressing the results of past racial and gender discrimination; promoting the efficient, sustainable and beneficial use of water in the public interest; facilitating social and economic development; protecting aquatic and associated ecosystems and their biological diversity; meeting international obligations.
White Paper on a National Water Policy for South Africa, 1997	This White Paper outlines the direction to be given to the development of a new National Water Bill in South Africa. It distinguishes three main priorities: basic needs, environmental requirements and international obligations.
Pollution Prevention Regulations – greenhouse gas prevention plan (by December 2017) for all who emit above 0.1 megatonnes of CO_2	Any person undertaking production processes in energy, industry, agriculture, forestry and other land uses and emit above 0.1 megatonnes of CO_2 are required to develop a Pollution Prevention Plan and as a result be subject to GHG gas emission reporting regulations.
GHG gas Emission Reporting Regulations (GHG Regulations)	These regulations govern the reporting of emissions emanating from the categories of emission sources listed in Annex 1 to the regulations which govern a broad spectrum of activities related to energy, industrial processes and product use, agriculture, forestry and other land uses and waste.
Draft regulations on carbon offsets under the carbon tax for comment	Currently open for comment
Draft Carbon Tax Bill for comment	Currently open for comment
A Climate Change Act, 2018 is being drafted (International Comparative Legal Guides, 2018)	Currently being drafted
Consumer Protection Act, No. 68 of 2008	Industry waste – if a good contains a substance that cannot be disposed of in the normal waste collection system, the supplier is under an obligation to accept the return of the goods, free of charge, irrespective of whether they supplied the particular goods to the customer.
Health Act (Act 63 of 1977)	To provide for measures for the promotion of the health of the inhabitants of the Republic – regulations relating to rubbish, night-soil, sewage or other waste and reclaimed products.
Environment Conservation Act (Act 73 of 1989)	To provide for effective and controlled utilisation of the environment.
Occupational Health and Safety Act (Act 85 of 1993)	Provides for the health and safety of persons at work and for the health and safety of persons in connection with the use of plant and machinery; the protection of persons other than persons at work against hazards to health and safety arising out of or in connection with the activities of persons at work; to establish an advisory council for occupational health and safety.

National regulation, strategy and legislation	Description
Municipal Structures Act (Act 117 of 1998)	Delineates responsibilities – local municipalities are responsible for refuse removal, refuse dumps and solid waste disposal whereas district municipalities are responsible for solid waste disposal sites serving the area of the district municipality as a whole, and promoting equitable distribution of resources between local municipalities to ensure appropriate levels of municipal services within the area.
Municipal Systems Act (Act 32 of 2000)	Section 76 to Section 78 of the Municipal Systems Act (32 of 2000) outline the key steps needed before municipalities are able to partner with the private sector for waste management.
Mineral and Petroleum Resources Development Act (Act 28 of 2002)	To make provision for equitable access to and sustainable development of the nation's mineral and petroleum resources; and to provide for matters connected therewith.
S 28 Notice: Paper and Packaging, electronic & lighting Industry Waste Management Plans (IndWMPs) 2016	Compulsory EPR schemes
International Trade Administration Act (Act 71 of 2002)	Global trade of recyclables – metal, glass cullet, plastic & paper
Customs and Excise Act (Act 91 of 1964)	Global trade of recyclables – metal, glass cullet, plastic & paper

3.2.5 Key plans, strategies, and fiscal drivers in waste management

3.2.5.1 National Waste Management Strategy, 2008

The National Waste Management Strategy (NWMS) is a legislative requirement of the Waste Act that mandates municipalities to implement alternative waste management solutions to divert waste from landfill and minimise environmental degradation (RSA, 2008). Unfortunately, the 'under-pricing' of waste management (see definition in section 4.2 and recommendations in Table 38) plays a role in the limited success of this strategy (see section 3.2.5.2 below) with many municipalities providing infrastructure for aggregation (drop-offs) and the separation (material recovery facilities, MRFs), rather than providing the actual recycling infrastructure. In December 2019, the Department of Environmental Affairs (DEA) released a draft of the revised and updated National Waste Management Strategy (DEA, 2019). In the latest strategy, it focuses on South Africa's strategy for the circular economy and three strategic goals (DEA, 2019):

1. waste minimisation – underpinned by a) waste prevention; and b) waste as a resource;
2. effective, sustainable waste services – through a) implementation of DEA's separation at source policy; and b) IWMPs within Provincial IWMPs and local provisions for recycling drop-off/buy-back/storage centres in local IWMPs by 2020 (see section 3.2.6.5);
3. awareness and compliance – through a) reducing illegal littering and dumping; and b) waste facilities' compliance with local provisions for recycling facilities.

3.2.5.2 *Pricing strategy*

The pricing strategy governs the how, what and when of waste management charges, procedures for collection of charges, and for the allocation and use of the generated funds. One of the main objectives of the National Pricing Strategy for Waste Management (DEA, 2016b) is to address the under-pricing of waste services in South Africa which has persisted despite various strategies to rectify this through national policy. Driven by the 'producer-pays principle', it covers methodologies for determining waste management charges and provisions for implementing Industry Waste Management Plans (IndWMPs). The NWMS looks at both upstream and downstream economic instruments (Figure 8). Downstream are volumetric tariffs 'pay-as-you-throw' approaches, including landfill taxes for waste disposal, while the upstream elements focus on extended producer responsibility and international practices. The DEA and National Treasury has indicated they will invest more for research into implementing or extending Deposit Refund Schemes and Waste Disposal Tax interventions for hazardous waste disposal instruments once under-pricing has been corrected (DEA, 2018a).

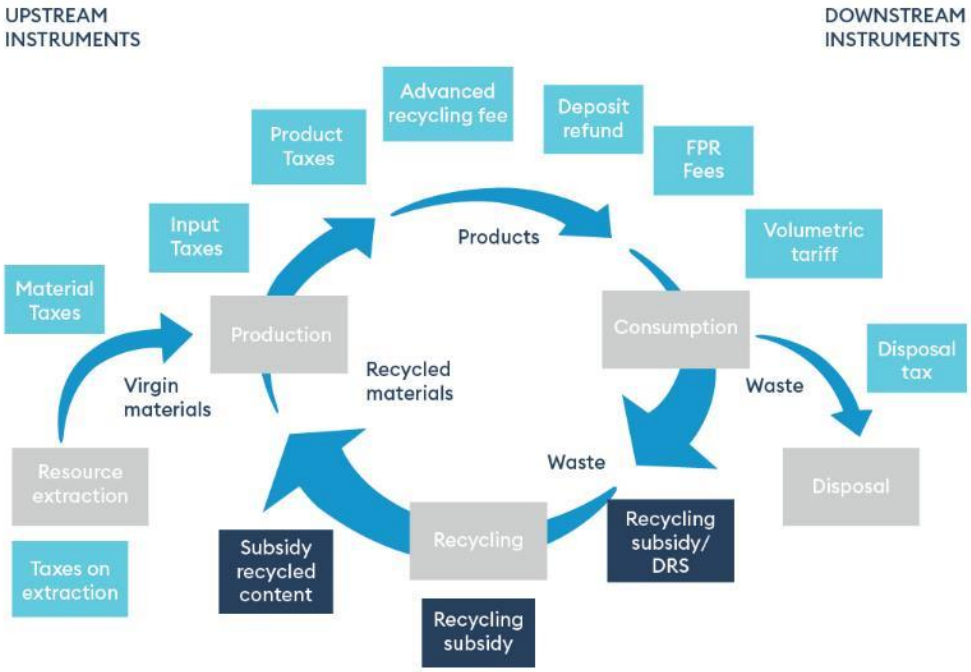


Figure 8: Example of economic instruments along the product waste value chain (Source: DEA, 2018a)

3.2.5.3 *Industry Waste Management Plans*

In 2017, new legislation was released which requires the paper and packaging, lighting equipment, and electrical and electronic industries to submit IndWMPs by September 2018. This has yet to be enforced and it is likely that the IndWMPs will only be implemented in 2020.

3.2.5.4 *Plastic bag levy*

South Africa introduced a plastic bag levy in 2003 in an attempt to reduce plastic bag consumption. Initially, there was a short-term drop in consumption when the levy came into force. However, South Africans became accustomed to paying for plastic bags and the demand soon began to increase. A study conducted by Dikgang et al. suggests the plastic bag levy did not appear to change consumer behaviour or plastic waste production (Dikgang et al., 2012). Figure 9 outlines the demand for plastic bags per R1000 of shopping in South Africa.

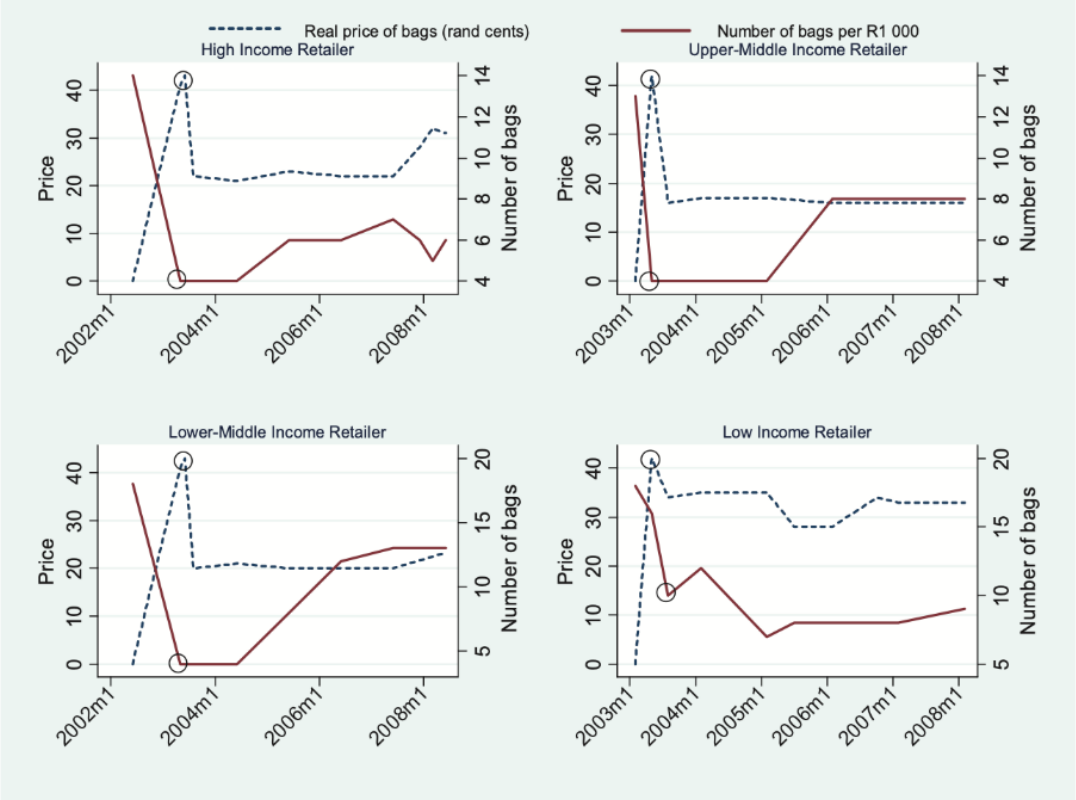


Figure 9: Demand for plastic bags per R1000 of shopping in South Africa (source Dikgang et al., 2012)

A review of the implementation and the effectiveness of South Africa's plastic carrier bag policies with a view to making recommendations for policy improvement found that it was also due to an increase in plastic bag use over the years as well an inappropriate price setting of the levy (DEA, 2019c). Setting the right levy level for bags may potentially nudge users to change their behavior in a way that will lead to fewer bags being used.

3.2.6 Anticipated regulations/guidelines

In addition to current regulations, there are several anticipated regulations and waste management guidelines currently under consideration by the South African Government. These include:

3.2.6.1 *Scheduled landfill restrictions (2019–2021)*

Under the national norms and standards for the assessment of waste for landfill disposal 2013, specific waste streams have recently (August 2019) been banned from landfilling, including liquid waste and hazardous waste with a caloric value of >20 MJ/kg. From 23 August 2021, POP pesticides listed under the Stockholm Convention, batteries other than lead acid, hazardous e-waste other than lamps, and macro-encapsulation of waste will be banned.

3.2.6.2 Western Cape diversion targets for organics

The Western Cape's DEA and DEA&DP recent organic waste diversion plan aims to divert 50% of organic waste from landfill by 2022, and 100% by 2027, which will require implementation and reporting on the municipal level.

3.2.6.3 *Norms and standards for composting*

With national pressure on diverting organics from landfill the national DEA is in the process of updating draft norms and standards for organic waste composting, which should reduce the licensing requirements, including a costly Environmental Impact Assessment (EIA) process (GreenCape, 2019).

3.2.6.4 *Guidelines for registration of digestate used as a soil conditioner or amendment*

The market of digestate is a significant barrier to the success of biogas projects, so the Department of Agriculture, Forestry and Fisheries (DAFF) is in the process of drafting guidelines for the registration of digestate as a soil conditioner or amendment (GreenCape, 2019).

3.2.6.5 *Guidelines for separation-at-source*

The DEA has developed voluntary municipal guidelines for separation-at-source of waste, which will be finalised in 2020 (DEA, 2019). The guidelines are first step to introducing separation-at-source into provincial and local IWMPs, with the aim of laying the foundation for a future DEA policy on separation-at-source, as referred to in the 2019 updated NWMS (DEA, 2020) (see section 3.2.5.1).

3.3 Roles and responsibilities

3.3.1 Stakeholders

South Africa's waste sector comprises the public and private sectors, and households. Table 6 below shows the division of roles between stakeholders for different waste streams within South Africa.

Table 6: Stakeholders contribution to waste management (Source: adjusted from the Waste Management Strategy DEA, 2011)

Role	General waste	Organic waste (garden refuse, wood chips/bark/dust, sugar bagasse, from paper production, pre-consumer food waste)	Recyclables (paper, plastic, metal, glass and tyres)	Hazardous (batteries, solvents, CFLs, etc.)
Advocacy and education	Municipality	Municipality	Industry in partnership with municipality	Industry
Providing bins at source or take-back facilities	Municipality	Municipality	Municipality to provide additional bins at source*; industry to provide access to take-back facilities	Industry
Collecting waste	Municipality	Municipality	Small- and medium-sized enterprises supported by industry	Industry
Processing waste	Municipality	Municipality	Materials Recovery Facilities (MRF) run by small- and medium-sized enterprises and supported by industry	Industry
Disposal of waste	Municipality (landfill)	Municipality (composting family) **	No disposal as per set of targets*	Industry

*Though these roles are outlined in the waste strategies, this does not yet occur.

**It should be noted that there is no separation of food waste (organic waste) on a municipal level.

3.3.2 Public sector

Solid waste management (SWM) in South Africa is the joint responsibility of the national, provincial, local and district municipality levels of government, which take an integrated waste management approach. The role of national government is to set out the overarching policy and financial and administrative framework in South Africa, including licensing for hazardous waste.

The provincial authority has the function of regulating and enforcing national legislation in the Waste Act and for the management and licensing of general waste management activities. Local and district municipalities are responsible for refuse removal, refuse dumps and solid waste disposal.

The NWMS's integrated waste management approach (Figure 10) aims to direct efforts at pollution prevention and minimisation at source before disposal.

The updated 2019 Third NWMS noted it was previously a top-down, state-led approach, and now re-focuses efforts on the Circular Economy (decreasing impact of economic activities by 3Rs and repurposing and processing waste to manufacture products instead of virgin materials).

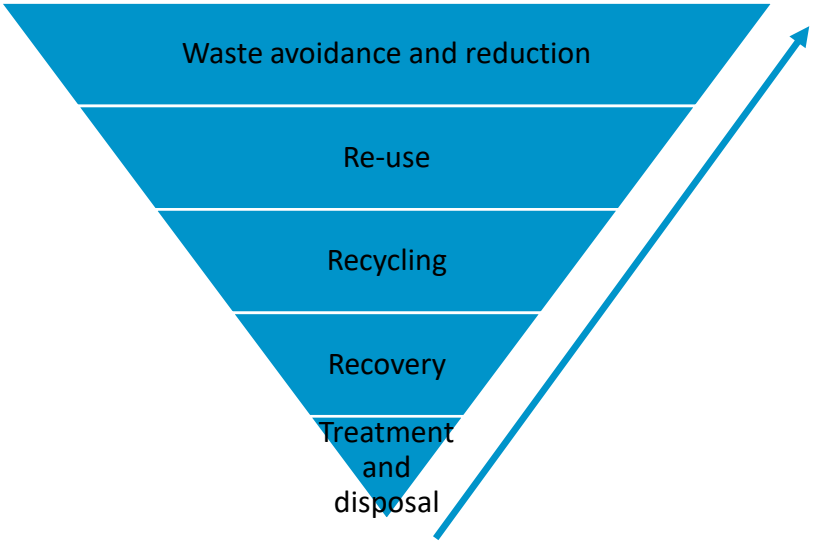


Figure 10: Waste management hierarchy (Source: NMWS, 2011)

The following section outlines how the three spheres of government work together for SWM in South Africa

3.3.3 National Government

The national DEA is the overarching authority for waste management in South Africa. The role of the DEA is to draft legislation, regulations, standards and Integrated Waste Management Plans (IWMP). The Waste Management Bureau has been established to manage and implement the IndWMPs. It also regulates multilateral agreements and ensures proper import and export controls.

The following Table 7 summarises the main national departments and their areas of responsibility in addition to the DEA.

Table 7: Roles of government departments (Source: NWMS, 2011)

Department	Area of responsibility	Description
Department of Co-operative Governance	Waste services planning, delivery and infrastructure	• Support municipalities to prepare Integrated Waste Management Plans (IWMPs) and integrate with Integrated Development Plans (IDPs). • Make MIG funds accessible for development and upgrading of municipal landfill sites.
Department of Trade and Industry	Industry regulation and norms and standards	• Manage the overall system of industry regulation. • Apply Consumer Protection Act. • Develop norms and standards using the Technical Infrastructure. • Support the development of markets for recycled materials.

Department	Area of responsibility	Description
		• Support the establishment of small businesses for waste collection services and recycling.
National Treasury	Fiscal regulation and funding mechanisms	• Oversee financial integrity of intergovernmental transfers to provincial and local government. • Manage the overall system of taxation and implement tax measures that support the goals and objectives of the NWMS. • Determine budget allocations for waste management functions at national level.
Department of International Relations	International agreements	• Give effect to Multilateral Environmental Agreements.
South African Revenue Services	Import and export control	• Ensure waste management measures are aligned with the product codes in the Schedules to the Customs and Excise Acts.
Department of Water Affairs	Water quality and licensing	• Collaborate with DEA in issuing integrated waste disposal licences.
Department of Mineral Resources	Waste management in the mining sector	• Regulate waste management in the mining sector that falls outside the ambit of the Waste Act (including residue deposits and stockpiles) and remediate land that mining activities have contaminated.
Department of Health	Healthcare risk waste	• Address healthcare risk waste and advise DEA and provincial departments on the appropriate standards and measures for the sector.
Department of Defence	Contaminated land	• Remediate land contaminated by explosives waste.

3.3.4 Provincial level

Waste management at the provincial level is mainly focused on providing guidance to district and local municipalities. Provincial authorities regulate and enforce national legislation and manage licensing of general waste management activities.

Provincial legislation includes:

i. **Integrated Waste Management Plans** (IWMPs) – each province is required to compile an IWMP and to report against this plan annually. The report must set waste management targets and describe plans for the three tiers of government. Importantly, it links mainstream budgeting and resource allocation to systems for performance monitoring and reporting.

   Information on waste management and waste data is comprehensive and easily accessible in Western Cape with a provincial IWMP 2017–2022 and a local municipal Integrated Waste Management Policy of the City of Cape Town. Durban is governed by the eThekwini Integrated Waste Management Plan 2016–2021, with no IWMP known to be available for KZN province.

For this reason, the data included in this report contains more in-depth information on the Western Cape.

ii. **Waste Minimisation Strategy and Plans** – each province has a mandate to work with their municipalities, industry and communities to promote waste minimisation through awareness campaigns and capacity building, facilitation, development and implementation of waste management policies with the aim to minimise waste, reduce environmental impacts and stimulate the waste economy and job creation. For example, the DEA&DP in the Western Cape**.**

3.3.5 Local government

Municipalities are responsible for waste services including household collection, removal, storage and disposal, collecting data for the Waste Information System (WIS) and running public awareness campaigns.

Key legislation includes:

i. **Waste Management By-laws** set service standards for separating, compacting and storing solid waste, managing and directing solid waste disposal, and controlling litter;

ii. **Municipal and provincial Integrated Waste Management Plans (IWMPs)** set out the strategy for waste collection standards in each community, which also feed into the local level Integrated Development Plans (IDPs).

3.3.6 Private sector

The commercial and industrial sector is, by law, responsible for managing of its own waste, whether this is outsourced to private service providers, or through paying local municipalities a waste management fee (for non-hazardous waste only). While the private sector is incentivised to explore alternative waste treatment options as landfilling fees increase, municipalities are not.

South Africa's recycling sector is driven by industry and supported by industry-funded associations. South Africa has 300 active recycling companies. According to Plastics South Africa (Plastics SA), the top 30 recyclers in South Africa currently process 54% of the country's plastic waste and Gauteng has half of all recycling companies in South Africa who handle 58% of the country's recyclate (Plastics SA, 2015).

3.3.7 Recycling industry associations

There are various industry associations in South Africa, including producer-responsibility organisations (PROs), material-specific organisations and recycling organisations. Each organisation is focused on recovery and recycling of materials (mainline recyclables, e-waste and organics) at different points across the value chain. Currently there are no regulated distinctions between the roles and responsibilities of the different industry associations.

Although membership and financial contributions to associations are voluntary, this may change with the implementation of mandatory Extended Producer Responsibility (EPR) and IndWMPs (including the paper and packaging, electrical and electronics, and lighting value chains) (GreenCape, 2019).

3.3.8 Informal waste sector

Recyclables in South Africa are recovered by the informal sector from either landfill sites, dumpsites or kerbside (household, commercial or communal bins). South Africa's informal waste collectors ('waste pickers' or waste 'reclaimers') play a critical role in recovering valuable materials diverted from landfill. Waste pickers emerged in the late 1980s, as many people lost their jobs in the formal sector (Mbata, 2018). Today, waste pickers represent some of the most vulnerable workers at a municipal level, facing serious health and safety concerns in precarious jobs that fail to meet the standards of decent work, including no labour rights. According to Plastics SA, the informal sector supplies 80 to 90% of packaging waste to recyclers in South Africa (Plastics SA, 2015).

Figure 11: South Africa's Waste Pickers

(Source: 1 Khabokhedi Waste Management, 2015. 2 Maile, 2017. 3 Viljoen et. al, 2018 Image: McLean Banda, a waste picker who lives in the informal settlement next to Genesis Landfill in Central Johannesburg, sorts his recyclable materials. Photo credit: APWC, 2019)

Because waste pickers selectively pick off the most valuable material, street picking is often associated with littering, which can, in turn, increase the municipal workload and associated collection and street cleaning costs. Despite their substantial contribution to the waste cycle at no cost to the local authority, informal collection and recycling sub-sectors are often excluded in city plans to modernise solid waste and recycling systems, with workers and their families increasingly criminalised (Maile, 2017; Commonwealth Voices, 2019).

In recent years there have been conflict, including incidents of forced removal of pickers from landfill sites and attempts to 'formalise' selected workers through exclusive contracts with recycling companies (Pillay, 2017; Postman, 2018). Although there is now increased dialogue with major stakeholders, and improving relations with municipalities, private contractors and the workers' associations including the formation of the South African Waste Pickers Association SAWPA (Groundwork, 2013; Arnoldi, 2019), tensions persist in many areas (Khanyile, 2019). Household residents are also concerned about litter resulting from pickers' activities, although this is often related to the stigma experienced by waste pickers (Harrisberg, 2019) (see Table 8 for an analysis of the socio-economic perspectives of the realities of waste pickers).

Image 6: Waste picker looking for recyclable material in Cape Town (Photo credit: APWC, 2019)

While there are widespread concerns over health and safety, employment and income levels, some academics have also raised concerns in relation to waste pickers and the planned mandatory Extended Producer Responsibility (EPR) schemes. Adoption of traditional EPR models has the potential to negatively impact on the livelihoods of waste pickers by creating competition between the informal and formal sectors in the collection and sorting of recyclables (Godfrey, Strydom & Phukubye, 2016).

While it has been proposed to 'formalise' the informal sector and utilise the individuals who have already trained themselves, the mandatory provision of adequate salaries, personal protection equipment and relevant inoculations are all at a proposal stage and no formalised review has been undertaken. Raising the socio-economic status of a very large 'informal' sector is, however, a complex process. Challenges with formalisation include:

- Informal workers could be incorporated into the formal system, but at lower wages and poorer working conditions, such as in Senegal during the 1990s (Niekerk & Weghman, 2019);
- Only a fraction of the informal waste workers might gain formal employment, further deepening inequalities between a formally employed workforce and informal waste workers;
- Engaging informal workers can often be seen as problematic for employees used to working within rigid organisations, as the informal sector by its very nature is often an 'invisible' and unstructured sector although there is a high degree of internal co-operation;
- Registration, which requires informal workers to produce documentation, often excludes undocumented or illegal immigrants.

Despite these challenges, understanding the perspectives of each sector (Table 8) is critical to furthering an integration of the informal sector into South Africa's waste management.

Table 8: Differing perspectives of socio-economic realities of the informal waste sector (Source: Churr, 2014)

FACTORS	Informal Waste Sector (IWS)	MUNICIPALITIES	PUBLIC
LIVELIHOOD AND EMPLOYMENT	Attractive livelihood because of ease of entry. Limited 'other' opportunities because of limited skills. Work for themselves with freedom of movement. Appetite for risk is low with low rate of job change often following lead of family.	Where informal waste reclaimers collect waste, they don't provide a reliable service, leaving the municipality to clean up after them. Generally, throughout the world, the IWS has no access to unions or regulatory bodies. Due to the informal nature, taxpaying jobs and taxpaying businesses are unable to compete with the IWS. In South Africa, the South Africa Waste Pickers Association SAWPA has been formed and is a representative voice (Groundwork, 2013).	Want reliable waste collection service delivery. See informal waste reclaimers as a nuisance because they can leave a mess. Perceive IWS to be linked to criminal activities, such as housebreaking.
HEALTH AND SAFETY	Unhygienic and dangerous conditions, exacerbated by the public habit of mixing dirty waste with valuable materials. Health issues from poor and harsh working conditions. IWS unaware of health risks and potential for lower life expectancy.	Aware of unhealthy, dangerous and unhygienic living environments. Safety at landfills has a major impact on landfill operations and risk/liability to the municipality. Waste reclaimers often blamed for vandalism (breaking down fences, theft of infrastructure).	Perceive landfills and drop-offs as unsafe and use these public areas with caution. Informal reclaimers are seen as a threat to health and safety due to nuisance from cherry-picking. Perceive kerbside collectors as introducing crime into suburbs. Unaware of the

FACTORS	Informal Waste Sector (IWS)	MUNICIPALITIES	PUBLIC
			long-term benefits to themselves or the IWS.
WORKING CONDITIONS	Intense physical labour under harsh conditions (sun, heat, rain). Long hours (early mornings and into the night), often to avoid persecution or the elements. Great distances to walk to collect and sell recyclables.	Causes operating problems for landfill managers. Realise lack of regulation/legislation on working conditions. Want to regulate activities at landfills but can't easily control access and does not want to impede on livelihoods. An example in South Africa where municipalities, waste pickers and funders work together to create a sorting space can be found in Ekurhuleni (Fair Plastic Alliance).	The public choose not to see working conditions – oblivious to working conditions of the poor. Public perception of working conditions of the IWS is limited mostly to street reclaimers.
LIVING CONDITIONS	Live on landfill sites, informal settlements or on the streets as close as possible to their source of livelihood (waste). Shelter often constructed from waste materials. Often no distinction between working and living environment. Often have right of tenure on the landfills but experience increasing opposition.	The government has a constitutional responsibility to improve living conditions and provide access to decent housing. Legislation makes no provision for reclaimers on landfill.	The public are oblivious to people living in and among waste at landfills in makeshift housing made from waste. Informal waste reclaimers sleep in the streets, under boxes, or wherever they can, and cause a nuisance and an eyesore. The public is not aware that reclaiming is an often consequence of poverty or homelessness.
DEMOGRAPHICS	Complete families, women and children are involved. Men are often involved in more manual labour such as pushing heavy street trolleys. Women can, however, work equally hard (if not harder). Women can work and earn an income, while taking care of children and doing other household tasks. Attracts many immigrants due to absence of systematic checks on working visas.	Municipal officials have very little status-quo information on the IWS. Often turn a blind eye to aspects such as child labour. Immigrants and waste pickers can be seen to cause social tension in communities.	The public misjudge waste reclaimers due to the way they look at hygiene. Perceptions limited to what is seen in the streets – trolley pushers, homeless, etc. Often unaware that women and children are involved, or they turn a blind eye. Child labour is frowned upon by the general public.

FACTORS	Informal Waste Sector (IWS)	MUNICIPALITIES	PUBLIC
VULNERABILITY AND OBSTACLES	Informal recyclers are, to a large extent, poor and low skilled. They do not have the financial means or technology to advance on their own within the recycling sector. Informal recyclers are prone to economic fluctuations given that solid waste is linked to consumption, and the value chain linked to global commodity prices. Limited transport capabilities, therefore, reclaim only material that takes up the least space will give them the most money.	Do not know how best to deal with IWS. Have very little information and data of the IWS and thus a vague understanding of their sector dynamics. Reluctant to acknowledge and accept the reality of the socio-economic conditions faced as this requires implementation of policy actions to address/integrate/include the IWS.	The general public perceives trolley brigades as a nuisance to drivers, as they take up space on the roads and cause traffic hazards.

3.3.9 Frameworks for cooperation between stakeholders

A number of institutional arrangements are in place to facilitate waste management and co-operation among various parties within South Africa. Figure 12 below provides an example of an institutional framework for the waste sector for the Western Cape province.

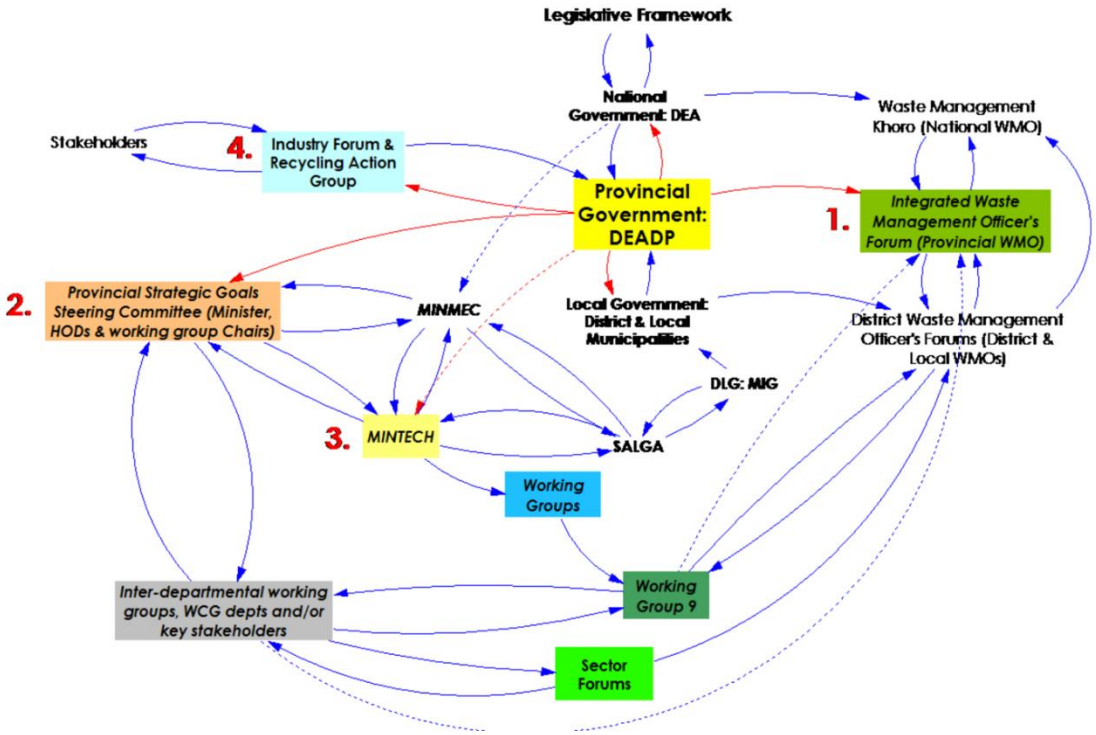


Figure 12: Institutional framework for the waste sector (Source: Western Cape Integrated Waste Management Plan (IWMP) 2017–2022)

4 Solid Waste Management

4.1 Service delivery overview

Mismanagement of plastic waste differs in severity across Africa. However, with growing urban population centres, mismanagement of plastic waste tends to increase (Figure 13), (Jambeck et al., 2018). Across Africa, eight countries (South Africa included) have the highest category for the mismanagement of plastic waste (equivalent to more than 0.8 kg per person per day). Half of these eight countries – including South Africa, Nigeria, Egypt and Algeria – have the highest generation of plastic waste per day (as shown in below Figure 13, Jambeck et al., 2018). South Africa is estimated to be eleventh in the world for mismanagement of plastic waste which could potentially enter the oceans (Jambeck et al., 2015).

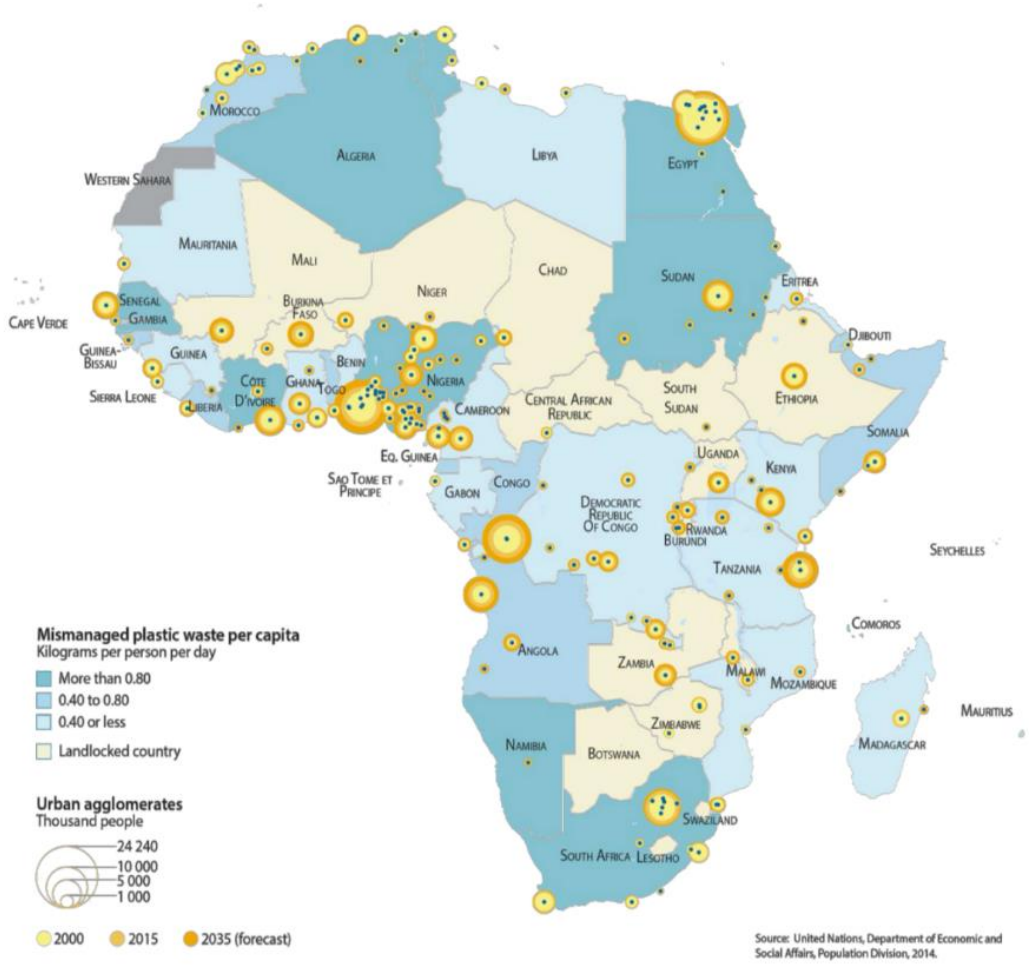


Figure 13: Mismanaged plastic waste generation and urban population increase in Africa (Source: Jambeck et al., 2018)

It was estimated in 2010 that 630,000 tonnes of plastic waste entered the environment because it had been mismanaged (Jambeck et al., 2015). The DEA notes that littering and illegal dumping (including of hazardous waste) is common in South Africa, particularly in urban areas (DEA, 2018).

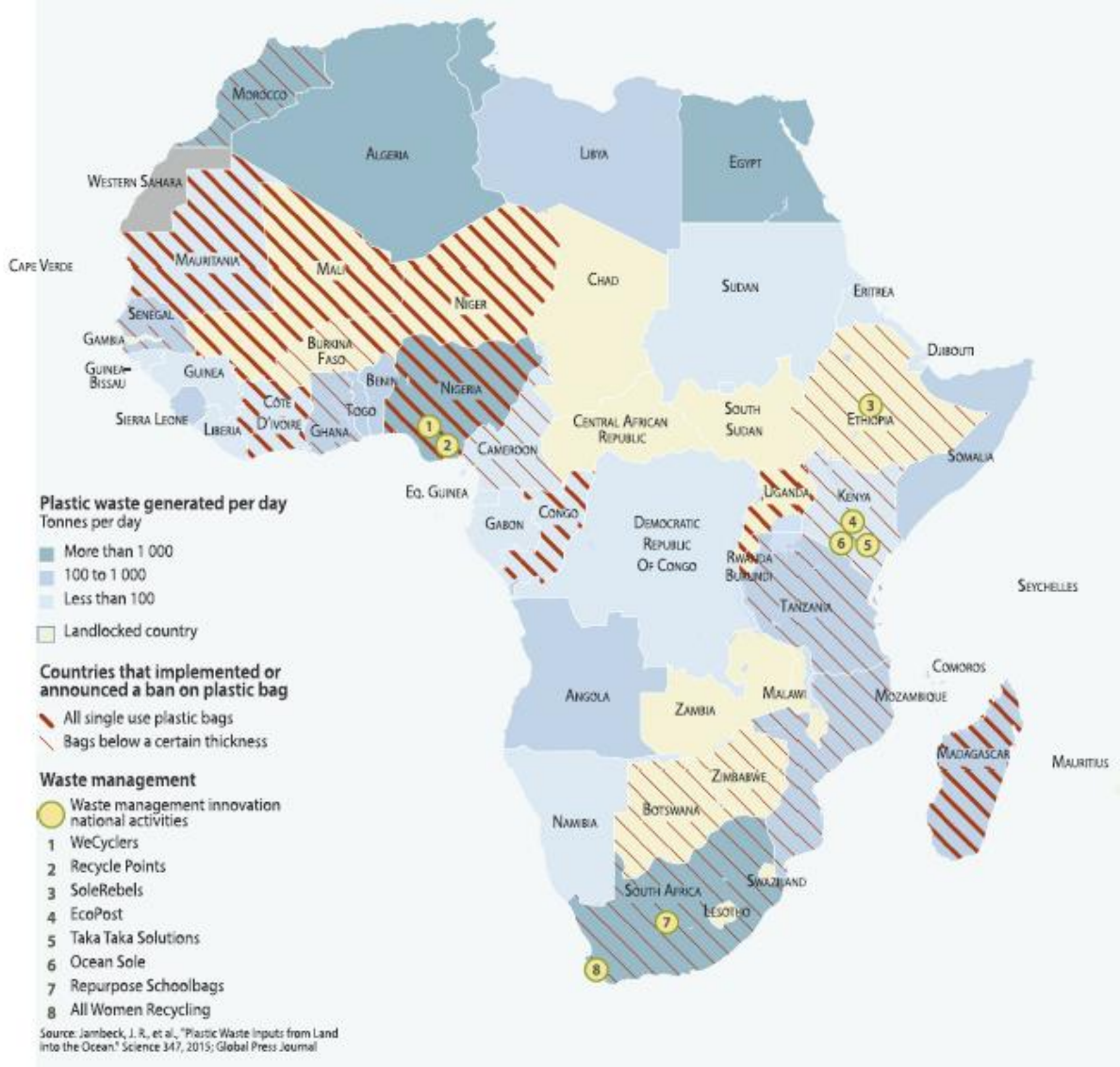


Figure 14: Plastic waste generation rates and projects addressing waste management in Africa and Plastic Bag policies (Source: Jambeck et al., 2018)

Based on the 2016 census survey across South Africa, 33% of households have no household waste collection services. This equates to more than 5 million households lacking a collection service. In addition, 5% of households have no sanitation services nor sanitation arrangements. Within individual provinces there is a wide variation on such service delivery (Stats SA, 2016c).

While these figures are low, the above data still shows an overestimation of households with waste and sanitation collections, notwithstanding that it has improved significantly over time (Stats SA 2011; Stats SA, 2018). In some traditional, informal and previously disadvantaged areas, the collection of waste and sanitation is conducted by municipality or municipal contractors at a community collection point, which may explain the data above. However, the collection in these areas sometimes fails due the following reasons (DEA, 2018; Treasury, 2011):

- A lack of regular or frequent collection from the collection point, leading to a piling up and overflow of waste;
- The point of access of the collection point is considered dangerous by the community;
- The point of access of the collection point is considered too far away for many members of community.

In 2016, it was reported that 33% of South African households disposed of their own waste (see Figure 15 below), while 61% households had their waste collected by the municipality collection service (Figure 16). Overall, 5% of Western Cape households and 46% of KZN households disposed of their own waste. Estimates put the backlog of solid waste service provision at around 2 million households, with some 900,000 households not receiving any service (DEA, 2016a, 2016c). Figure 15 provides an overview of the total population, number of households and number of households that receive municipal waste services across South Africa, and further broken down to Western Cape, Eastern Cape and KwaZulu-Natal provinces.

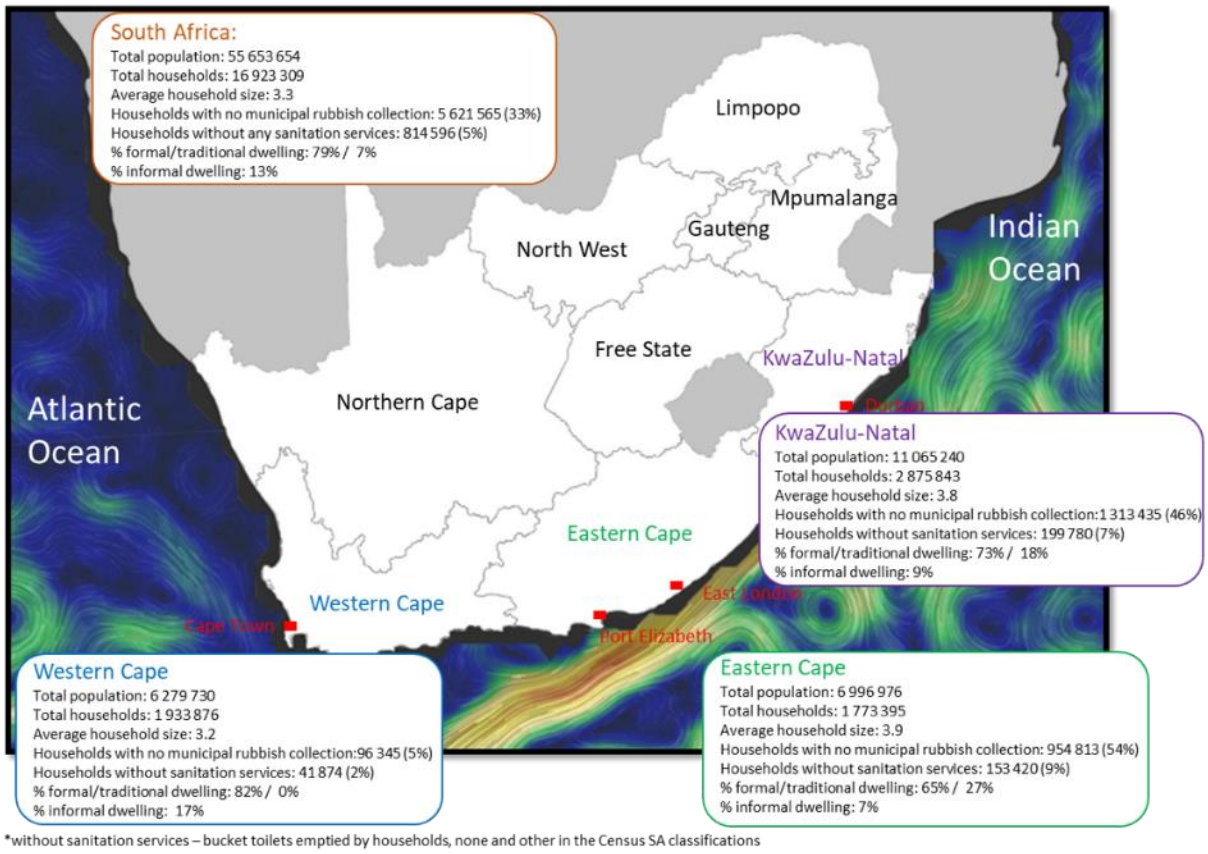
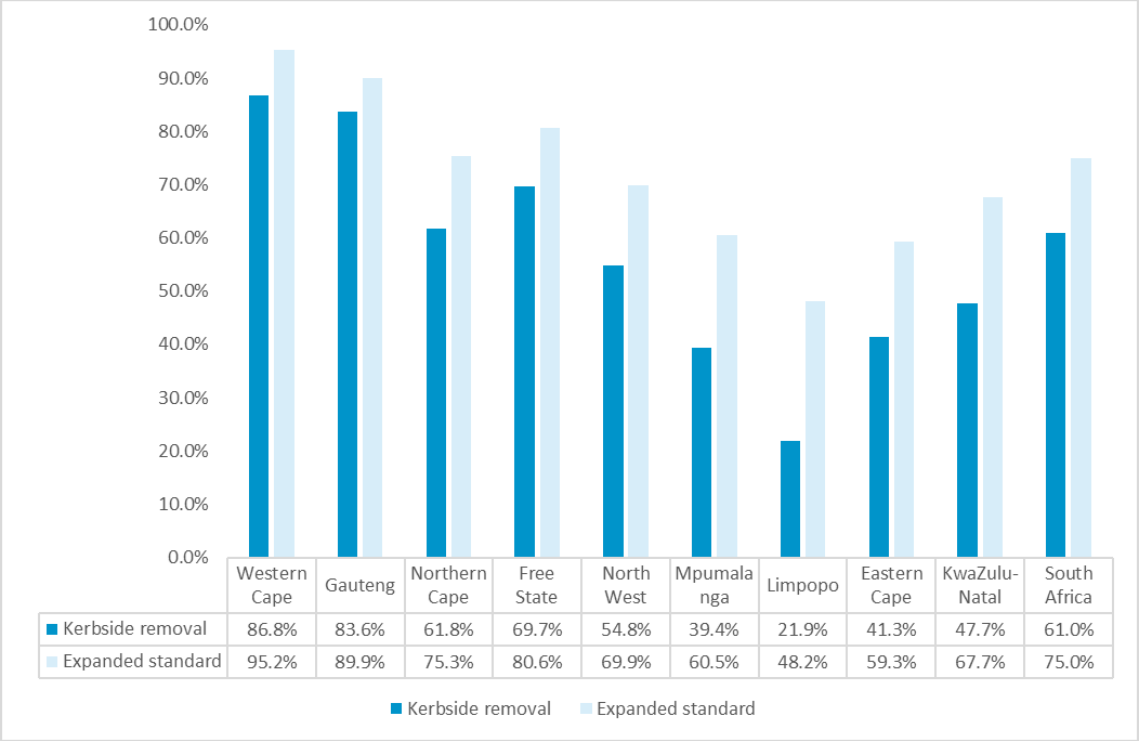


Figure 15: Map of South Africa focusing on population size and waste service delivery in three provinces (Source: Data: Compiled by Cefas (Statistics South Africa, 2016a, 2016c). Satellite imagery: (NaturalEarth, 2018) visited on 12/09/2018

Map: https://www.vectorstock.com/royalty-free-vector/outline-south-africa-map-vector-1602127 visited on 12/09/2018

In order to fulfil its mandate that all households have access to some basic refuse disposal, the DEA defines basic refuse disposal as the most appropriate level of waste removal services given local conditions. In many formal townships and informal settlements, this is done through central official

collection points or 'communal containers', which leads to an overestimation of effective waste disposal and services.



	Western Cape	Gauteng	Northern Cape	Free State	North West	Mpumalanga	Limpopo	Eastern Cape	KwaZulu-Natal	South Africa
Kerbside removal	86.8%	83.6%	61.8%	69.7%	54.8%	39.4%	21.9%	41.3%	47.7%	61.0%
Expanded standard	95.2%	89.9%	75.3%	80.6%	69.9%	60.5%	48.2%	59.3%	67.7%	75.0%

Figure 16: Households with an appropriate level of access to solid waste disposal services by province using DEA definition of 'context appropriate' disposal, 2016 (Source: Stats SA, 2016b)

Illegal dumping areas that are regularly cleaned by municipal waste workers are also utilised by urban communities with little to no regular waste services. In areas where there is no municipal collection, settlements use their own uncontrolled dumpsites, or indiscriminately dump their rubbish anywhere, including using waterways, streams and rivers to remove rubbish from the immediate area (Table 9). This observation is supported by the APWC interview data.

Table 9: Household refuse removal by province and urban/rural status (Source: adapted from StatsSA 2018, general household survey)

Province	Urban/Rural status	Removed at least once a week	Removed less often than once a week	Communal refuse dump	Own refuse dump	Dump or leave rubbish anywhere	Other
Western Cape	Rural	23.2%	10.6%	40.6%	20.9%	2.0%	2.8%
	Urban	97.2%	0.0%	2.3%	0.0%	0.5%	0.0%
	Metro	90.4%	0.5%	9.0%	0.1%	0.1%	0.0%
	Total	**88.7%**	**0.9%**	**8.8%**	**1.2%**	**0.3%**	**0.2%**
KwaZulu-Natal	Rural	3.3%	0.7%	4.8%	89.0%	2.2%	0.1%
	Urban	69.7%	1.3%	2.7%	26.2%	0.2%	0.0%

Province	Urban/Rural status	Removed at least once a week	Removed less often than once a week	Communal refuse dump	Own refuse dump	Dump or leave rubbish anywhere	Other
	Metro	83.8%	5.2%	0.7%	9.6%	0.5%	0.0%
	Total	**51.2%**	**2.6%**	**2.7%**	**42.4%**	**1.1%**	**0.1%**
South Africa	Rural	8.2%	1.2%	4.0%	81.9%	2.7%	1.5%
	Urban	82.7%	2.6%	1.9%	10.6%	2.1%	0.1%
	Metro	88.3%	1.5%	4.2%	4.5%	1.5%	0.1%
	Total	**64.7%**	**1.7%**	**3.5%**	**27.7%**	**2.0%**	**0.5%**

It is also important to note that the national figures hide large discrepancies between rural and urban areas, and between provinces. As can be seen in Table 9 above, a staggering 82% of rural households rely on their own refuse dump compared with 10.6% in urban areas, and 4.5% in metro areas (most likely in informal households). This is true for most rural households in South Africa with the exception of the Western Cape, where 20.9% use their own dump.

The differences of rural waste collection between Western Cape and other provinces may result from Western Cape consisting largely of organised farmland that is less inhabited due to the geography of the Cape Fold Belt when compared with the densely populated KZN rural and tribal areas (DEA, 2011). On average across both urban and rural areas, 2% reported to dump or leave their rubbish anywhere.

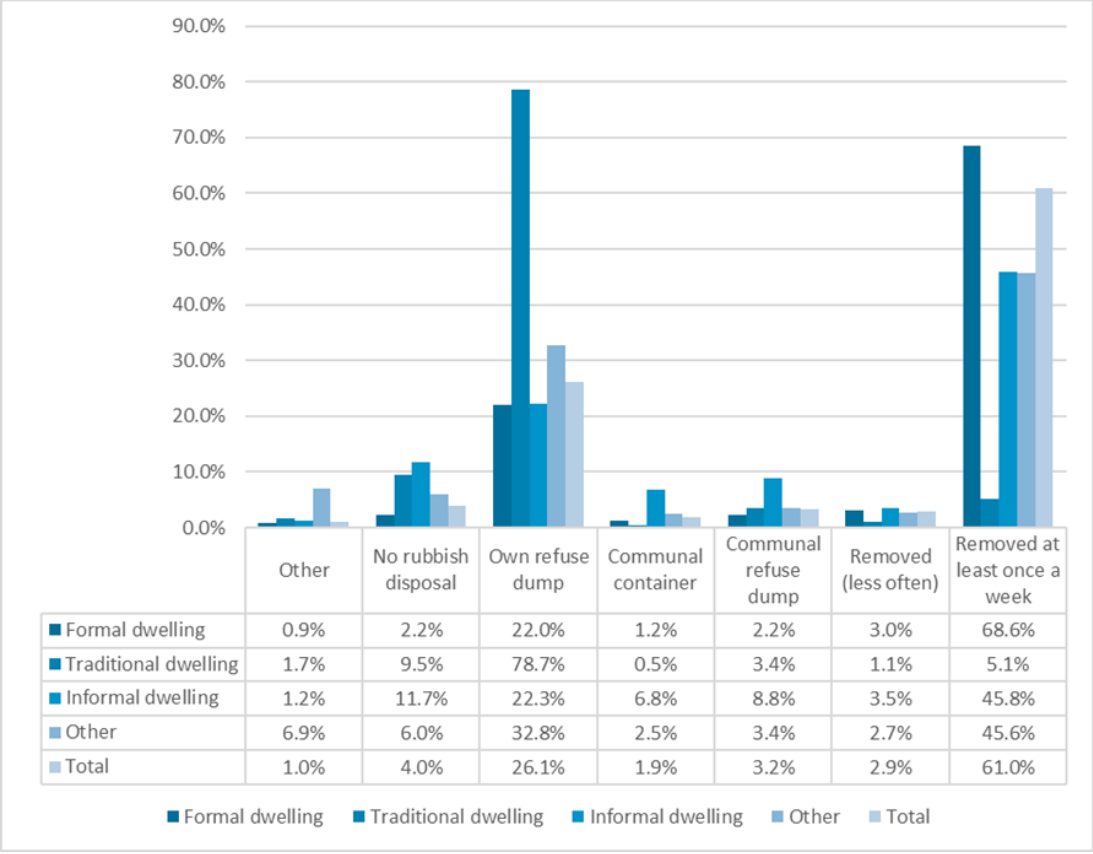


Figure 17: The distribution of households by refuse removal and type of main dwelling (Source: StatsSA, 2016 community survey)

As can be seen in Figure 17 above, nationally 25% of formal dwellings, 90% of traditional dwellings and 35% of informal dwellings receive no waste management, either using uncontrolled refuse dumps, or dumping waste anywhere.

The satisfaction of households with municipal waste services varied significantly between provinces throughout South Africa (Figure 18). Households in the Western Cape were much more satisfied with the quality of municipal waste removal service, with 76% rating it as 'good' versus 40% in KZN, which was lower than the national overall rating (49%). Only 0.8% of WC residents, 16% in KZN and 13% nationally stated they got no access to municipal waste services.

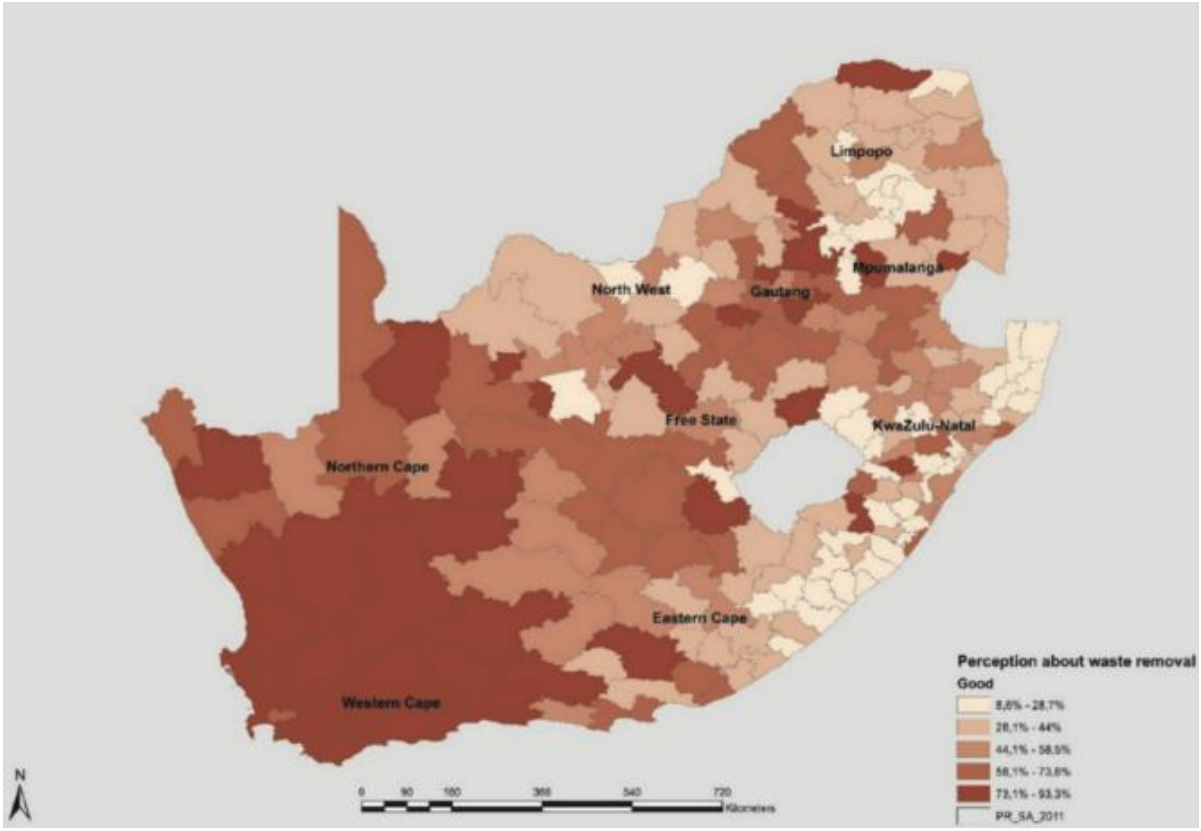


Figure 18: Household perception of refuse removal services by local municipality, 2016 (Source: Stats SA, 2016b).

4.2 Solid waste management in South Africa

In 2016, the waste economy:	•Contributed R24.3 billion to the South African GDP. •Provided 36,000 formal jobs. •Supported 80,000 informal jobs/livelihoods (DEA, 2017).
A 2012 Waste Sector survey found:	•The formal waste sector (public and private) is R15.3 billion, or 0.51% of GDP with the majority situated within large enterprises (88.0% of private sector revenue) and metropolitan municipalities (80.4% of public sector revenue).
Approx. 62% of the total revenue generated from waste activities:	•By companies which had been in the industry for more than 25 years. •Waste companies younger than five years contributed a minimum of R188 million into the economy.
The majority of employees in the formal waste sector are situated within large enterprises:	•77.5% of private waste sector employees and metropolitan municipalities. •64.9% of public sector employees.
The figures for highly qualified graduates in the waste sector are relatively low:	•1,324 diplomas, 1,066 degrees, 119 Masters degrees, and 14 PhDs employed in the South African waste sector (Godfrey et. al, 2014).

Figure 19: South Africa's waste sector economy (Source: APWC compiled from DEA, 2017; DST, 2013; Godfrey, 2014)

Like most African nations, South Africa relies heavily on dumps and landfills as a means of disposal of end-of-life materials (World Bank, 2012). The ongoing disposal of waste to landfill is largely due to the 'under-pricing' of the true costs of waste management by municipal governments, and the undermining of waste minimisation efforts by limited resource capacity.

Consequently, despite strong waste legislation, waste prevention, reuse, recycling and recovery are more expensive relative to disposal to landfill. Under-pricing waste disposal services essentially incentivises waste generators and waste producers (such as households or the plastics industry) to continue to dispose of waste to landfill (such as single use plastics) rather than re-using, recovering or recycling materials.

The result is the growth of the recycling sector only seeking the higher value waste streams, specifically ferrous metals, PET and paper (Godfrey et. al, 2016). According to the DEA, despite recycling efforts by formal companies and informal waste reclaimers, 90% of solid waste in South Africa (for which data is collected) still arrives as mixed waste on landfill sites (Churr, 2014).

Figure 20 shows a typical waste management arrangement in east and southern Africa (Okot-Okumu, 2012).

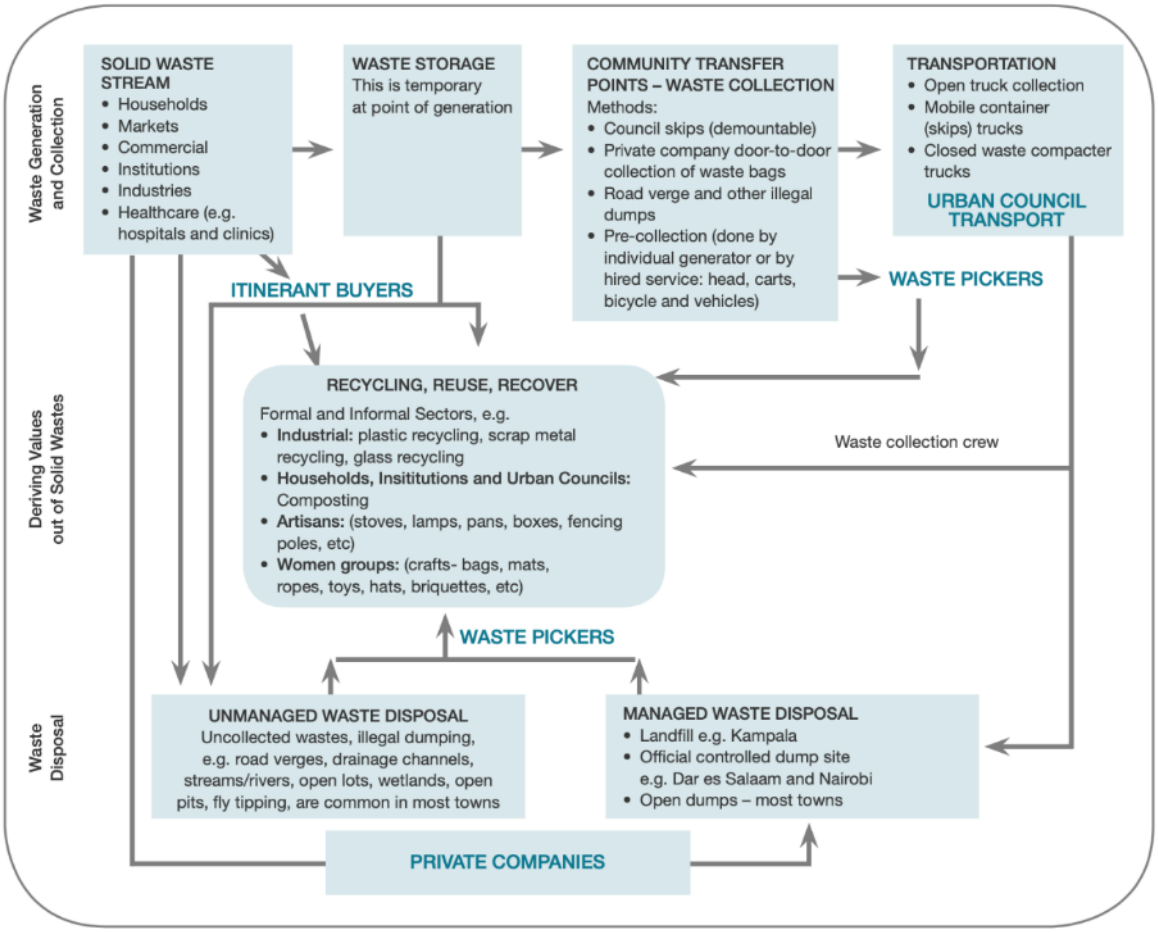


Figure 20: Waste management arrangement in Africa (Source: UNEP, 2018; Okot-Okumu, 2012)

4.2.1 Key issues

There is a number of key waste management issues identified by the DEA within South Africa (DEA, 2011; DEA 2019). These include:

- littering and illegal dumping;
- low levels of separation at source;
- lack of investment and infrastructure for recycling;
- lack of a recycling culture;
- backlogs in waste service delivery;
- increased complexity of waste streams and few waste treatment options are available to households and producers;
- limited data on main waste flows and national waste balance;
- a policy and regulatory environment that does not promote the waste management hierarchy, thus negatively influencing the economic potential of the waste management industry;
- the cost of waste management not appreciated by society or industry;
- few waste treatment options are available to households and producers.

4.2.1.1 *Storm water drains*

A major contributing factor to the significant rise in marine plastic pollution is the lack of focus and impetus given to effectively managing stormwater solid waste. Despite the current and potential impacts experienced by these environments, there continues to be a lack of required integration among relevant government departments and agencies to effectively address solid waste and stormwater control and discharge. The lack of integration means that often the solid waste can flow out to sea, out of sight and out of mind. The impacts of stormwater as a major source of entry for plastic to enter the ocean is clearly illustrated in the images below.

Image 7: Plastic debris on Cape Town's beaches (Photo credit: WWF Nedbank Green Trust, 2018)

Image 8: Durban beachfront (Photo credit: Hanno Langenhoven, Wild Trust)

Image 9 and Image 10: Litter following heavy rains on Blue Lagoon beachfront, Durban (Photo credit: Durban Green Corridor, Sifiso Mngoma, 2019)

4.2.1.2 *Status of recycling*

There is no national formal sorting system in South Africa, and broadly speaking, there is no culture of separating waste at source (GreenCape, 2018), with recycling figures below 20% across all provinces (Figure 21). There is little to no incentive or disincentive for separation as households pay for management through municipal rates regardless of waste diversion. Even if municipal by-laws could make mandatory separation at source, effectively enforcing it would be challenging.

Image 11: Recyclable content dumped in Cape Town (Photo credit: APWC, 2019)

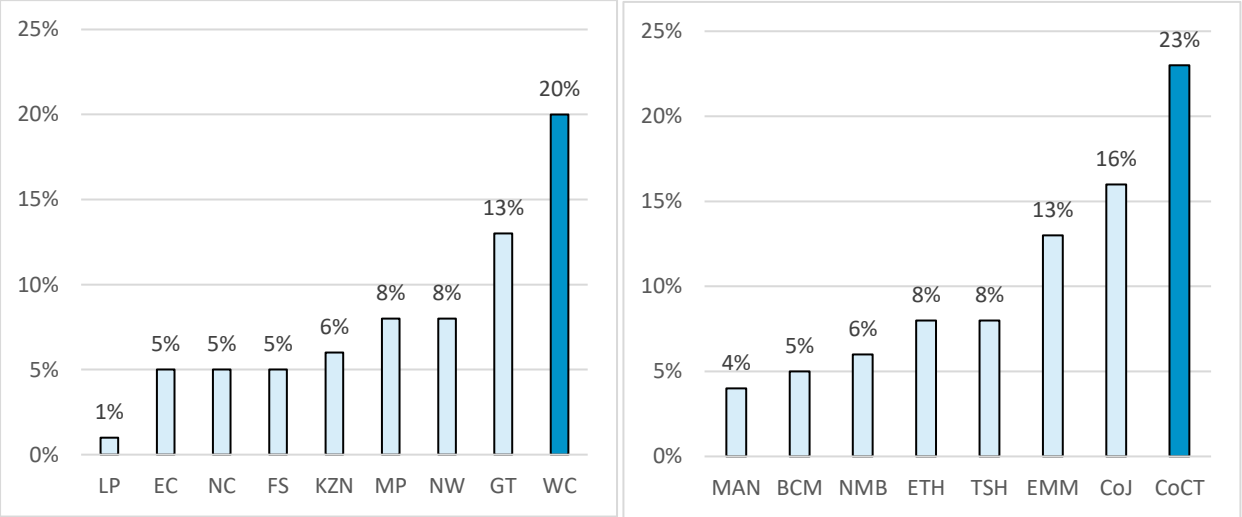


Figure 21: Household separation by province (left) and metro (right) (Source: GreenCape, 2019)

Despite several million rand being spent on sophisticated recycling plants, the history of recycling on a large scale in South Africa has not been particularly successful. One such example is the Athlone Integrated Waste Management Facility, opened in early 2017. It was forced to close in 2018 due to including incorrect waste characterisation of MSW, unexpected technical problems, and difficulty securing markets for tailings and digestate.

There has been reasonable success in certain regions, with organisations such as Collect-a-Can, Nampac, Sappi, Mondi and Consol Glass concentrating mainly on beverage cans, paper, plastics and glass, as well as PACKA-CHING, a mobile recycling unit travelling between communities in exchange for money on an e-wallet. Voluntary recycling and small buy-back centres have met with limited success due to a lack of recycling culture in South Africa (DEA, 2019), and the convenience of single-use plastics in the 'Age of Landfilling' (Godfrey and Oelofse, 2017; CSIR, 2005).

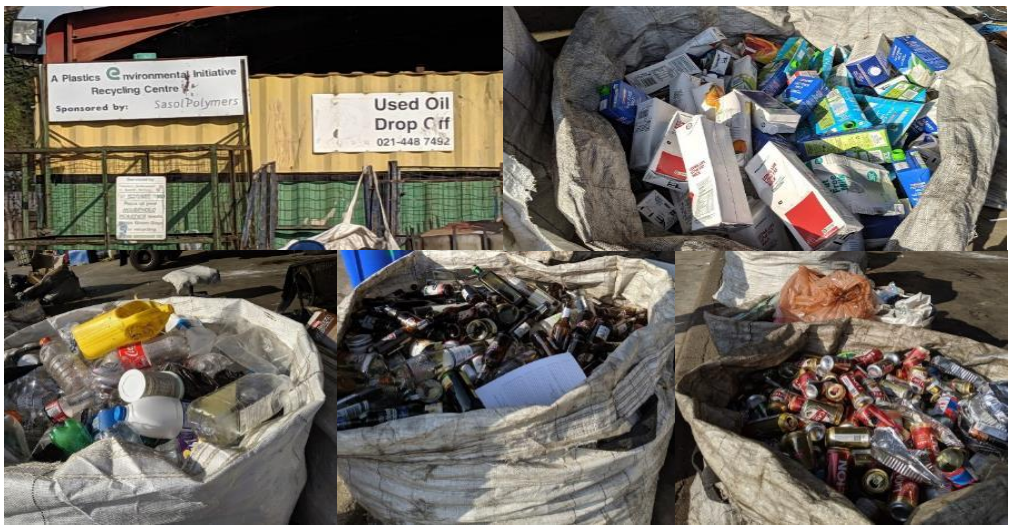


Image 12: Plastics, glass and aluminium cans bag ready for recycling at Recycling Centre Cape Town. (Photo credit: APWC, 2019).

As with all resource recovery, recycling requires an economic incentive, both for individuals and for businesses. Studies reveal that household collection of waste is more beneficial than drop-off centres (with no economic incentives) when attempting to increase recycling rates (DEA, 2017; González-Torre and Adenso-Díaz, 2005; Larsen et al., 2010). With high unemployment rates, informal waste pickers provide a valuable link to recyclers (Godfrey et al., 2016).

4.2.1.3 Solid waste information

All information regarding the legal generation and management of waste is captured by the South African Waste Information Centre (SAWIC).

Municipalities are required to submit monthly waste reports on the waste quantities disposed of and diverted from waste disposal facilities via the Integrated Pollutant and Waste Information System (IPWIS), using either weighbridge records, landfill airspace calculators or the Department's waste calculator. In terms of what occurs on the ground, the majority (64%) of Western Cape municipalities have not submitted all the required reports while the CoCT was fully compliant in 2015/2016 (WCG, 2017b). Similar data could not be found for KZN or eThekwini Municipality due to the lack of comprehensive data such as can be found on the Western Cape (see 3.3.4). In addition to capturing data on the tonnages of waste generated, recycled and disposed of in South Africa, the SAWIC is also used as a repository for the uploading of waste management licences.

4.2.1.4 Limitations of waste data in South Africa

The waste data available in the public domain in South Africa primarily reports on waste to landfill and not on improperly disposed waste. Considering almost 30% of households nationally in South Africa

dispose of their own waste (DEA, 2018a) – and as high as 81.9% in rural areas – this represents a significant proportion of South Africa's waste that is unknown in terms of volume or composition.

Regarding waste to landfill, baseline reports were published by the DEA in 2011 (National Waste Information Baseline Assessment) and updated in 2017 (State of Waste report – SoWR) as part of the NWMS action plan. It aims to estimate all general waste generated in South Africa, either collected at kerbside or brought to landfill for disposal.

The methodology used collates and interprets existing empirical data obtained through a number of sources, including through previous waste characterisation studies, and the municipal data reported to SAWIS using landfill weighbridges. The few waste characterisation studies on municipal waste that were undertaken at the time in South Africa, such as those completed by Gauteng in 2008 and Cape Town in 2008 (Gibb, 2008), were used for municipal waste composition data collation for estimates for these reports.

Limitations include:

- No primary collection was done. Secondary data from a wide range of sources was used, including SAWIS and waste characterisation studies;
- Figures estimate municipal landfill rates, not household generation rates or composition. As the municipalities only collect the data going to landfill, the waste diverted before landfill (e.g. recycling depots, kerbside waste pickers for mainline recyclables) was not accounted for and as a consequence, the SoWR notes there is likely to be an underestimate of the total general and waste generated in South Africa in the baseline year;
- The DEA states that it does not have confidence in the quality of information collected through SAWIS as most districts are not compliant with reporting standards, and units across districts were not consistent between tonnes and kilograms.

4.2.2 General Waste in South Africa

4.2.2.1 Waste generated

In 2011, the DEA reported South Africa generated 59 million tonnes of general waste, of which 10% was recycled and 90% landfilled (DEA, 2012). Interestingly, the State of Waste Report (SoWR) (2017) suggested that the total waste generated in 2017 reduced to 54 million tonnes and 38% of this was recovered/recycled and 61% landfilled (see Table 10 below). A comparison between the last two national baseline measurements is shown in Figure 22 below.

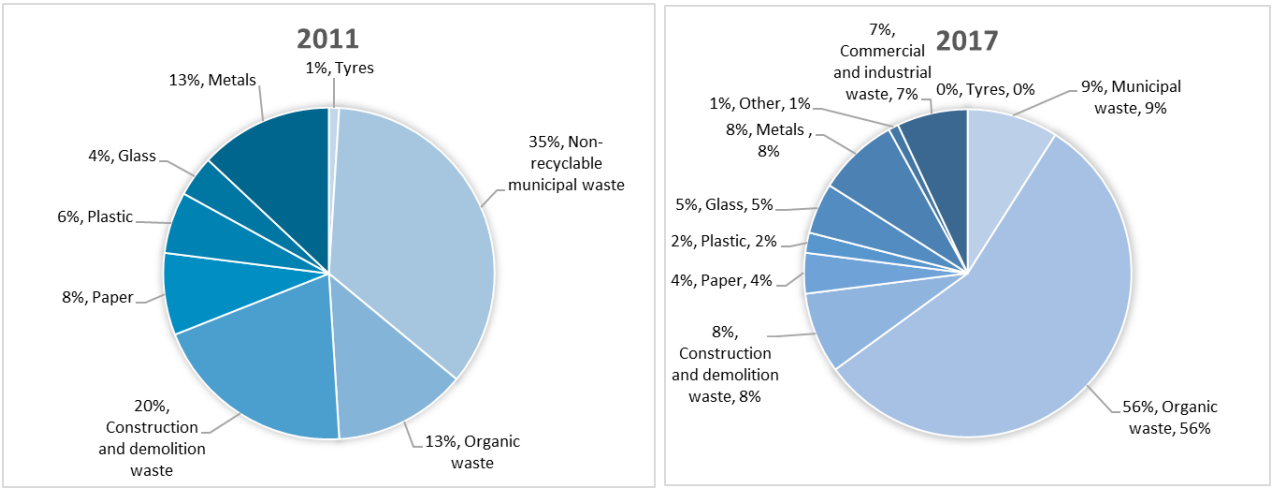


Figure 22: Comparison between 2011 and 2017 baseline report of general waste in South Africa (Source: APWC, compiled from DEA 2011 & DEA 2018)

Table 10: General waste generated in South Africa by management option, adjusted from the Waste Management Strategy (Source: DEA, 2011).

		Estimated tonnes	Imports	Exports	Recycling/ recovered	Landfilled	Recycling/ recovered	Landfilled
Municipal waste (non-recyclables)		4,821,430	2	4	0%	10%	0%	100%
Commercial and industrial waste		3,550,505	0	0	10%	90%	0%	100%
Organic waste (garden refuse, wood chips/bark/dust, sugar bagasse, from paper production, pre-consumer food waste)		30,499,455	4,048	298	31%	69%	12%	88%
Construction and demolition waste		4,482,992	0	0	90%	10%	6%	94%
Recyclables	**Paper**	2,211,225	58,548	129 375	58%	42%	39%	61%
	Plastic	1,113,362	6,804	20 947	43%**	56%	15%	85%
	Glass	2,492,636	39,928	11	78%	22%	23%	77%
	Metals	4,035,929	27,976	1,703,743***	75%	25%	48%	52%
	Tyres	240,000	0	0	100%	0%	29%	71%
Other		729,615	0	0	9%	91%	0%	100%
Total		**54,175,147**	**137,490**	**258,557**	**39%**	**0%**	**11%**	**89%**

* No tonnage for recovery/recycling was given in the SoWR draft 2, only percentages (DEA, 2018a).

**Due to significant difference in data reported in draft 1 (DEA, 2018b) and 2 (DEA, 2018a), both percentages are included in this table. See section 4.2.2.4 on limitations on waste data and section 4.2.2.5.1 on plastics waste data. Actual recycling tonnage for draft 1 figures can be found in the DEA, 2018b.

***The metal export figures are reported differently in the SoWR, namely 68,192 tones vs 1,703,743 (comprised of 1.5 million tonnes of ferrous and 132,102 tonnes non-ferrous). See Figure 23 in this report (TUTWA, 2017).

4.2.2.2 *Imports and exports*

Recovery of waste is a global industry, as recyclables are transported to areas with the facilities to recycle the goods economically. As such, in 2017, South Africa exported 258,557 tonnes of waste, accounting for 1% of total waste generated. This export figure for each waste stream represented 6% of total paper waste generated, 3% plastic, and 2% metals. It was calculated that 137,490 tonnes of general waste was imported (DEA, 2018a).

4.2.2.3 *Recovered/Recycling*

South Africa's dry recyclable sector is supported by industry-driven associations. Table 11 below from GreenCape's 2019 Waste Intelligence Report shows stream-specific tonnages for the Western Cape as reported by industry annual reports and engagements with industry association.

Table 11: Recyclables processed and available in 2017 as reported by associations (Source: GreenCape, 2019)

Name of industry association		Industry association	Material in circulation (imported/manufac-tured)		Collected/diverted from landfill		Available for recycling (tonnes)		
					Tonnages	%	Total in SA	Western Cape	
								Pop	Nomimal output
Plastics	PET (beverage bottles)	PETCO	143,438	210,939	93,235	65%	50 203	5,783	7,015
	PET (Thermoform/ edible oil)	-	67,500		0	0%	67 500	7,775	9,432
	LDPE	POLYCO	341,412	883,999	105,155	31%	236 257	27,213	33,011
	HDPE		227,000		63,333	28%	163 667	18, 852	22,869
	PP		315,587		47,338	15%	268 249	30, 898	37,481
	PVC	SAVA	157,912		17,844	11%	140, 068	16, 133	19,571
	PS	PASA	50,318		5 384	11%	44 934	5,176	6,278
Paper		PRASA	1,813,680		1,282,120	71%	531 560	61, 227	74,273

Glass		TGRC	770,412		631,738	82%	138 674	15, 973	19,376
Metal	**Cans**	MetPac-SA	162,000	217 000	164,486	76%	52 514	6,049	7,338
	Closures		18,000						
	Drums/ pails		37,000						
E-waste		ERA	360,000		45,000	13%	315 000	36, 283	44,014
		SAWEEEDA (2015)	322,000		45,000	14%	277 000	31, 906	38,704
Organic recyclers		ORASA	-		-	-	-	-	-

According to the SoWR, 39% of general waste was recycled (DEA, 2018a), which is a significant increase from 2011, when only 10% of general waste was recycled (DEA, 2012).

However, based on what is available in the public domain, recycling figures are not straightforward, with figures on collection, recovery, diversion from landfill, available for recycling versus tonnage turned into recyclate are often used interchangeably, and statistics taken from different points of the value chain. As an example, the general waste figures presented in the DEA's SoWR regarding mainline recyclables show tonnages of what is recovered from municipal waste, not what is turned into product. Furthermore, as noted in Table 12, the recycling figures released by the DEA in the 2018 SoWR are inconsistent within, as well as between, the first and second draft released in 2018.

With regards to plastics recycling figures, leading academics (Blottniz, 2019) have also challenged the plastic recycling statistic of 43%, which relies on industry figures. The latter is outlined in more detail in section 4.2.2.5.1 and Figure 31 on the plastics waste stream.

4.2.2.4 Waste composition

The following infographic outlines waste category definitions in South Africa:

According to the DEA, half of South Africa's general waste comprised of organic waste from industry (56.3%), followed by recyclables (17.2% including glass 4.6%; paper 4%; and plastic 2%), non-recyclable municipal waste (8.9%) and construction and demolition waste (6.6%) (DEA, 2018a).

The following charts highlight the waste composition in 2018 South Africa (Figure 23) and more specifically the Western Cape Province (Figure 24), the City of Cape Town (Figure 25 and Figure 26) and eThekwini Municipality (Figure 27).

4.2.2.4.1 South Africa waste composition

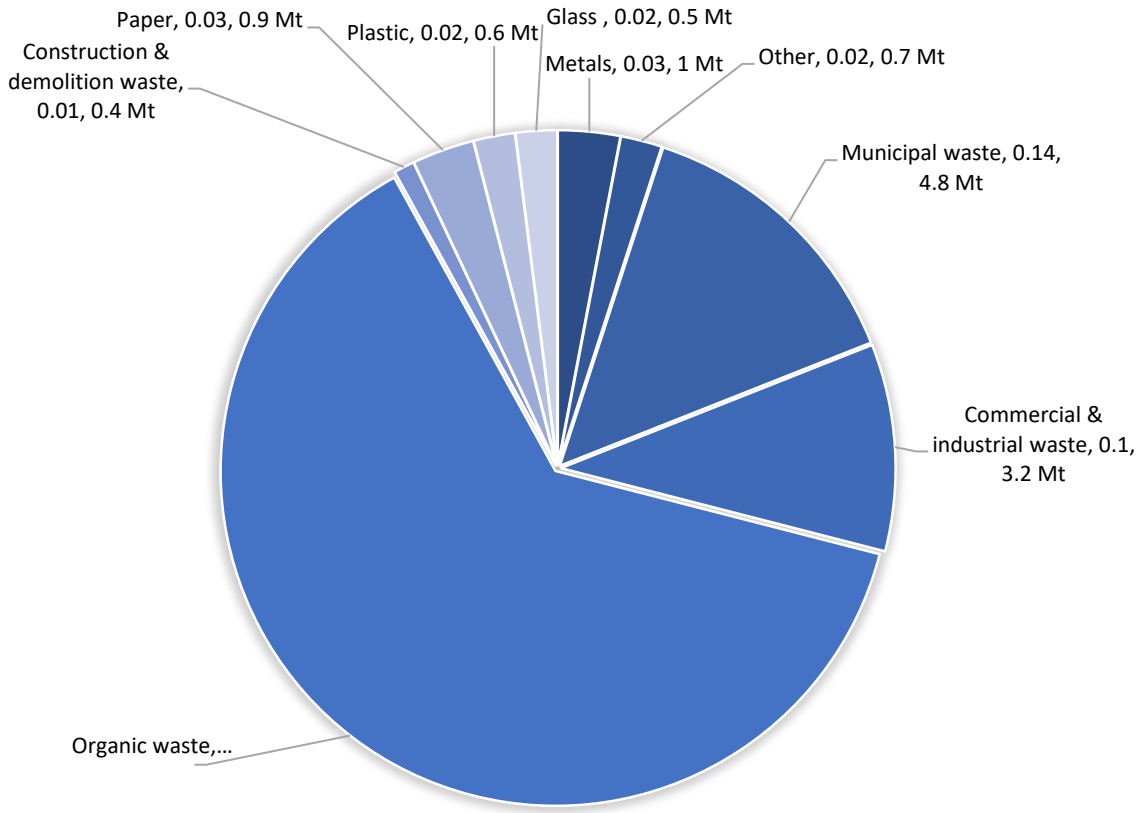


Figure 23: Breakdown of general waste composition generated South Africa in 2017 (Source: State of Waste report pg. 34)

4.2.2.4.2 Western Cape Province & City of Cape Town waste composition

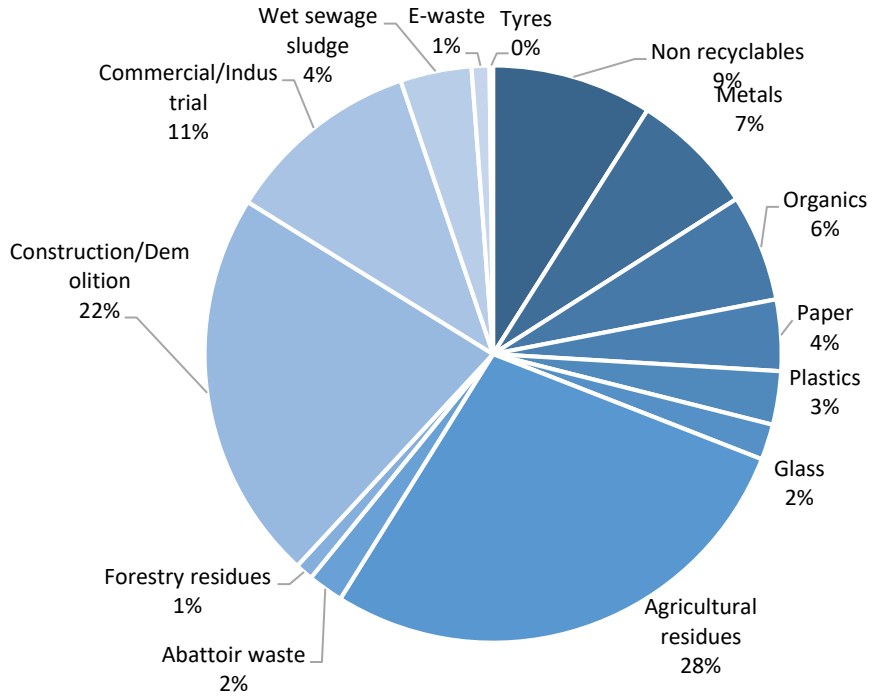


Figure 24: Western Cape Waste Characterisation (Source: GreenCape 2019)

In the Western Cape, general waste primarily comprised organic waste from industry (31.0%), followed by mainline recyclables 17.2% (namely glass 4.6%; paper 4%; and plastic 2%), non-recyclable municipal waste (8.9%), construction and demolition waste (6.6%) (DEA, 2018a).

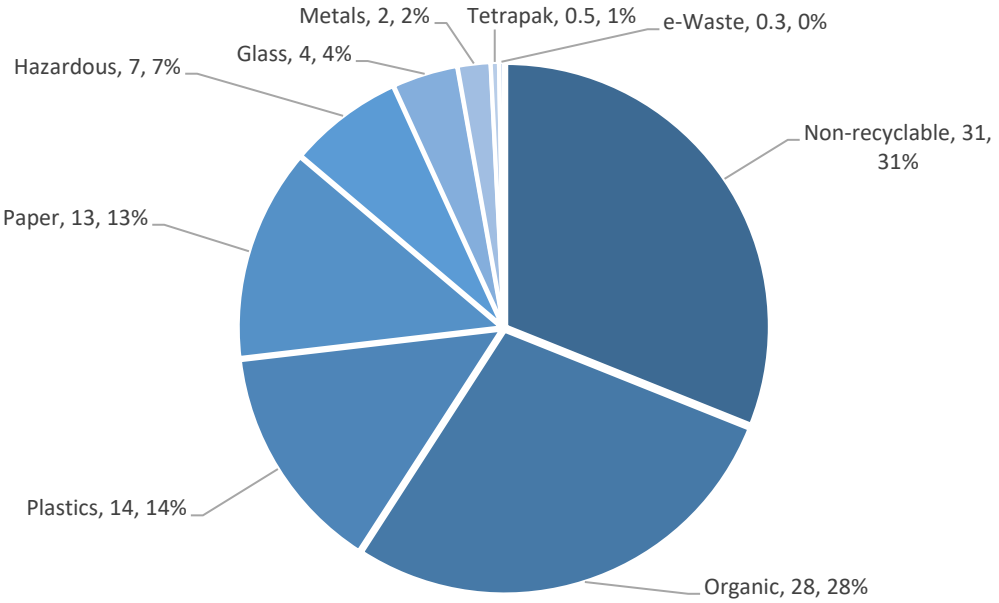


Figure 25: Waste composition for City of Cape Town (Source: CoCT 2018a)

Beyond the SoWR, nationwide municipal waste composition studies are lacking within South Africa. However, studies have been undertaken in Florida, Gauteng and Cape Town, Western Cape. Figure 26 shows the results of these studies, indicating that between households and businesses that require a daily collection of waste, the main differences lie in organic waste, plastics and 'other wastes'.

With no significant difference between the composition of Cape Town and Johannesburg's waste, the DEA used Gauteng waste as an indicator for the rest of the country (DEA, 2012). Given that the initial waste pickers collect the recyclables before the municipal kerbside collection does, this does not show household composition of waste, but rather municipal landfilled waste. The number of informal waste pickers has also grown substantially since 2008, so there is further uncertainty in the data.

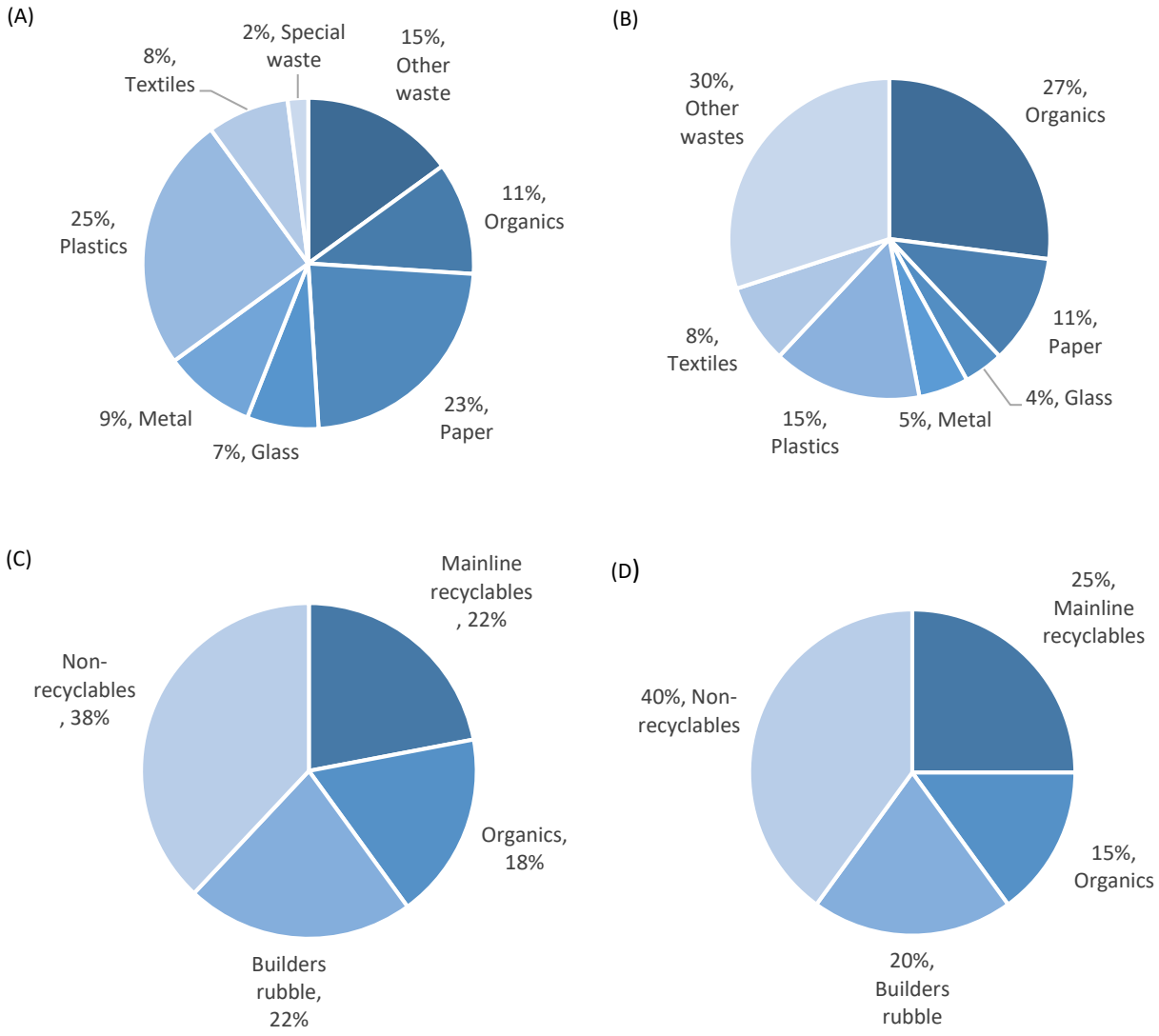


Figure 26: Waste composition studies. (A) daily business collection in Florida, 2016, (B) kerbside household collection, Florida, 2016. (C) household collection Cape Town, 2008 (D) household collection Cape Town, 2008 (Ayeleru et al., 2016)

The most recent waste characterisation study in the City of Cape Town was undertaken in 2018 by Jeffares and Green, which assessed six waste aggregation sites over a given period and then extrapolated across all CoCT facilities.

Table 12 shows that 31% of all waste was made up of non-recyclables such as textiles, residual, construction, and wood, with further breakdown of the materials and percentage of waste displayed.

Table 12: City of Cape Town Waste characterisation study (Source: GreenCape, 2019).

Material			Fraction
Packaging/recyclable	**Paper**		13.23%
	Cardboard		
	Glass		3.80%
	Plastics	Soft	7.16%
		Hard	7.13%
	Tetrapack		0.53%
	Multilayer		1.60%
	Metals		1.97%
Hazardous	**E-waste**		0.34%
	Hazardous	Cleaning, toiletries	0.07%
		Fluorescent bulbs	0.00%
		Batteries	0.00%
	Nappies		6.75%
Organics	**Food waste**	Mixed	8.51%
		Liquids	0.44%
		Starches	0.56%
		Dairy	0.03%
		Fruit/veg	4.45%
		Meat	0.53%
	Residual organics		5.94%
	Garden waste		7.37%
Other	**Residual**	Remaining fraction	18.80%
	Textile		6.38%
	Other		1.50%
	Construction		1.68%
	Wood		1.25%

4.2.2.4.3 eThekwini Municipality

Available data on eThikwini municipality is not as comprehensive as the available data on the Western Cape. Figure 27 presents the combined waste landfill quantities for 2014–2015.

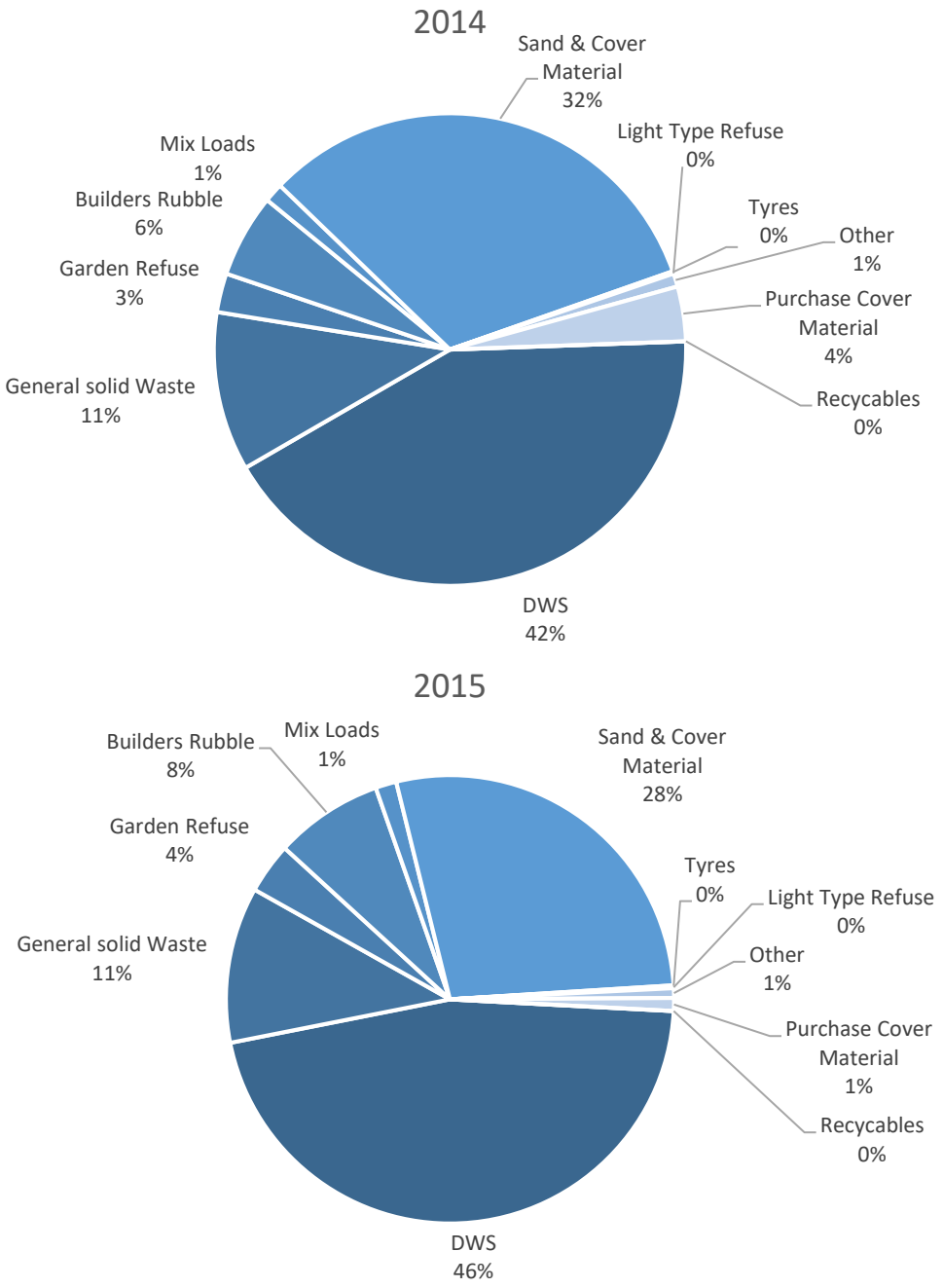


Figure 27: eThekwini Municipality combined landfill waste quantities 2014-2015 (Source: eThekwini, 2015)

4.2.2.5 Waste to landfill

The composition of waste in landfills (not recycled nor recovered) is described in Figure 28. This waste makes up 61% of the waste generated in South Africa and its biggest component is industrial organic material at 21 million tonnes or 63%, followed by municipal waste 4.8 million tonnes or 14%.

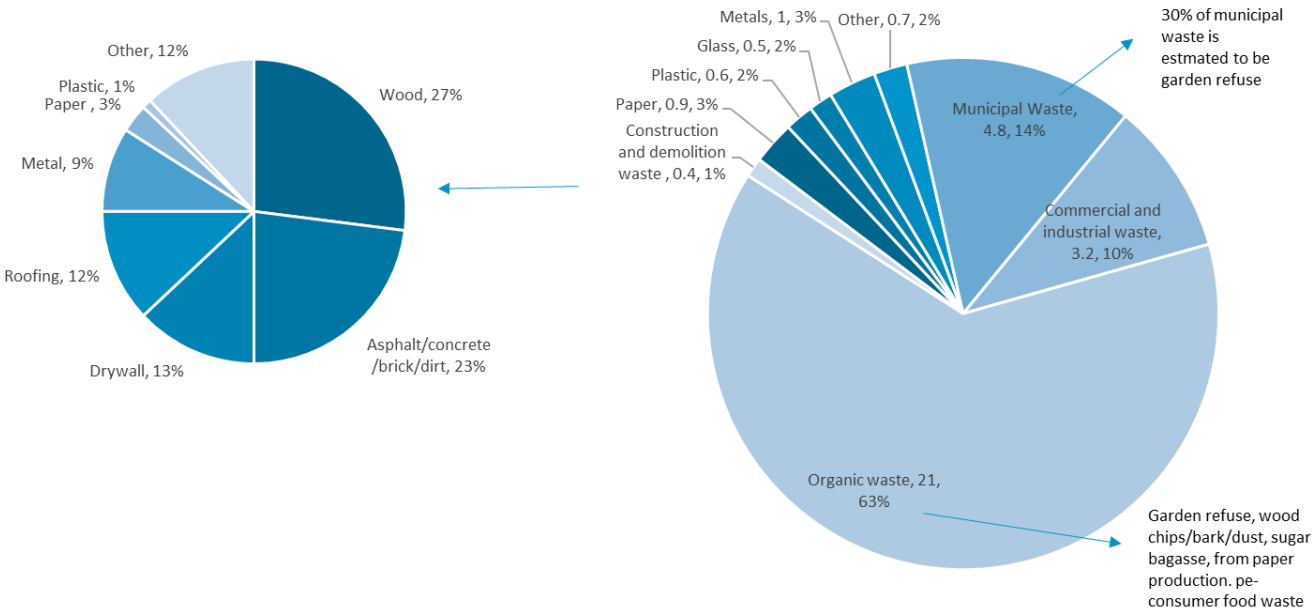


Figure 28: Breakdown of landfilled general waste (million tonnes) generated in 2017 compiled from DEA Affairs (2018).

4.2.2.5.1 Plastics

The World Wildlife Fund for Nature (WWF) estimates that South Africans use between 30 kg and 50 kg of plastic per person per year (WWF, 2018). This is based on South Africa consuming approximately 1.8 million tonnes of plastic in 2017 (Plastics SA, 2018). Of this plastic, 84% is virgin plastic and 16% comes from recycled materials as shown in Figure 29 below (Plastics SA, 2018).

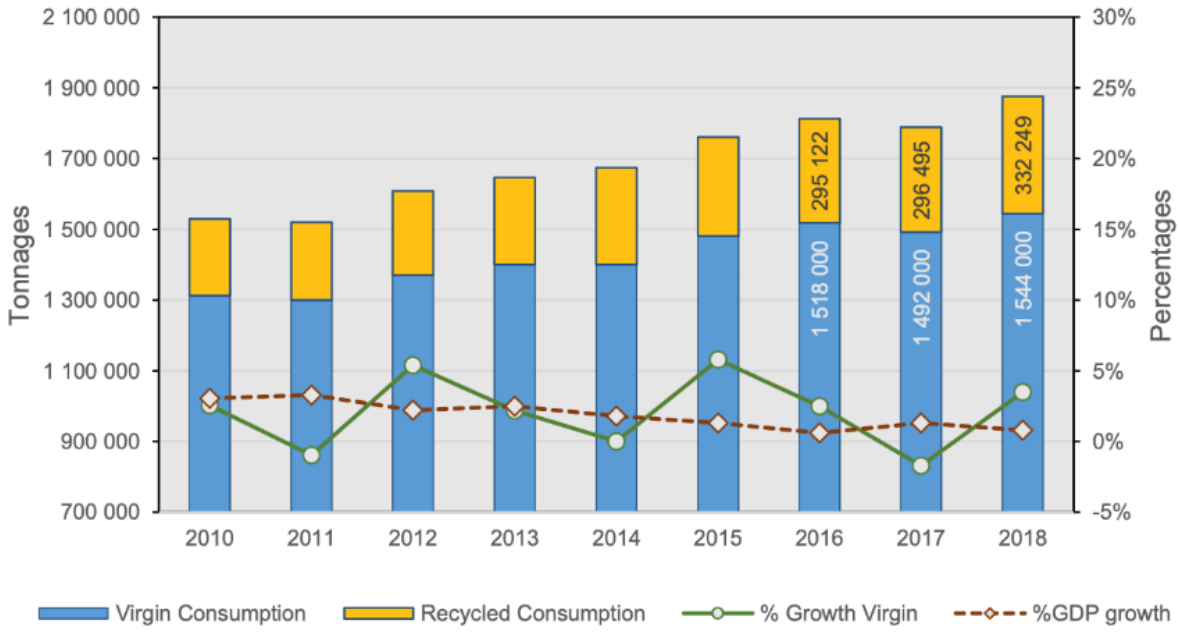


Figure 29: Domestic polymer consumption in South Africa – virgin and recyclate (Source: Plastics SA, 2018)

Plastics SA released industry figures stating that South Africa recovers 43.7% of its plastic waste, outperforming Europe's plastic recycling by 12.5%.

Another way to quantify South Africa's plastic recycling is to use the available figures to produce a process flow diagram to show an average recycled content of plastics products made in South Africa. This equates to only 17.5% of plastics turned into recyclate.

This is significantly different from Plastics SA's widely-published figure of 43%, which is actually an initial 'input recycling rate' before further losses to landfill, and only represents a portion of the plastics estimated to go to short-term usage as it excludes durable plastics.

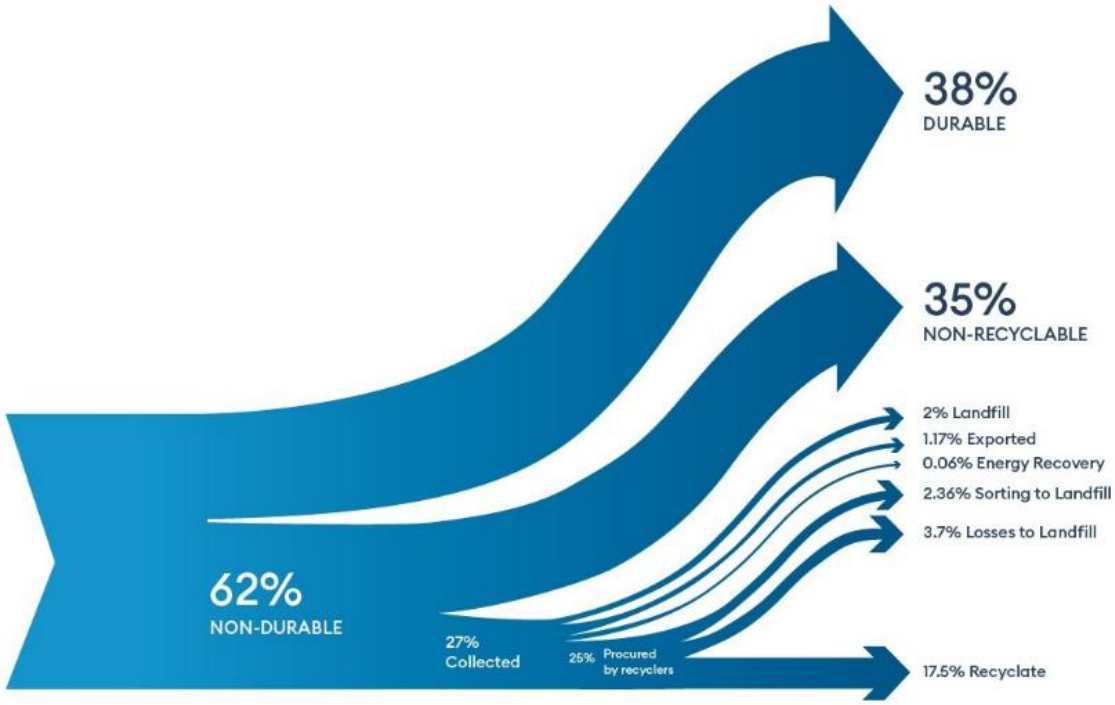


Figure 30: Process flow diagram for plastics in South Africa (Source: APWC, compiled from statistics from DEA, 2018).

Harro Blottniz at the University of Cape Town also makes this criticism of the statistics presented by Plastics SA, by stating that if South Africa has a 43.7% headline recycling rate, and 56% of plastic waste poorly managed (Jambeck et. al. 2015), this would mean that only 0.3% of plastic waste is properly disposed in landfill sites.

Blottniz further presents data in a material flow analysis as one mass balance (Blottniz et al, 2018) in Figure 31 below.

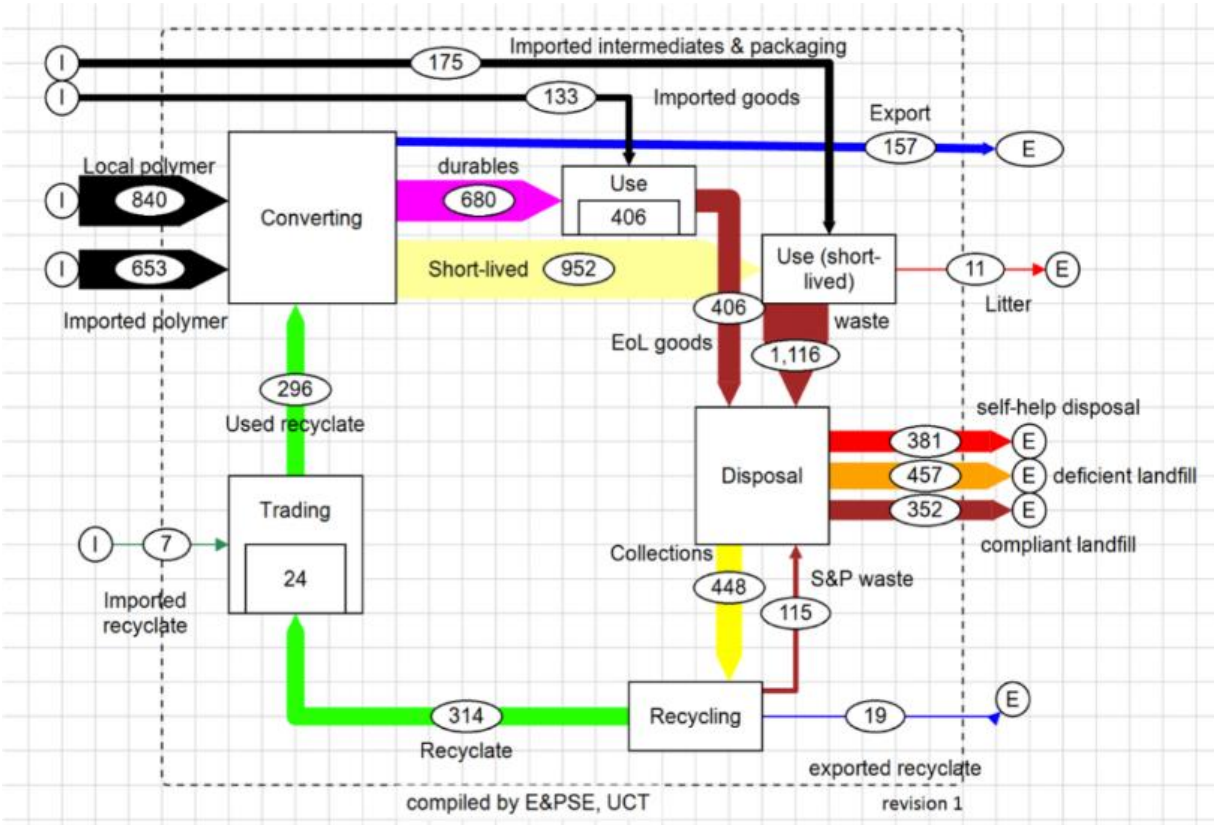
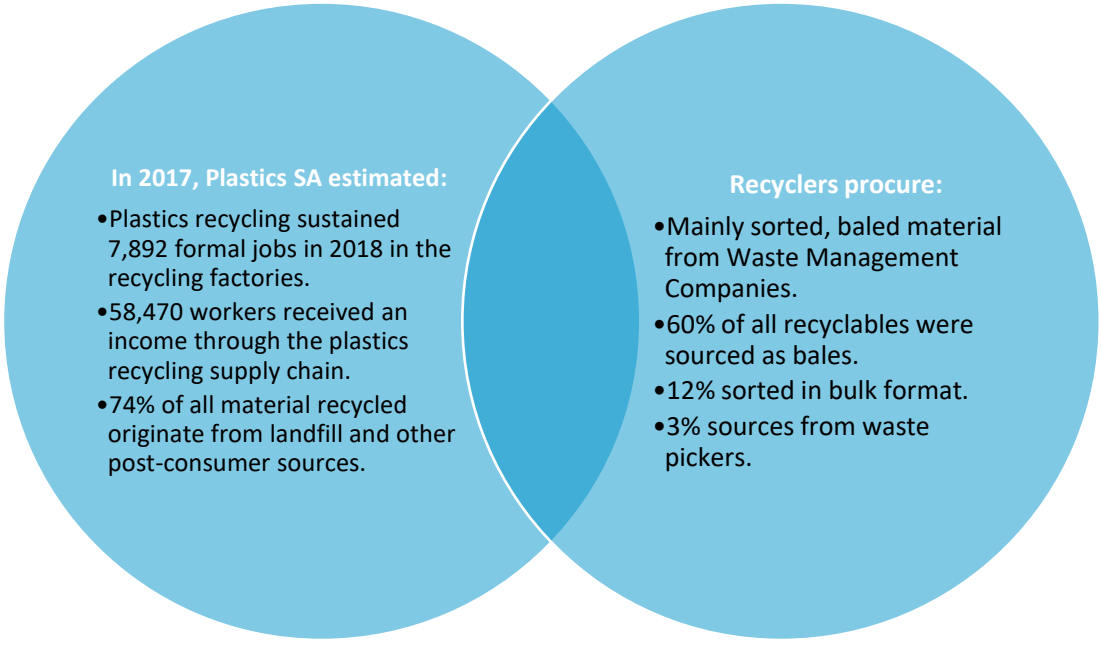


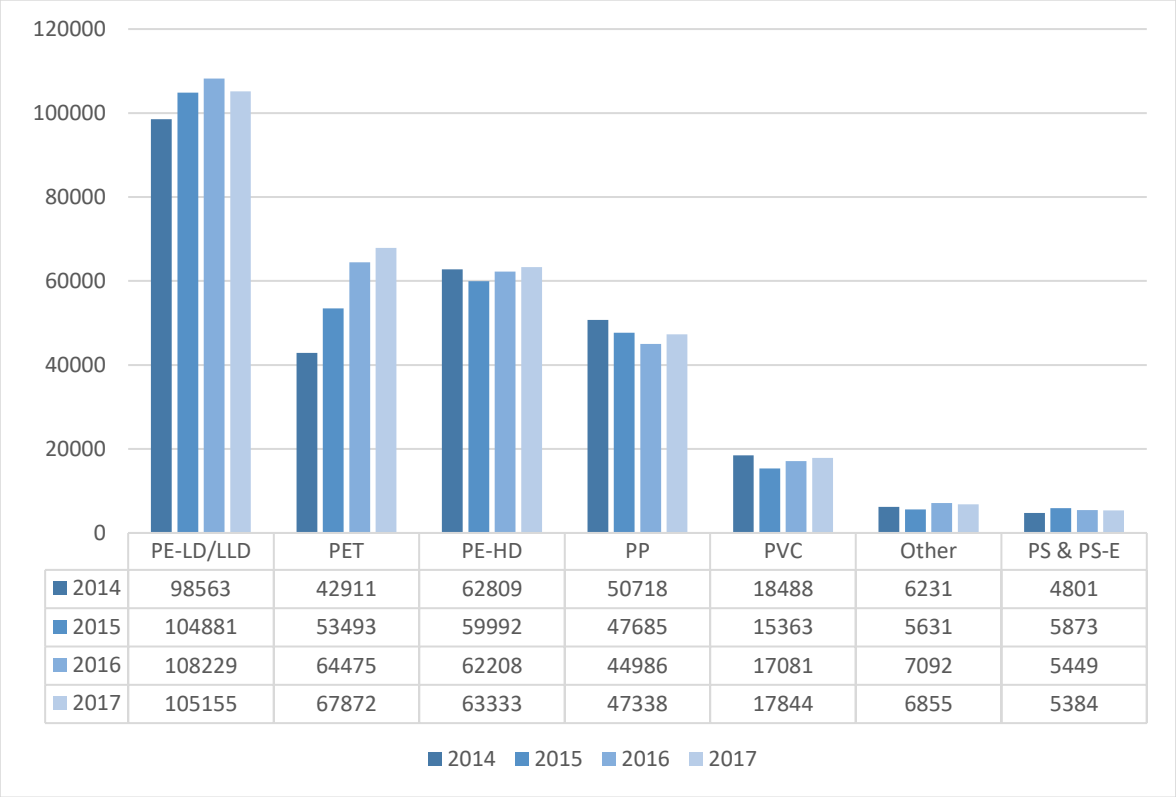
Figure 31: Material flows of plastics (in kt) in South Africa in 2017 (Source: Blottniz et al., 2018)



(Source: Plastics SA, 2017)

In terms of plastic type, the most widely recycled plastic continues to be low-density polyethylene (PE-LD and PE-LLD) packaging films, which is the most common plastic primarily used in packaging. It

includes plastic bags, plastic films, wrappings, geo-membranes and rotational moulded tanks (Figure 31). The high recycling rate is mainly due to the very low barriers to entry and markets that are well established. It is followed by PET recycling (22%) that continues to increase steadily from 2014–2017 due to the demand for PET material to relieve the pressure on limited virgin materials. PE-HD is the third most recycled material (20%) with a slight increased demand for mainly milk bottles (Figure 33).



	PE-LD/LLD	PET	PE-HD	PP	PVC	Other	PS & PS-E
2014	98563	42911	62809	50718	18488	6231	4801
2015	104881	53493	59992	47685	15363	5631	5873
2016	108229	64475	62208	44986	17081	7092	5449
2017	105155	67872	63333	47338	17844	6855	5384

Figure 32: Tonnes of plastic waste recycled in South Africa in raw materials 2014–2017 (Source: Plastics SA, 2018)

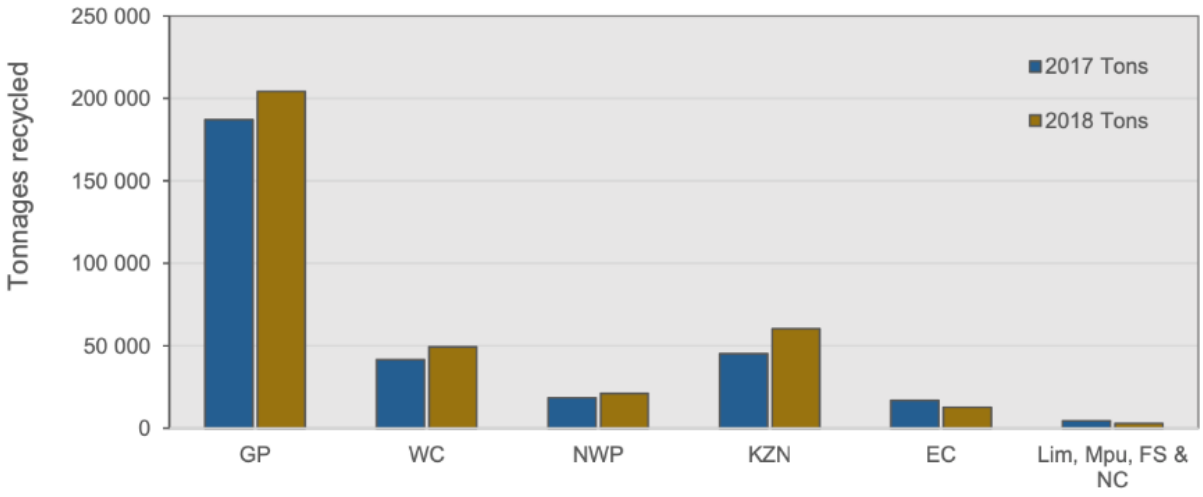


Figure 33: Provincial representation of plastics recyclers 2017–2018 (Source: Plastics SA, 2019)

4.2.2.5.2 Organic waste

According to the SoWR, in 2017 it was estimated approximately 30% of the municipal solid waste generated in South Africa was garden refuse. Additionally, South Africa produces approximately 31 million tonnes of food annually, of which an estimated 10 million tonnes (or 32.7%) is lost on an annual basis to the following commodity groups presented in Figure 34, below (WWF, 2017).

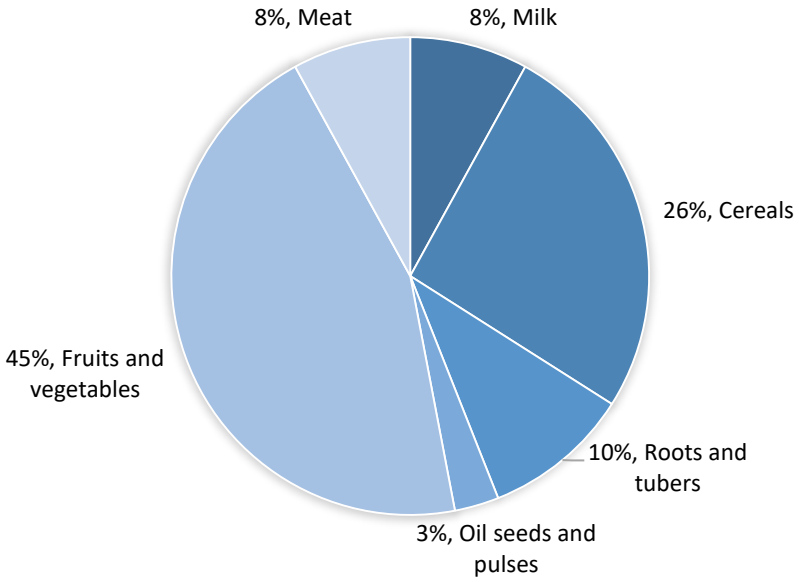
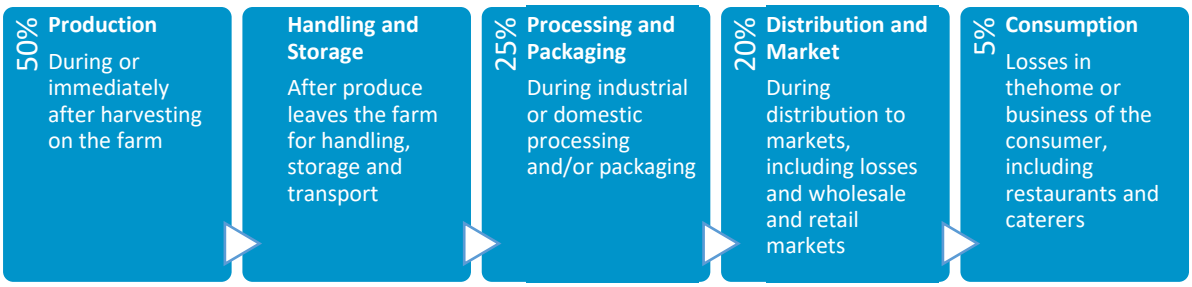


Figure 34: Percentage contribution of each commodity to total food losses or wastage (Source: WWF, 2017)

The majority of these food losses or wastage occurs at the following points in the food value chain:



In 2012, a study showed that 1.4 million tonnes of food was wasted by South African households each year, which equates to 15% of total household waste generated, a cost in terms of wasted food and disposal at R21.7 billion per annum. This equates to 0.8% of GDP or 10% of annual sales by food retailers in South Africa (Nahman et al., 2012).

4.2.2.5.3 Paper

South Africa generates 2.2 million tonnes of paper annually, collected in general municipal waste, of which 40 to 60% is landfilled (DEA, 2018a). Table 13 shows paper production and generation.

Table 13: South Africa's paper production and generation (Source: DEA, 2018a)

Paper product	Local production	Paper imports	Paper exports	Paper consumption/waste generation
Newsprint	180,727	3,746	36,980	147,493
Printing/writing	342,457	487,581	136,243	693,796
Corrugated material	1,208,571	141,038	326,947	1,022,661
Wrapping papers	46,950			46,950
Tissue	228,991	35,879	36,282	228,588
Board	138,186	47,227	104,005	81,408
Other paper	34,178			34,178
TOTAL (tonnes)	**2,180,061**	**715,471**	**640,456**	**2,255,075**

According to Packaging SA, 40% of paper and paper packing is recycled through the efforts of waste pickers (Packaging SA, 2018). It also proposes in the IWMP to support the informal sector through proposing individuals operating in the informal sector form co-operatives and SMMEs.

4.2.2.5.4 Glass

Approximately 2.5 million tonnes of glass waste were collected in kerbside municipal waste collections, excluding the glass separated by households dropped at recycling depots and glass collected by waste pickers. In terms of the reuse of glass, an estimated 1.72 million tonnes of returnables were placed on the South African market in 2017 (Barnes, 2018). Of this, approximately 1.65 million tonnes of returnables were recovered. In 2017, an estimated 305,590 tonnes of cullet (crushed glass that is ready to be used in the furnace) was recycled. Figure 35 below outlines the process of recycling glass.

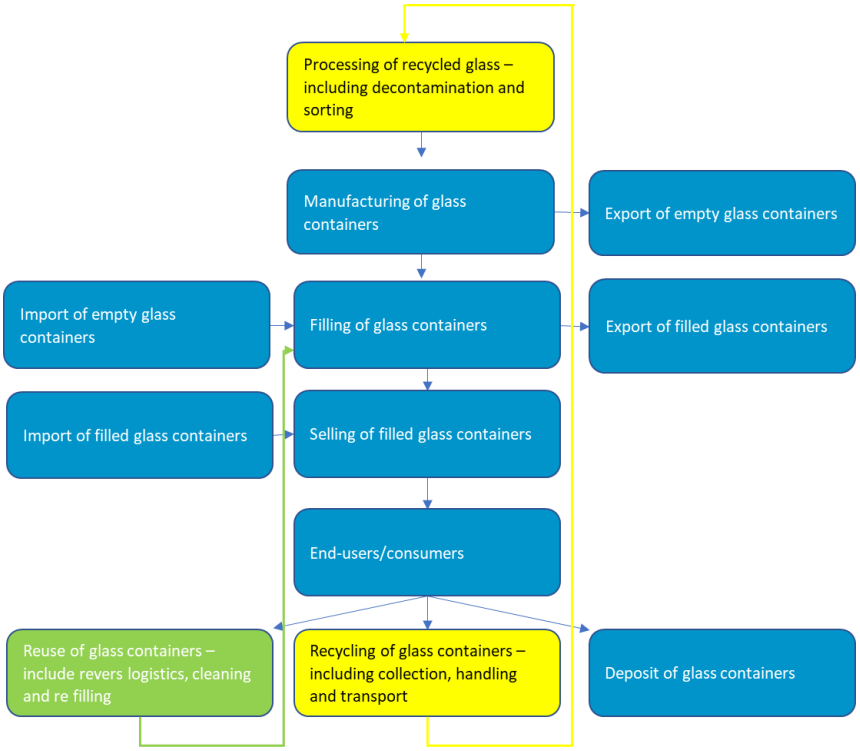


Figure 35: Commercial activities involved in the production, use, reuse, recovery and recycling of glass containers (Source: Packaging SA, 2018)

4.2.2.5.5 Metals

According to TUTWA (2017), South Africa is a net-exporter of scrap metals, accounting for 2% of the scrap metals imported globally. Ten thousand people are directly employed in the formal SA metal recycling sector. Figure 36 (following) presents the recycling value chain for metals.

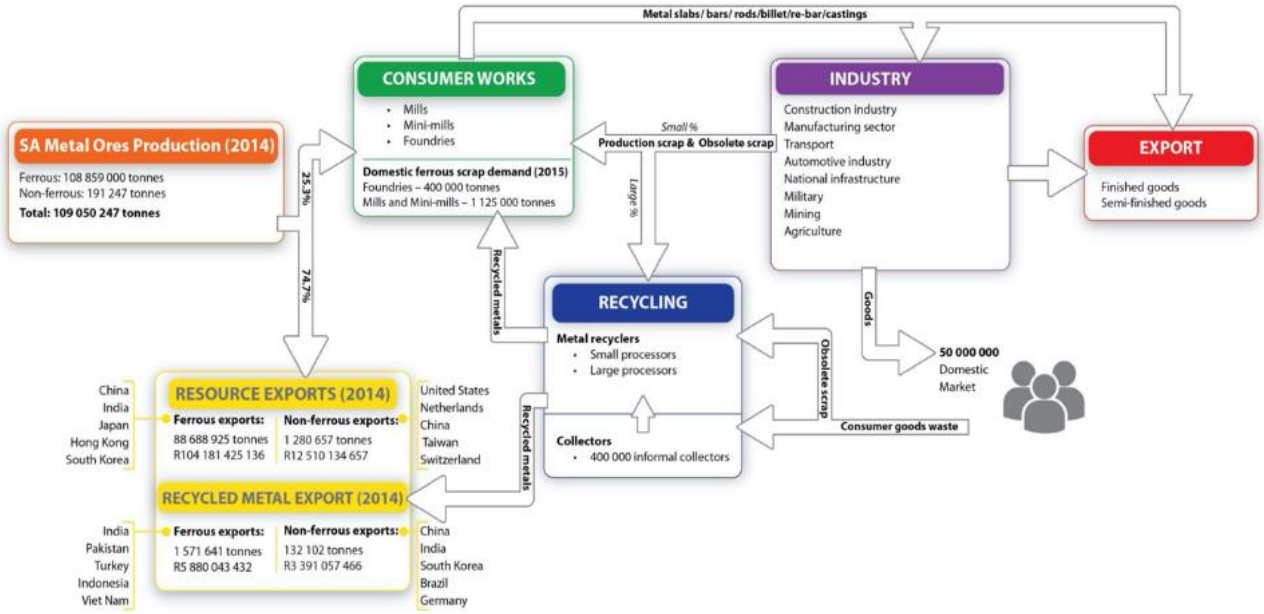


Figure 36: African scrap metals value chain (Source: TUTWA, 2017)

Non-ferrous metals are base metals or alloys such as aluminium, copper, lead, tin and zinc. In South Africa and globally, non-ferrous scrap metals account for less than 10% of the total recycled metal volume in circulation and on average is worth 10 times that of ferrous scrap. Ferrous metals made of iron or steel-based products constitute 90% of scrap metal volumes (Tutwa, 2017).

4.2.2.5.6 Tyres

In South Africa, unofficial estimates of used tyre stockpiles range between 30 million (500,000 tonnes) and 60 million tyres (1,000,000 tonnes) (DEA, 2018a). An estimated 14 million tyres are sold in South Africa on an annual basis, with just over 50% of the tyres imported and the rest being locally manufactured. This equates to an estimated 238,000 tonnes of waste tyres annually, with only 60,000 tonnes (25%) recycled.

The environmental and health risks posed by tyres are significant, with acid smoke produced in tyre fires and an oily residue left after the burn. There is also risk of poisonous microbes seeping into underground water (Ziadat & Sood, 2014).

4.2.2.5.7 Construction

The reuse of construction and demolition (C&D) waste is generally not well recorded in South Africa as C&D waste for reuse is typically separated at source (e.g. intact bricks, wood, roof tiles, and glass) (DEA,

2018c). Crushing is the most widely practised form of recycling, with a number of mobile and permanent crushers currently operating in South Africa. This is typically used as fill or in road sub-bases.

According to the Institute for Waste Management in South Africa, 85% of builders' rubble is landfilled in South Africa despite its potential re-use and the high financial and societal costs of landfilling. According to a paper outlining GreenCape's work supporting the development of the builders' economy, the biggest opportunities for builders' rubble processing and use lie in the construction and rehabilitation of roads. High performing builders' rubble economies exist in Japan and the Netherlands, where 80% of the C&D waste diverted from landfill is applied in roads. There are therefore opportunities on both the supply side for the crushing industry, as well as on the demand side in road construction for both the public and private sectors (Barnes and Basson, 2016).

4.2.2.5.8 E-waste/Waste Electrical and Electronic Equipment

South Africa generates approximately 360,000 tonnes of electronic scrap or e-waste annually (in 2017) and recycles only 9.7% (DEA, 2018a). According to the chairman of the e-Waste Association of South Africa (eWasa), South Africans generate about 6.2 kg of e-waste per year (Anderson, 2018).

Rapid technological development, reduction in costs of technology, short lifecycles by design and an increase in disposable income has seen the rise of e-waste in developing countries (International Solid Waste Association, 2016). E-waste in South Africa can be divided into both the formal and informal sector. There is currently no municipal kerbside collection of e-waste and so the informal sector (waste pickers) contributes 25% to the recycling e-waste industry (e-Waste Association of South Africa, 2013), with a workforce estimated at 10,000 with 2,000 of these being regular e-waste waste pickers. The informal sector sometimes also contributes towards dismantling, which is high risk, both individually and environmentally.

The formal collection of e-waste waste occurs through large integrated waste management companies, small companies who collect directly from consumers, collection sites (600 nationally), and business-to-business (asset replacement services) (DEA 2018a; Mintek, 2017).

The biggest contributor source market to the recycling e-waste industry and the most recycled e-waste inputs are shown in Figure 37 and Figure 38, respectively.

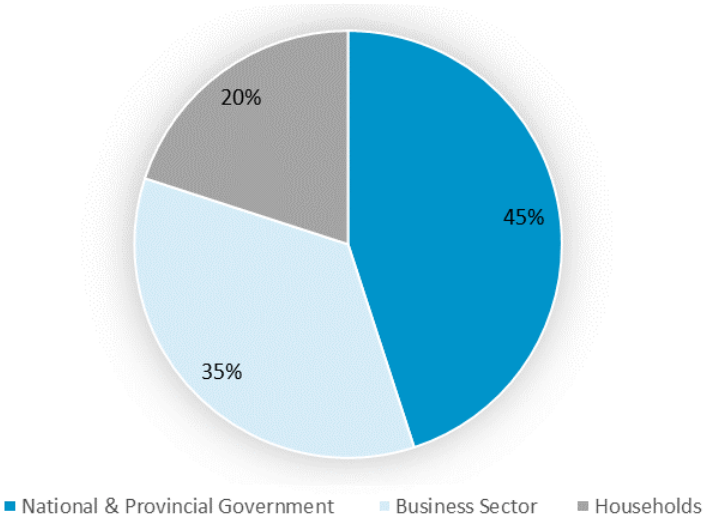


Figure 37: Source markets by sector for the Waste Electrical & Electronic Equipment Device (WEEE) industry in South Africa, 2015 (Source: Mintek, 2017)

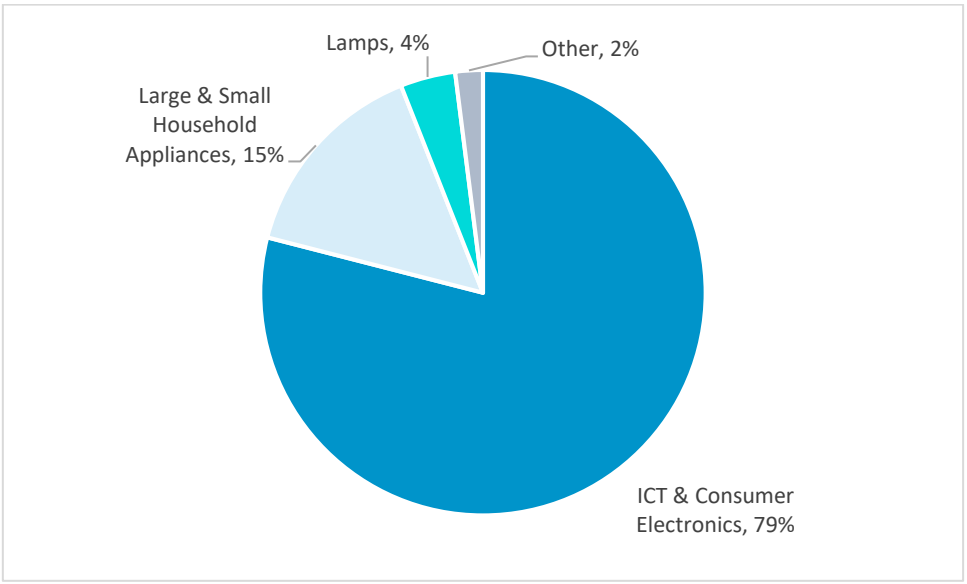


Figure 38: Composition of WEEE as determined by Mintek, 2017

E-waste or the Waste Electrical & Electronic Equipment (WEEE) is a complex and potentially high-value industry in South Africa (approximately 25 jobs per 1,000 tonnes e-waste handled) (Mintek, 2017). It has both formalised and diversified in the last 10 years, leading to over 100 registered e-waste recycling companies.

Most activities focus on dismantling or refurbishment of equipment due to low barriers to entering into the dismantling stage, but high barriers for entering the pre-processing and processing stage (Mintek, 2017). However, e-waste recycling is not a profitable, stand-alone industry for small firms and only 42% of companies in this business consider it their primary industry.

Gauteng is the hub of this industry (55% of volume in 2015) and the Western Cape and KwaZulu-Natal and are important source markets (Figure 39). Although sub-Saharan Africa only provides 6% of current input to the e-waste recycling industry in South Africa, in the future, the Southern African Development Community (SADC) is believed to become an important source (Mintek, 2017).

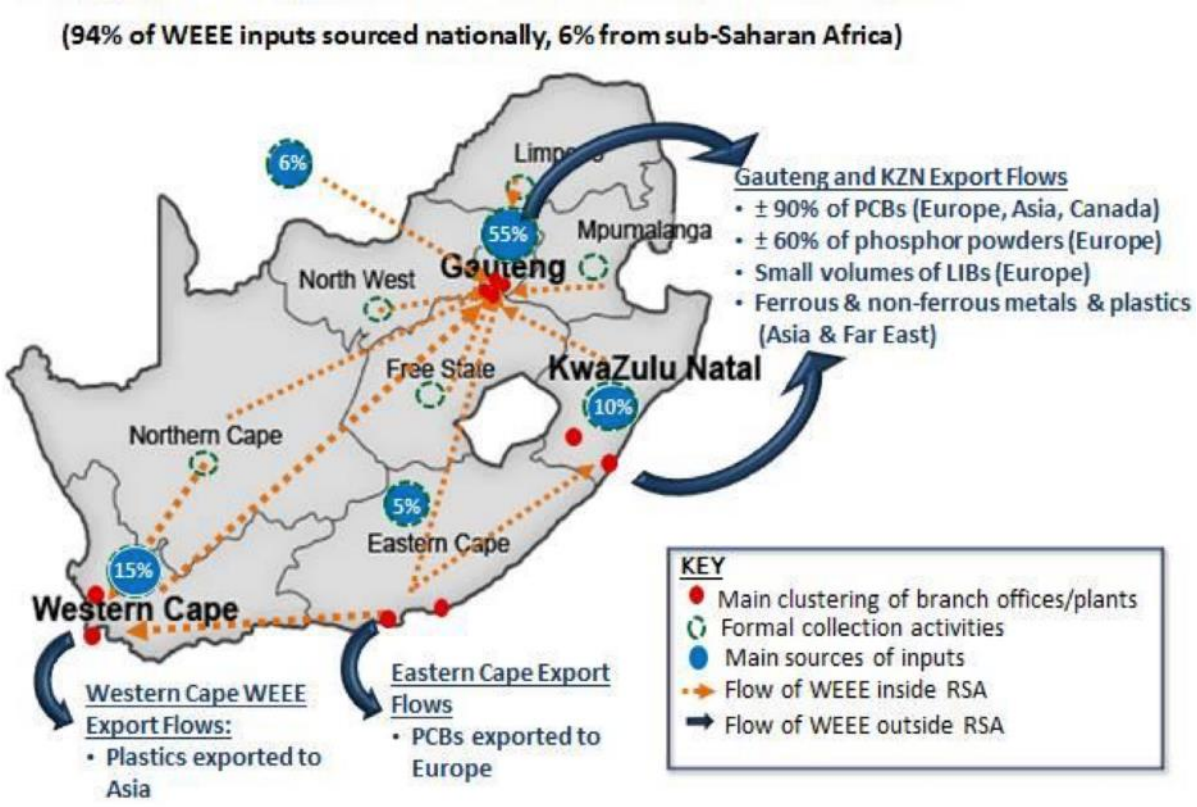


Figure 39: The geographic scope of WEEE activities in South Africa: Inputs & Outputs (Mintek, 2017)

According to Mintek (2017), the following barriers currently exist for the South African e-waste industry in the reprocessing and processing stage:

- only 42% of the industry consider WEEE processing as their primary function;
- refurbishment is more profitable then recycling (60% of revenues);
- currently the processing of complex streams are exported, including the remanufacturing of WEEE plastics (80%) and no precious metals are recaptured in South Africa as it is economically and environmentally unviable;
- 90% of glass from WEEE (typically lamps) is processed and remanufactured in South Africa. The remaining 10% is mostly CRT glass (cathode ray) is landfilled, not exported.

The availability of enough volume of WEEE is the biggest constraint of this industry. This requires the combined efforts of society, industry and government to separate the WEEE out of the waste stream. However, the output markets are unstable, making predictions and therefore raising funds difficult for start-ups. There are also export restrictions and levies on the metal outputs.

Finally, much of this industry is operating at 30–50% capacity due to:

- low collection volumes;

- regulation uncertainty;
- uncertainty around the proposed Extended Producer Responsibility scheme;
- high cost of compliance (time and monetary) as all waste management activities require integrated licences that include permission from the DEA, the Department of Water Affairs and relevant Member of the Executive Council's (MEC). This ensures that further environmental problems do not arise from the waste management activity (DEA, 2011).

In their report on South African WEEE (Mintek, 2017) on behalf of the DEA and the Council of Scientific and Industrial Research, Mintek included the following recommendations in Table 14:

Table 14: WEEE recommendations by Mintek

Recommendation	Potential Impact/s	Responsible Department/Organisation
Expediting the implementation of the Extended Producer Responsibility (EPR) scheme and WEEE Industry Waste Management Plan	Regulatory certainty Establishment of a nation-wide, properly financed WEEE collection scheme and increased WEEE collection volumes Financing the development of WEEE collection infrastructure to reduce costs and the recycling of negative value products	DEA
Establishment of concessionary funding windows for the mechanisation of the WEEE sector	Given the low-margin nature of the recycling business, government funding support will help lessen the financial burden/costs associated with mechanising operations	DTI, Industrial Development Corporation
Removal of restrictions on access to export markets	Enable recyclers to get full value for WEEE fractions from export markets, rather than compel them to sell to domestic markets where the prices they receive are lower than prevailing international market price, while incentivising the establishment of local markets to attract recyclers to sell locally instead of exporting	DTI
Promoting use of non-hazardous WEEE plastics in plastics products designed for markets such as plumbing pipes and gutters for low-cost houses	Preferential certification of WEEE plastics products with South African Bureau Standards	DTI

Recommendation	Potential Impact/s	Responsible Department/Organisation
Incentivising the development of e-waste refurbishment infrastructure	Encouraging the re-use of WEEE, particularly PCs and fridges, which ranks higher than recycling in the waste hierarchy and has the potential to create more jobs than recycling. Capacitating small and medium recycling companies that currently derive 60% of their revenues from refurbishment compared to the 40% from recycling activities.	DEA, Department of Trade & Industry (DTI)
Embarking on greater public awareness campaigns aimed at communicating the benefits of recycling WEEE in order to grow collection volumes	Reduce the perception of residual value of WEEE (R1/kg in South Africa) but is free in developed countries.	All stakeholders (government industry, associations, academia, public) DEA to champion the clarification of Public Finance Management Act and Municipal Finance Management Act provisions on WEEE
Business and government consider changing business model with respect to e-waste ownership, e.g. moving from purchasing to leasing to support greater return of end-of-life products to the value chain	Reduce the high storage rates of obsolete WEEE in government departments due to issues around assets, security and provisions in finance Acts.	All stakeholders (government, industry, associations, academia, public)
Creation of a 'one stop shop' for hazardous waste licensing and other compliance requirements for WEEE recyclers	Regulatory certainty by providing support to the WEEE recycling industry (from a single department or entity). Issuance of hazardous waste licences, transport and WEEE export permits under one roof. Timeous finalisation of hazardous waste licences (currently taking between 2–4 years to be concluded). Convenience to recycling companies and investors.	DEA

Recommendation	Potential Impact/s	Responsible Department/Organisation
Establishment of EEE data management system	Establish the quantities of EEE put on the market per annum: Imports and export of WEEE. Installed capacity of EEE in government, business and household. Average useful lives of EEE. Storage & recycling rates of WEEE.	Statistics SA
Capacitate and strengthen collaborative R&D work on the processing of complex WEEE fractions, e.g. phosphor powders containing REE, PCBs, plastics and CRTs	Through uptake of R&D and technologies, unlock resources (and value) back into the economy. Mintek and the universities have already done some exploratory work on the establishment of a refinery for REE in South Africa. Future R&D activities should determine the feasibility of using lamp phosphor powders as one of the alternative secondary source of REE materials in South Africa.	Department of Science and Technology, universities, science schools, recycling companies

4.2.2.5.9 Healthcare Risk Waste

In South Africa, it is mandatory to treat (with incineration or autoclave) healthcare risk waste prior to disposal in landfill. The DEA reported in 2018 that South Africa produces 48,749 tonnes of this waste annually, of which 100% is recorded as landfilled at specifically licensed facilities.

In KZN, eThekwini Municipality does not collect or dispose of medical waste but outsources this to private companies, such as Compass Waste Services and ClinX Waste Management. Currently, certain medical waste is disposed of via incineration at the Holfontein Landfill site. Compass Waste Services currently autoclaves sharps, which is then disposed of at the Mariannhill Landfill (eThekwini, 2014)

Due to the sub-contractual nature of the healthcare risk waste industry, nationally this waste has been known to be illegally dumped, untreated, without the source healthcare facilities' knowledge. Examples include Wasteman, investigated by the Green Scorpions for illegally dumping high-risk medical waste (Parliamentary Monitoring Group, 2010) and Dolphin Coast Landfill Management discharging leachate during high rainfall (Laldas, 2018). When this has been identified by the community, the perpetrators are required to enforce compliance. As of 2017, 15 licensed facilities exist nationwide, with 17 more in the pipeline.

4.2.3 Hazardous waste

Table 15 below outlines hazardous waste generation and management in South Africa in 2017, totalling 66 million tonnes. The majority of hazardous waste is landfilled, with the exception of waste

oils and batteries where the majority (80% and estimated at 73% respectively) is recycled or recovered. Fly ash and dust, mainly from coal-fired power stations make up the majority (44 million tonnes) of this hazardous waste, followed by bottom ash, slag and brine. A small percentage (6.8%) of fly ash is now used in brick manufacture (DEA, 2018). The composition of this hazardous waste highlights the industrial nature of the South African economy. According to the SoWR, 66.8 million tonnes of hazardous waste (7%) was re-used or recycled, with the remainder treated and/or landfilled.

Table 15: Hazardous waste by management option in 2017 (Source: DEA, 2018)

Waste type		Estimated tonnes	Imports	Exports	Recycling/ recovered	Treated	Landfilled
HW 01	Gaseous waste	6				0.0%	96.0%
HW 02	Mercury-containing waste	1,392				0.0%	95.6%
HW 03	Batteries	39,867	32,608	46,000		0.0%	26.9%
HW 04	POP waste	570				0.0%	100.0%
HW 05	Inorganic waste	786,083				0.6%	99.4%
HW 06	Asbestos-containing waste	6,721	5,700			0.0%	100.0%
HW 07	Waste oils	116,250	214,241		80.0%	0.0%	20.0%
HW 08	Organic halogenated and/or sulphur-containing solvents	663			19.9%	6.2%	73.9%
HW 09	Organic halogenated and/or sulphur-containing waste	8,812			0.0%	4.4%	95.6%
HW 10	Organic solvents without halogens and sulphur	4,562			42.1%	5.5%	52.4%
HW 11	Other organic waste without halogen or sulphur	519,413	25,000		0.0%	40.7%	59.3%
HW 12	Tarry and bituminous waste	249,080			0.0%	0.0%	100.0%
HW 13	Brine	5,793,645			0.0%	0.0%	100.0%
HW 14	Fly ash and dust	44,000,000			6.8%	0.0%	93.4%
HW 15	Bottom ash	6,000,000	100		8.3%	0.0%	91.7%
HW 16	Slag	7,887,879	3,500		4.1%	0.0%	95.9%
HW 17	Mineral waste	115,754			0.9%	2.8%	96.4%
HW 18	WEEE	360,000	4,740		9.7%	0.0%	90.3%
HW 19	HCRW	48,749			0.0%	0.0%	100.0%
HW 20	Sewage sludge	632,749			15.0%	0.0%	85.0%
HW 99	Miscellaneous	294,064	10,330	3,000	0.9%	1.5%	97.6%
Total		**66,866 260**	**296,219**	**49,000**	**6.0%**	**0.3%**	**93.7%**

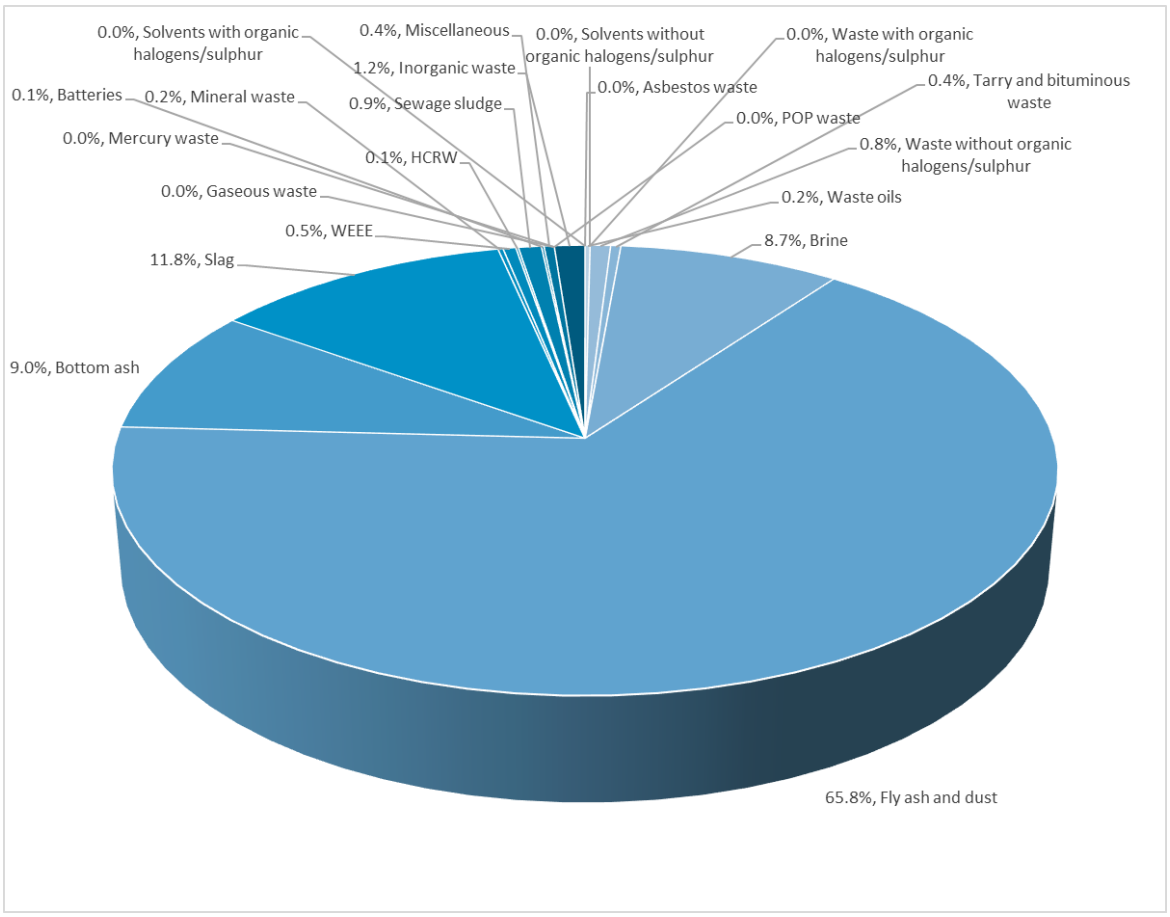


Figure 40: Percentage breakdown of hazardous waste in 2017 (source: DEA, 2018a)

4.2.3.1.1 Batteries

According to the DEA, there is limited information available on the quantities of spent lead-acid and dry-cell batteries generated and recycled in South Africa (DEA, 2016b). The annual quantities of spent lead-acid batteries generated in South Africa is approximately 39,747 tonnes. The SoWR therefore estimated, based on the quantities of lead-acid batteries manufactured locally, 37,500 tonnes, plus the quantities of lead-acid batteries imported (18,684 tonnes), minus the quantities of lead-acid batteries exported (14,437 tonnes).

From 2012, according to the National Waste Information Regulations, batteries are reported as an individual waste stream (DEA, 2012). The most common batteries in South Africa are lead-acid batteries, which contain both lead and sulphuric acid. Lead-acid batteries are subject to a 'deposit return scheme' – a levy driven by the manufacturers to encourage the return of batteries for recycling. They are also collected and returned (or sold overseas) by scrap metal merchants. There are four facilities capable of recycling lead-acid batteries within South Africa. Their main challenge is the export of these batteries to overseas facilities. Spent dry-cell batteries are instead returned to drop-off points at participating shops. This method is irregular and faces collapse due to lack of funding. These batteries are stored in Gauteng before exportation to France (DEA, 2018a).

4.3 Waste service provision

Similar to other African nations, South Africa's waste management treatment progresses from illegal dumping through to sanitary landfills, as per Table 16, with a process flow of a typical South African municipality shown in Figure 41.

Table 16: Definitions of waste management terms predominate in Africa (Source: UNEP, 2018)

Fly-tipping or "indiscriminate" dumping	Open or uncontrolled dumping	Controlled disposal	Sanitary engineered landfilling
Waste is deliberately, often illegally, dumped in open spaces in cities, towns, rural areas or rivers	Waste is indiscriminately deposited at a designated site with either no, or at best very limited measures to control the operation and to protect the surrounding environment	Waste is deposited at a designated site, which has access control, cover and compaction, but no liners, leachate collection systems, etc.	Waste is deposited in an engineered, controlled facility, designed and operated to minimize impacts. Includes, e.e. lines, leachate collection systems, and landfill gas recovery
Progression in the management of waste →			

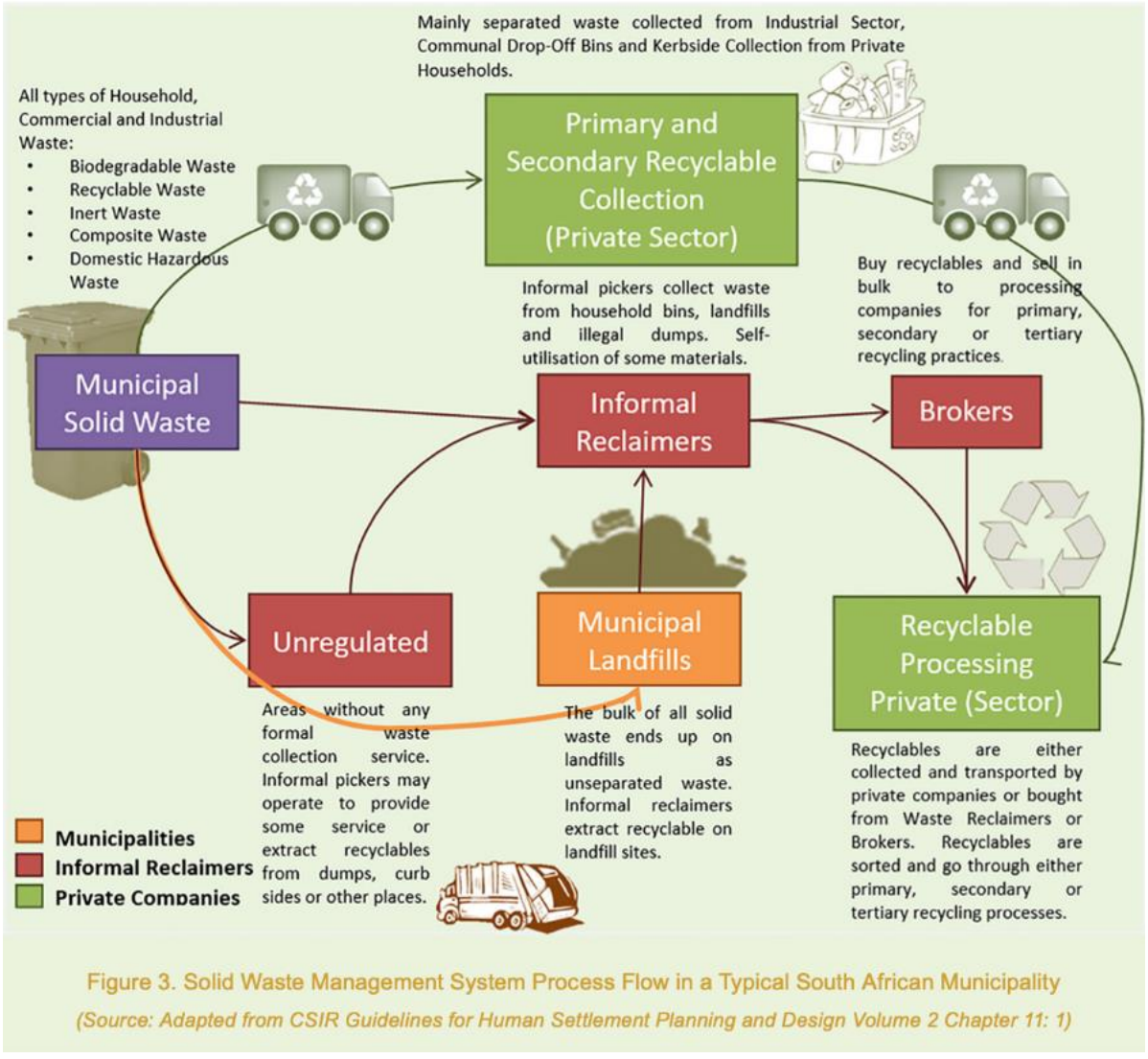


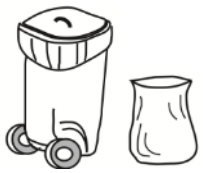
Figure 41: SWM process flow of a typical South African municipality (Source: DEA, 2014)

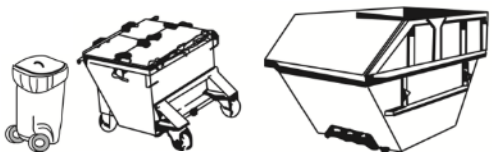
In addition to the normal forms of leakage occurring globally through transportation, processing or storage, land-based solid waste is entering stormwater drains, rivers and waterways through high-levels of illegal dumping and littering. Unequal waste management services is a significant challenge in South Africa with collection varying significantly between provinces, municipalities and often between suburbs adjacent to each other (Resnick, 2014; Stats SA 2016c). The middle and affluent areas have a formal system of collection with trucks, while many of the low-income areas have a service that has been contracted out, or a very erratic and inadequate service from the municipality.

4.4 Waste collection services

Waste collection is the responsibility of local municipal government in South Africa, with 239 municipalities collecting waste in 8.4 million households using labour directly or by appointing contractors or community co-operatives (DEA, 2016a). Table 17 below outlines the services provided to different area types.

Table 17: Current waste collection service in City of Cape Town & eThekwini (Source: compiled by APWC from various sources)

	City of Cape Town Solid Waste Management (SWM)	**eThekwini** Durban Solid Waste (DSW)
Formal residences	Residential waste collection services are provided by the Council (SWM) and via Council tenders. Service for formal residences is a once-a-week, kerbside containerised waste collection service. All households (except for places that are impractical and cannot be provided with a service, for example difficult access for trucks with illegal electrical wires as can be seen near Philippi in the sampling area) are provided a 240-L wheelie bin at council approved tariffs. Those without services need to access services through a drop-off point, similar to informal areas. The bin is placed outside the property boundary for waste collection on the scheduled days according to municipal 'beat' maps. 	Receive a weekly domestic waste removal service (approximately 650,000 households). Once-a-week, kerbside containerised waste collection service. In some residential areas (such as Westville North, uMlazi, Phoenix, Durban Central, Mount Edgecombe and parts of uMhlanga), orange (paper, cardboard, tetra pack materials & plastic) and clear (glass and cans) plastic bags are supplied by DSW for placing certain recyclable materials, although this programme has been surrounded in controversy (see section 4.5.2). Blue bags are for garden refuse. 

	City of Cape Town Solid Waste Management (SWM)	eThekwini Durban Solid Waste (DSW)
Informal residences	Once-a-week, bagged, door-to-door waste collection. Each informal household is provided weekly with Council refuse bags. The service is provided through external contractors, but only to local labour sourced through a database  OR Central collection points in shipping containers pending removal twice weekly to a landfill OR Unofficial, illegal dumping site, that is regularly cleaned by municipal council workers OR 9.2% households that do not get serviced regularly bury, burn or dump their waste (Census, 2011).	Central collection points in shipping containers pending removal twice weekly to a landfill OR Unofficial, illegal dumping site, that is regularly cleaned by municipal council workers. OR 10.8% households that do not get serviced regularly bury, burn or dump their waste (Census, 2011).
Commerce & industry	Once-a-week for commercial areas. Per contractual agreement for industry.	240L wheelie bins for small businesses. 600L for medium waste generators and businesses operating in high-density areas. Removal of dense, high-volume, non-compactable dry waste is collected in 8 m^3, 5.5 m^3, 14 m^3, and 27 m^3 skips. Beige bags are provided for street cleaning disposal. 
Agricultural land	Once-a-week for collection service for 22% of rural areas.	Once-a-week for collection service for 3.3% of rural areas.

	City of Cape Town Solid Waste Management (SWM)	eThekwini Durban Solid Waste (DSW)
	OR Communal collection point for 10% of households. OR No waste removal service for 23% of households.	OR Communal collection point for 4.8% of households. OR No waste removal service for 89% of households.

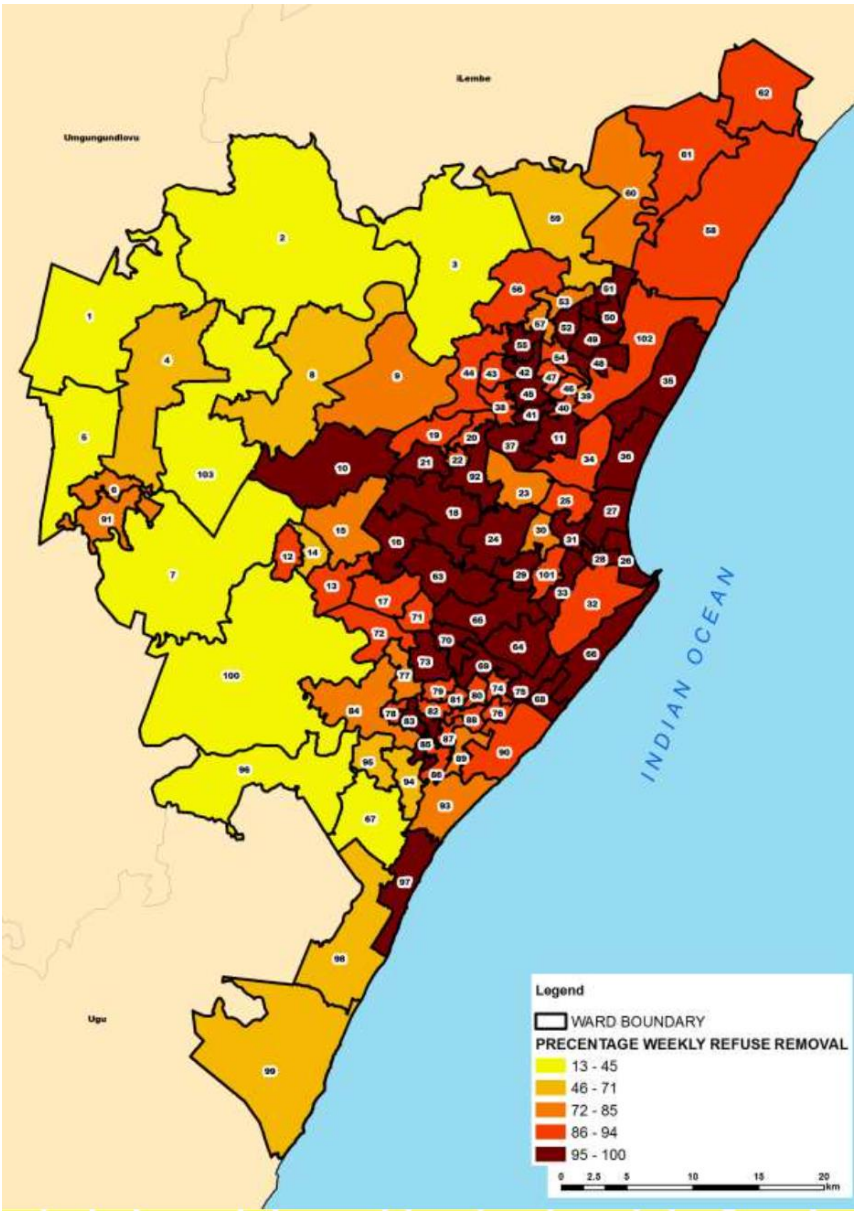


Figure 42: Map illustrating percentage of weekly refuse removal in eThekwini (Source: eThekwini, 2014)

The City of Cape Town (CCT) generates about 70% of waste in the Western Cape, where 60% of the waste generated is handled by the private sector and the remaining 40% is handled by the municipality (Conversation with Coetzee, B 2014 as cited by GreenCape MIR 2015).

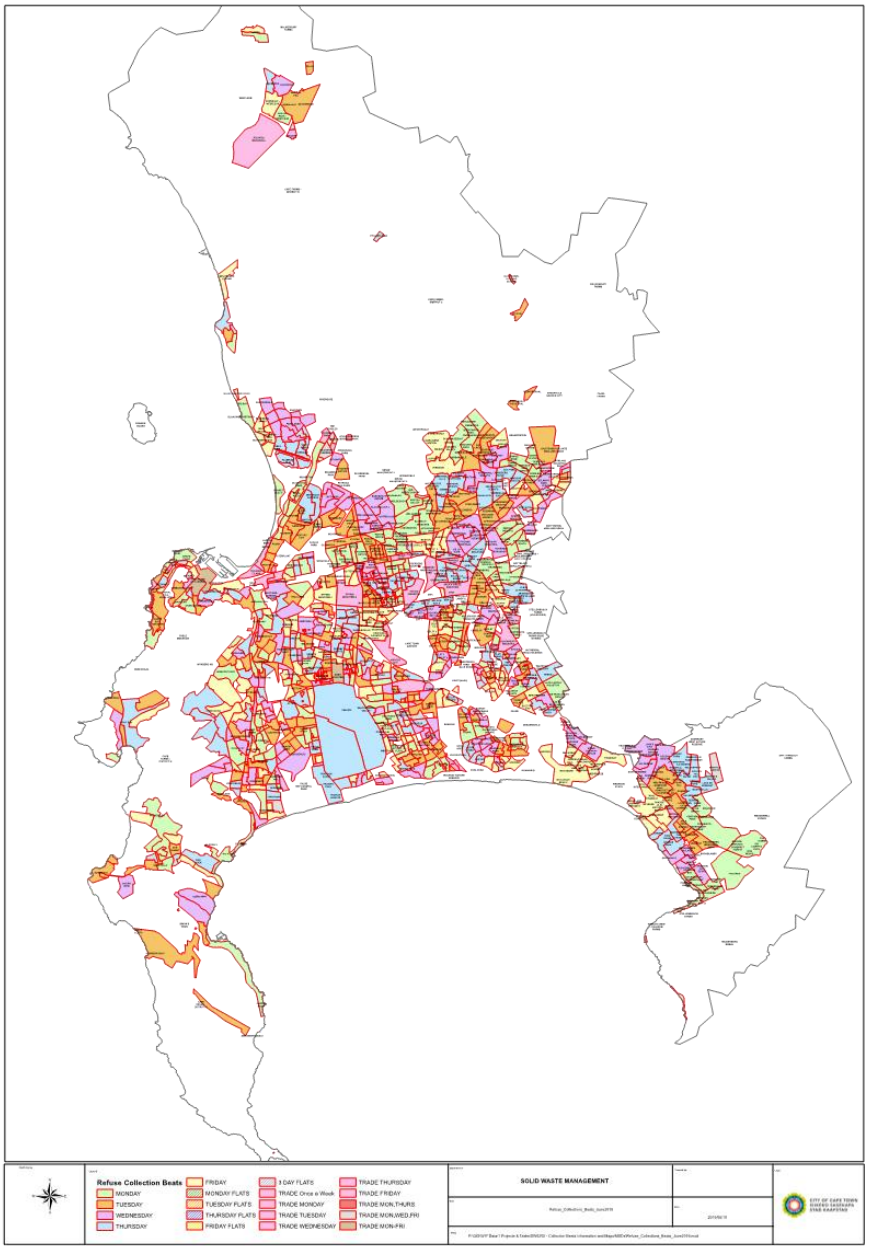


Figure 43: Refuse collection beats for the City of Cape Town (Source: CoCT, 2019)

4.4.1 Waste Transport

Waste collection vehicles in South Africa are designed for the start/stop mode required for kerb-waste collection and fitted with hydraulically operated waste compactors. In eThekwini, waste is delivered to waste transfer stations, into hoppers, compacted into 27 m^3 long-haul containers, which are then uplifted and driven to landfill by long-haul road vehicles for disposal to the designated landfill.

Table 18 and

Table 19 below outline the fleet and solid waste vehicles present at Durban Solid Waste

Table 18: Durban solid waste fleet (Source: Durban Solid Waste, 2019)

NO	PLANT CATEGORY	UNITS	EXPECTED LIFE SPAN (YEARS)	% OF PLANT PER CATEGORY	AVERAGE AGE IN YEARS
1	ART. DUMP TRUCK	10	10	15.38	7.3
2	4X4 FUEL SERVICE WAGON	1	10	1.54	7.0
3	ART. HOOK-LIFT TRUCK	5	10	7.69	6.4
4	ART. WATER TANKER	6	10	9.23	13.2
5	BULLDOZER	10	10	15.38	11.1
6	LANDFILL COMPACTOR	8	10	12.31	6.4
7	LANDFILL COMPRESSOR	1	10	1.54	24.0
8	EXCAVATOR	4	10	6.15	10.5
9	FRONT END LOADER	7	10	10.77	10.1
10	GRADER	1	10	1.54	24.0
11	ROLLER	2	10	3.08	13.5
12	SHREDDER	1	10	1.54	11.0
13	TIPPER	2	14	3.08	10.5
14	TLB	4	10	6.15	0.6
15	TRACTOR	2	10	3.08	23.5
16	SERVICE WAGON	1	10	1.54	4.0
PLANT TOTAL		**65**		**100.00**	**11.4**

Table 19: Durban solid waste vehicles (Source: Durban Solid Waste, 2019)

NO	TYPE OF VEHICLES	UNITS	EXPECTED LIFE SPAN (YEARS)	% OF PLANT PER CATEGORY	AVERAGE AGE IN YEARS
1	BUS - MICRO	2	10	0.35	4.5
2	CAR	5	6	0.88	3.4
3	COMP - C300	6	14	1.05	6
4	COMP - ROTOPRESS	5	14	0.88	0.6
5	COMP - M150	136	14	23.82	9.3
6	COMP C200 - 19 M3	20	14	3.50	11.7
7	COMP IND - 19 M3	30	14	5.25	9.1
8	EDUCATION TRUCK	2	14	0.35	4
9	HOOK-LIFT - 4X2	1	14	0.18	20
10	HOOK-LIFT - 6X4	22	14	3.85	6.5
11	HOOK-LIFT - 8X4	24	14	4.20	6.8
12	LDV	175	8	30.65	6.6
13	SWEEPER - VACUUM	7	14	1.23	6.6
14	TELEHOIST - 6X4	18	14	3.15	6.8
15	TIPPER - CAGE	79	14	13.84	7.3
16	TRAILER	26	14	4.90	11
17	TRUCK - CRANE	2	14	0.35	9
18	WATER TANKER	8	14	1.40	9.8
19	CHERRY PICKER	1	10	0.18	6
VEHICLE TOTAL		**569**		**100.00**	**7.6**
TOTAL FLEET		**634**			

In CoCT, a dedicated railway line transports solid waste from the centrally located Athlone Refuse Transfer Station to the Vissershok landfill site to the north of the city centre. In rural areas in eThekwini, DSW utilises tractors and trailers or smaller vehicles for waste collection.

4.5 Waste Management Facilities

Municipalities in South Africa provide waste collection and disposal infrastructure. The *Waste Act,* the 2011 NWMS and the draft 2019 NWMS require local municipalities to implement alternative waste treatment in order to divert waste from landfill and to minimise environmental degradation. In some cases, municipalities provide infrastructure for aggregation (drop-offs) and the separation (at material recovery facilities known as MRFs) rather than providing the actual recycling infrastructure. These facilities are either operated by the municipality or outsourced to the private sector.

Private sector facilities

There are more than 200 private waste service providers operating in the Western Cape across the full value chain, i.e. collection, transportation, disposal, recycling, sorting, storage and cleaning (GreenCape, 2019). The linear value chain (collection, transportation and disposal) is dominated by the larger waste management companies such as Averda, Enviroserv, Interwaste and WasteMart. Averda and Enviroserv are the only waste management companies that jointly own a landfill site,

located in Cape Town. There are five other privately owned landfills, owned by PetroSA10 (in Mossel Bay), PPC11 (in De Hoek and Riebeek West), Exxaro12 (in Vredenburg) and ArcelorMittal13 (in Saldanha Bay) but none of these companies' core business is waste management.

In eThekwini, the following privately owned sector players operate, which are seen by the municipality as direct competitors for tenders and contracts (Table 20).

Table 20: Privately owned waste management companies operating in eThekwini (Source: Durban Solid Waste, 2019)

NAME OF BUSINESS	TYPES OF SERVICES	TYPES OF VEHICLES	WASTE TYPES	AREA COVERED
Averda	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	Telehoist, industrial compactor, refuse collectors, roll-on roll-off	General, hazardous, liquid	National
The Waste Group	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	Telehoist, industrial compactor, refuse collectors, roll-on roll-off	General, hazardous, liquid	National
Oricol	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	Telehoist, industrial compactor, refuse collectors, roll-on roll-off	General, hazardous, liquid	National
Interwaste	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	Telehoist, industrial compactor, refuse collectors, roll-on roll-off	General, hazardous, liquid	National
Wasteng	Bags, bins, skips, recycling	Telehoist, industrial compactor, refuse Collectors, roll-on roll-off	General	eThekwini
Don't Waste Service	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	M150, Telehoist, roll-on roll-off	General, hazardous, liquid	National
Waste Trans	Skips	Telehoist, roll-on roll-off	General	-
Commerical Waste	Skips	Telehoist, roll-on roll-off	General	EThekwini
Urban Accent	Bins, recycling	-	General	National
Enviroserv	Recycling, skips	Telehoist, industrial compactor, refuse collectors, roll-on roll-off	General, hazardous, liquid	National

NAME OF BUSINESS	TYPES OF SERVICES	TYPES OF VEHICLES	WASTE TYPES	AREA COVERED
DCLM	Bins, skips, recycling, liquid waste, e-waste, chemical waste, hazardous waste	-	-	-
Durban Waste	Skips	Telehoist, roll-on roll-off	General	eThekwini
MEDICAL WASTE				
Compass Waste	-	-	-	National
Solid Waste Technologies	-	-	-	National
Vikile Africa	-	-	-	National
RECYCLING COMPANIES				
Premier Waste	-	-	-	eThekwini
Planet Care	-	-	-	eThekwini
Remade Recycling	-	-	-	National
Eco Green	-	-	-	National
Pandae	-	-	-	National
SmartMatta	-	-	-	National

4.5.1 Equipment and disposal infrastructure and equipment

Based on SAWIC's 2018 data, South Africa has the following licensed activities presented in Figure 44 below. Of note, only 15% of waste management facilities were found to be compliant with their licences (DEA, 2018) .

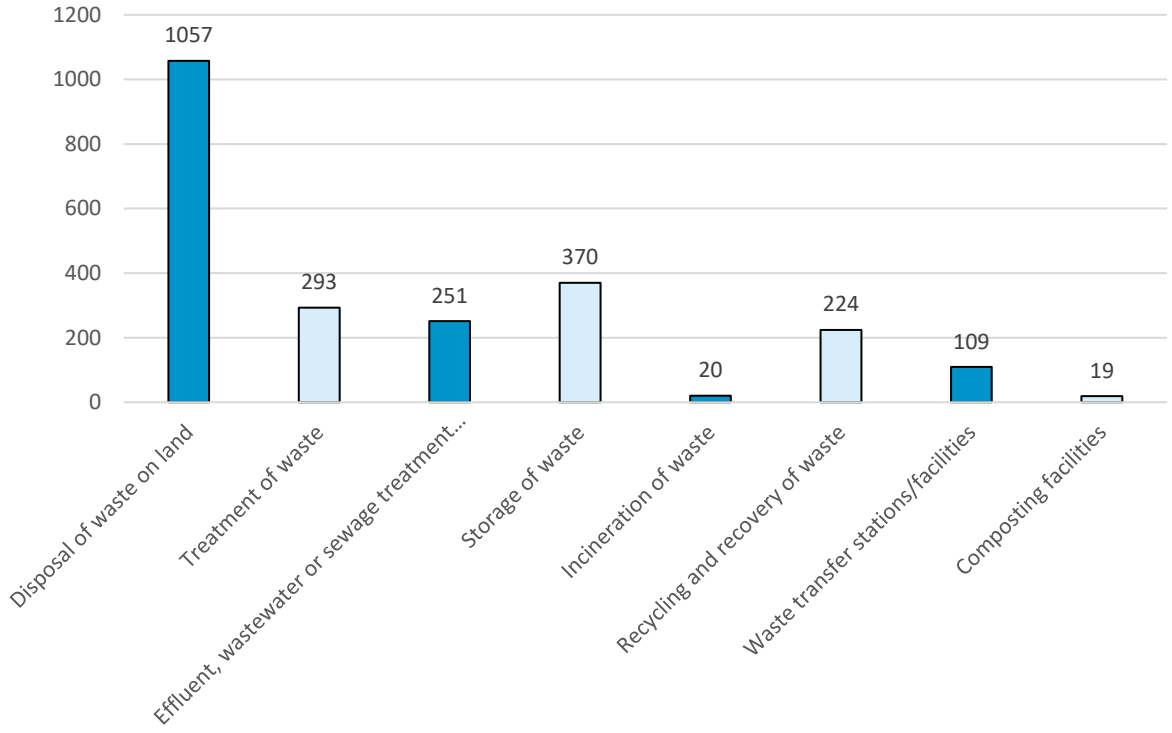


Figure 44: Breakdown of licensed activities in South Africa (Source: DEA, 2018a)

4.5.1.1 eThekwini Municipality

eThekwini Municipality has the following waste infrastructure at its disposal (Table 21). Figure 45 below highlights the locations of the waste transfer stations and landfills within the eThekwini Municipality.

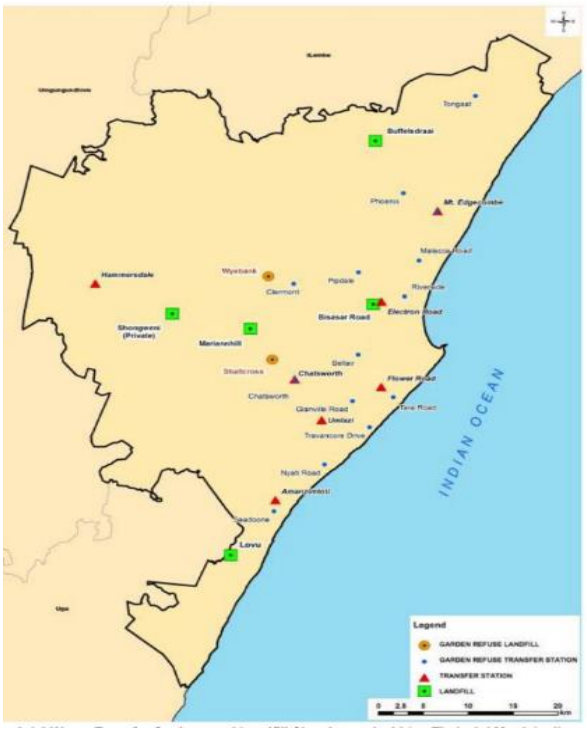


Figure 45: Waste transfer stations and landfills located within eThekwini (Source: DSW, 2019)

Figure 46: eThekwini Municipality waste infrastructure (Source: DSW, 2019)

Table 21: eThekwini's current assets and value (Source: Durban Solid Waste, 2019)

Asset type	No. of Assets	Current replacement costs (Rand)
Buildings	285	412,478,148.00
Electrical equipment	1	458,000.00
External lighting	1	10,000.00
Fences and gates	194	23,350,247.00
Fixed equipment	10	6,077,999.00
Fuel tanks and bowsers	1	250,250.00
Gas engines	8	48,850,000.00
Generator	1	0.00
Header stations	1	250,000
Land parcels	16	0.00
Landfill	6	1,445,852,900.00
Mechanical equipment	16	18,694,785.00
Miscellaneous	27	8,828,145.00
Paved areas	117	169,781,552.00
Pipe work	2	1,481,000.00
Ponds	8	12,638,016.00
Process control and instrumentation	1	494,393.00
Reservoirs	3	1,593,600.00
Roads	80	181,733,165.00

Service connection on site	1	55,000.00
Signs	312	406,626.00
Site walls	91	20,739,873.00
Stairs	32	126,685.00
Static waste compactors	6	12,385,000.00
Weighbridges	15	10,339,400.00
TOTAL		**2,376,874,784.00**

4.5.1.2 City of Cape Town

The City of Cape Town Municipality has the following waste infrastructure at its disposal. The map below highlights the locations of the waste transfer stations, MRFs and landfills within the Cape Town Municipality.

Figure 47: Cape Town Municipality waste infrastructure

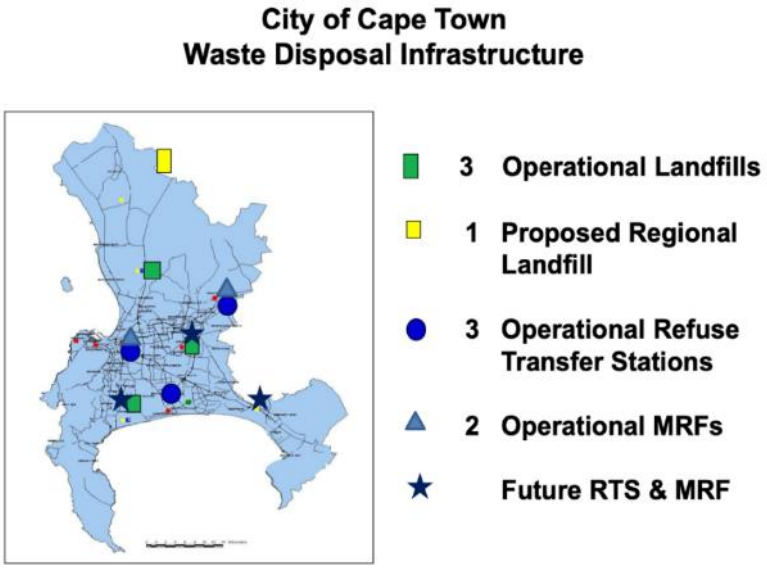


Figure 48: City of Cape Town Waste Disposal infrastructure (Source: CoCT, 2014)

4.5.1.3 Landfill disposal

With rapid urbanisation and lack of affordable housing putting land at a premium in metropolitan areas, landfills once at an acceptable distance now sit adjacent to low-income communities (CSIR, 2005). It has become increasingly difficult to find acceptable landfill sites within an economically viable radius for waste collection operations and clashes between municipalities protecting facilities and landfill areas from the expanding informal settlements are becoming more volatile.

Generally, it takes municipalities at least five years to obtain a waste licence, and an additional 12 months for the construction of a new landfill facility (Institute of Waste Management Science, 2019), without any public opposition to such a facility, such as has occurred in the City of Cape Town.

4.5.1.4 eThekwini Municipality

Durban Solid Waste operates four landfill sites: Buffelsdraai Landfill (Northern Region); Bisasar Road (North Central); Mariannhill Landfill Conservancy (Western Region); and Lovu Landfill (Southern Region). There is one planned landfill (Shongweni). Fourteen garden refuse transfer stations, where households can deliver waste, are distributed throughout the municipal area (Table 22 and Table 23).

Image 13: Buffelsdraai Landfill Site, Durban, South Africa (APWC, 2019)

Table 22: Durban Solid Waste Landfill sites NB: Wyebank & Shallcross closed (Source: Durban Solid Waste, 2019)

Site	Times (open/close)	Waste types	Responsible engineer	Contact numbers	Site contact
Bisasar Road Landfill Site	07:00–17:00 Mon–Sun	Garden refuse, Builders rubble, Sand & cover material	Engineer: Ziphelele Goba	082 341 7602	031 322 4582
			Landfill Officer: Bonga Mnguni	073 322 5605	
Wyebank Garden Site	07:30–16:00 Mon–Sun		Engineer: Mfundo Nhlengethwa	071 115 7440	031 700 8946
			Landfill Officer: Melvin Govender	084 240 6818	
Shallcross Garden Site	07:30–16:00		Engineer: Mfundo Nhlengethwa	071 115 7440	031 700 8946
			Landfill Officer: Melvin Govender	084 240 6818	
Marianhill Landfill Site	07:00–16:45 Mon–Sun	Solid refuse, garden refuse, builders rubble, mixed loads, condemned foods, weighing service sand/ suitable cover material, whole tyres, very light,	Engineer: Mfundo Nhlengethwa	071 115 7440	031 700 8946
			Landfill Officer: Melvin Govender	084 240 6818	
Lovu Landfill Site	07:00–15:30 Mon–Sun		Engineer: Ziphelele Goba	082 341 7602	031 322 2945

		light waste treated, sensitive waste, vehicle/container ext.wash, special disposal, inert dry waste, saw dust & other powder type	Landfill Officer: Bonga Mnguni	073 322 5605	
Buffelsdraai Landfill Site	07:00–17:00 Mon–Sun		Engineer: Randhir Sivapersad	079 511 2978	031 322 4582
			Landfill Officer: S'busiso Shandu	076 775 2459	

Table 23: Durban Solid Waste landfill sites capacity (Source: Durban Solid Waste, 2019)

eThekwini Catchment Area Landfill Site	Central Bisasar Road	West Mariannhill	North Buffelsdraai	South Lovu	New West Shongweni
Design Airspace capacity (m^3)	25,000,000	4,400,000	45,000,000	9,660,000	54,800,000
Remaining Airspace (m^3) – Approx	140,000	399,500	39,097,793	8,979,335	54,800,000
Tonnage received (t/day) – Average	1000	1350	2135	700	3000
Five-year Airspace Development	150,000	0	3,300,000	2,100,000	4,000,000
10-year Airspace Development	0	0	4,100,000	6,200,000	7,000,000
Remaining useful life (Years)	0.8	0.8	51	32	90

The Marianhill Landfill Conservancy deserves special mention as a world-class landfill site, setting new standards for sustainable urban infrastructure, boasting indigenous vegetation and restoration with almost a million trees planted and waste-to-energy gas collection (approximately 1.1MW and 6.5MW electricity at Marianhill and Bissasar Road landfill sites) (SA Cities, 2014).

Image 14: Mariannhill landfill conservancy (Source: Landfill conservancies, 2017)

4.5.1.4.1 City of Cape Town

There are around 193 landfill sites across the Western Cape, with landfill gate fees ranging between R200 and R450 per tonne on average (Table 24 and Table 25). The CoCT is the only city that faces depletion of its airspace halfway through 2030 (SA Cities, 2014).

The private Vissershok Hazardous Waste Management Facility (WMF) treated and/or disposed of 435,160 tonnes of hazardous waste during 2015 and 2016. The largest waste types treated at the facility included inorganic solids, sewage sludge and HCRW. In addition to the aforementioned, the CoCT's Hazardous WDF received 46,529 tonnes of hazardous waste over the same period. (WCG, 2017b).

Table 24: Operational landfill sites City of Cape Town (Source, CoCTa, 2019)

Name	Location	Licensing status	Adherence to permit conditions	Complaints	Salvaging issues	Available airspace (May 2016)
Bellville South	Bellville	licensed	Yes	Neighbourhood pressure to close	No salvaging allowed	2,496,090 m^3
Coastal Park	Muizenberg	licensed	Yes	Minimal	No salvaging allowed	6,179,078 m^3
Vissershok	Farm Outspan (N7)	licensed	Yes	Minimal	No salvaging allowed	1,120,797 m^3

Table 25: Landfill space remaining City of Cape Town landfill sites (Source, CoCTa, 2019)

LANDFILL AIRSPACE DATA AS AT 12 MAY 2016 Description	Unit	Bellville	Vissershok	Coastal Park
Date of survey	09-May-16		12-May-16	11-May-16
Type of survey	Groun-based		Ground-based	Ground-based
Airspace remaining to final profile	m^3	2,496,090	1,120,797	6,179,078
Average monthly reduction in airspace over the past 12 months calculated from weighbridge tonnages	m^3/month	55,298	88,680	84,702
Average monthly reduction in airspace over the past 12 months calculated from surveyed data	m^3/month	38,029	36,208	45,644
Remaining lifespan of site based on weighbridge tonnages	Months	45	13	73
Remaining lifespan of site based on surveyed data	Months	66	31	135
Remaining lifespan of site based on licence restrictions (Bellville only)	Months	28	N/A	N/A

Image 15: Image sourced from CoCT, special waste handling report, 2014

4.5.2 Recycling and recovery

Recycling or recovery services differ between provinces, cities and municipalities, as outlined below (DEA, 2018a):

- Western Cape: the municipalities of Bitou, George, Hessequa, Kannaland, Knysna, Mossel Bay, Outshoorn, Breede Valley, Overstrand, Langeberg, Stellenbosch and Saldanha Bay have implemented various levels of separation at source;
- KZN: the eThekwini Municipality is reported to have implemented the 'Orange Bag Recycling Project', a separation-at-source initiative. Initially servicing 800,000 households on a weekly basis with their municipal waste collection (DEA, 2018a), this initiative has had mixed success with its closure announced by flyer in 2018. Media reports suggest closure was due to irregularities in the tendering and contracting process, and there is a legal investigation currently underway by the Hawks (Ndaliso, 2018).

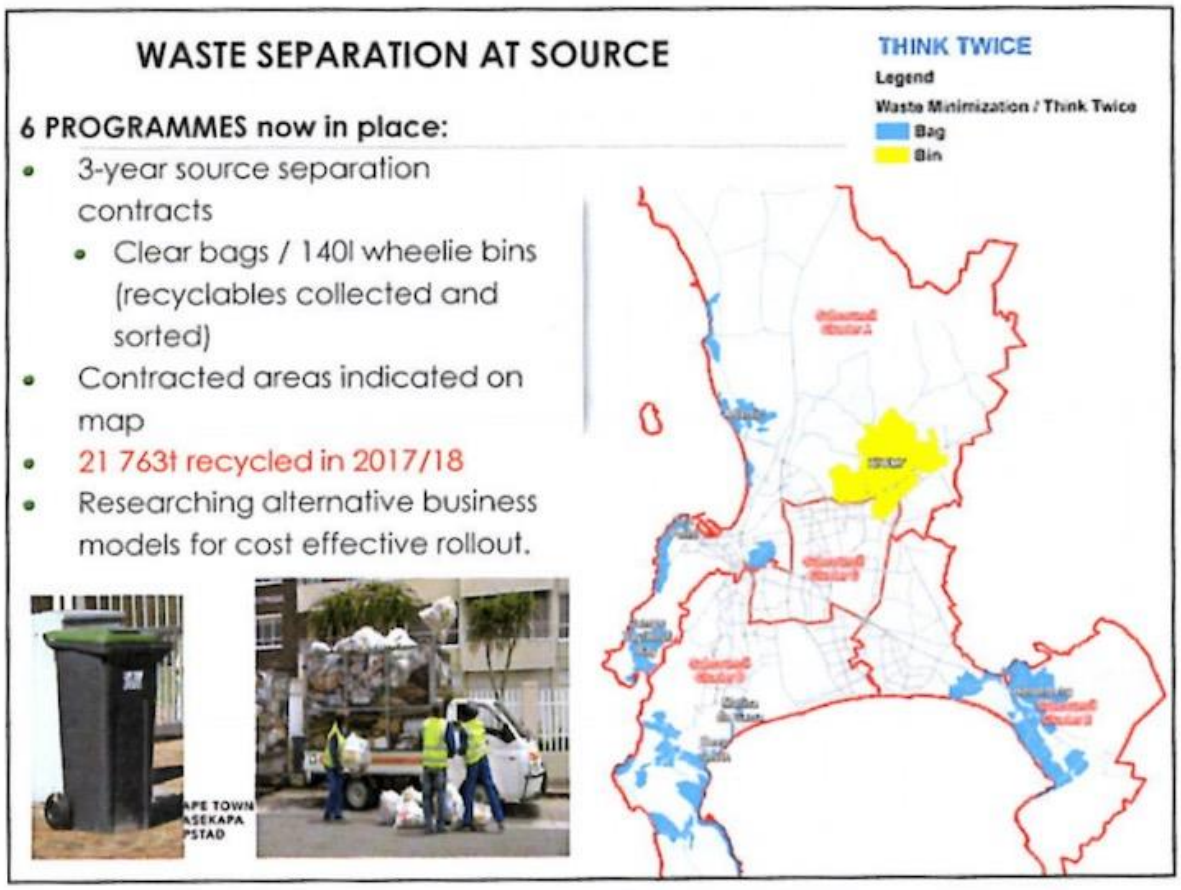


Figure 49: Cape Town waste separation-at-source programmes (Source: CoCTa, 2019)

Finding a convenient and easy to locate e-waste collection site is difficult for the public (Mhlanga, 2018). In eThekwini Municipality, there are no policies governing the safe disposal of e-waste, but certain private organisations have initiated drop-off receptacles, for example, Pick n Pay and Woolworths for CPL bulbs and old batteries. The Pavilion Shopping Centre, Makro and Incredible Connection stores each have designated areas to drop off e-waste.

Plastics recycling also leads to confusion. Packaging is printed with a numeral (1 to 7), usually within a triangle. This refers to the resin type, which was originally designed to assist waste collectors and waste separators but not the customer. This looks similar to the recycle symbol, and it is a common misinterpretation that the packaging can be recycled. While most resin types are technically recyclable, many are not recyclable in South Africa. With the aid of WWF, a group of six major retailers are rolling out standardised recycling instructions, known as On Pack Recycling Labels (OPRLs), which will indicate whether the packaging is recyclable (Figure 50) (WWF, 2019).

Figure 50: Woolworths recycle label (left) vs Pick n Pay (right) (Source: Business Insider, 2019)

For glass recycling, there are more than 4,000 glass collection points in South Africa, which is home to 32 dedicated collect-a-can companies. These jointly collect 72% of all beverage cans and recovered more than 75% of all metal packaging last year.

4.5.3 Street cleaning/cleansing

Many municipalities in South Africa make use of the Extended Public Works Programme (EPW) for street cleaning. The EPW is an initiative of the national government which provides subsidies to provinces and local governments to employ workers on a temporary basis to do jobs such as street cleaning, clearing of alien vegetation, community safety, fire- fighting and so on.

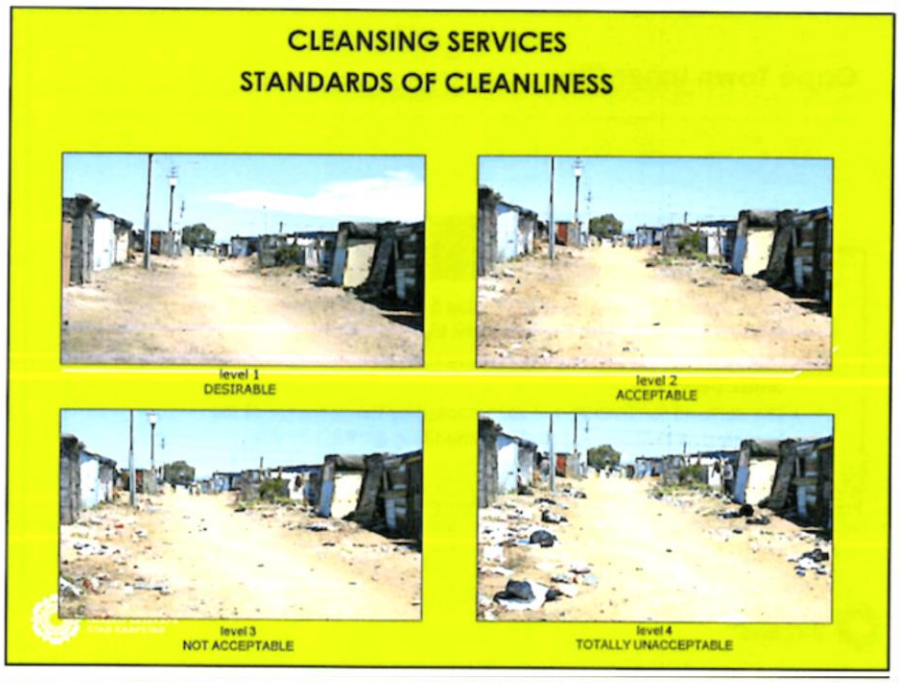


Figure 51: Cleansing service standard of cleanliness (source: CoCTb, 2019)

Local municipalities are responsible for cleansing, including litter bin provision and servicing, street sweeping, litter picking, the clearing of illegal dumping and animal carcasses, beach cleaning, and the cleaning of industrial pollution, waste and debris generated by natural disasters and processes.

Image 16: One of the four canals in Masiphumelele where human waste is contaminating waterways due to lack of sanitation. (Photo credit: Masixole Fani, 2017)

4.5.4 Illegal dumping

Illegal dumping is a major challenge for municipalities in South Africa. It is often included not as a separate line item, but as part of cleansing or waste collection services. The City of Cape Town spends approximately R350 million per year (CoCT, 2019) or 10% of its cleansing budget, for the removal and rehabilitation of illegal dumping sites (Durban Solid Waste, 2019); for eThekwini, it is approximately R180,000,000 a year. Based on a review of available IWMPs by the DEA, it was found that cleaning up litter and illegal dumping accounts for between 1% and 26%, with an average of 8%, of their operating expenditure on waste management (DEA, 2018a).

Hot spots of illegal dumping in the City of Cape Town are in Dunoon, Kensington, Khayelitsha, Nyanga, Browns Farm (Philippi), Mitchells Plain and Philippi (Figure 52) (WCG, 2017b).

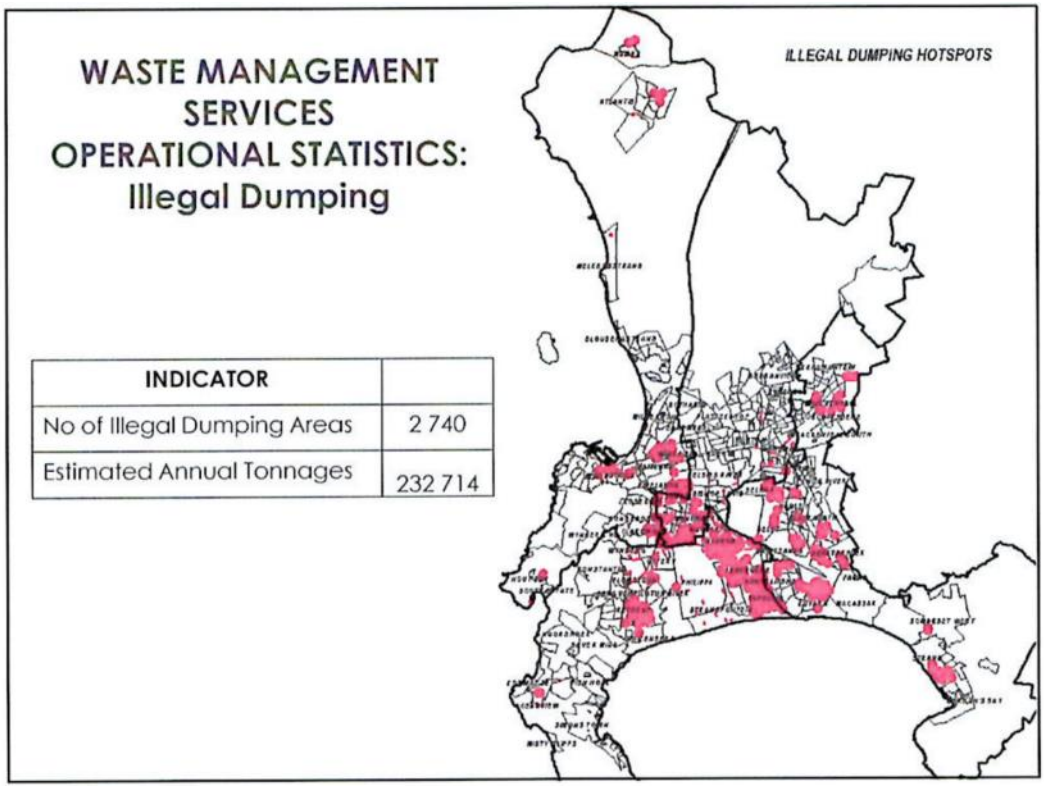


Figure 52: Illegal dumping hotspots in City of Cape Town (Source: CoCTb, 2019)

The CoCT attends yearly to 118,244 sewer blockages across the city, including unblocking of full-flush toilets in informal settlements. Its Integrated Waste Management By-law sets fines between R500 and R10 000 and criminal sentences of six months to two years for certain offenders. Illegal dumping can be reported by phone, email or the City's social media pages.

Nationally, there is a dedicated Environmental Management Inspectorate (EMI) unit known as the 'Green Scorpions'. They have a broad legal mandate that covers the green (biodiversity/protected areas), brown (pollution, waste, impact assessment) and blue (integrated coastal management) (RSA, 2017).

Image 17: Illegal dumping in Nyati Road, Durban (Photo credit: Green Corridor)

4.6 Fees, charges and council budgets

Municipalities collect fees for waste service provision for households through municipal rates, and for commercial and industrial premises for an additional charge, as well as landfilling rates. According to Stats SA 2018 general household survey, only 36% of households pay for refuse removal (Table 26).

Table 26: Households currently paying for the removal of refuse, by province, in 2018 (Source: Stats SA, general household survey, 2018)

Pay for refuse removal	Thousands									
	Western Cape	Eastern Cape	Northern Cape	Free State	KwaZulu-Natal	North West	Gauteng	Mpuma-langa	Limpopo	South Africa
Yes	1 154	373	144	311	857	257	2 370	329	195	**5 988**
	61%	22%	42%	35%	30%	21%	49%	26%	12%	36%
No	682	471	103	411	781	470	2 137	284	260	**5 598**
	36%	28%	30%	46%	27%	39%	44%	22%	16%	34%
Do not know	12	6			34	6	91	7	12	**170**
	0,6%	0,4%	0,0%	0,0%	1,2%	0,5%	1,9%	0,5%	0,8%	1,0%
N/A	30	835	93	179	1 232	477	286	669	1 112	**4 914**
	2%	50%	27%	20%	42%	39%	6%	52%	70%	29%
Total	**1 877**	**1 685**	**342**	**901**	**2 905**	**1 210**	**4 884**	**1 289**	**1 579**	**16 671**

City of Cape Town

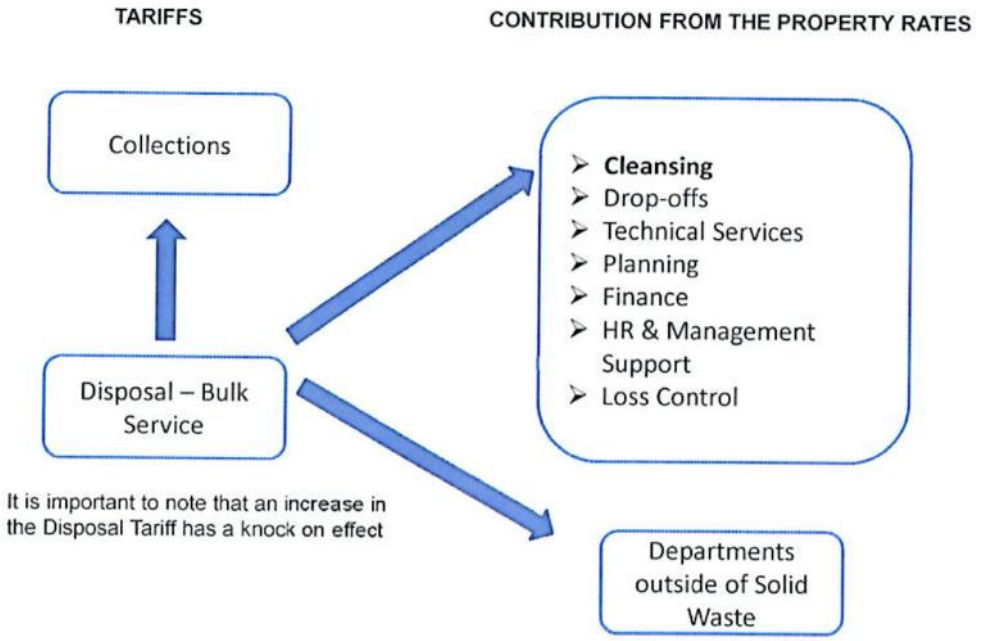


Figure 53: SWM budget structure for City of Cape Town (Source: CoCTa, 2019)

CoCT's capital budget will double from 2019 to 2020. This increase is primarily in budget allocated to development of landfill sites and development of transfer stations by an increase of 131.6 million rand and 52 million rand, respectively.

4.6.1 eThekwini Municipality

The Durban Solid Waste annual revenue budget and actuals are shown in Table 27.

Table 27: Durban Solid Waste Revenue budget 2018/2019 (Source: DSW, 2019)

Category	2018/2019 Revenue budget	2018/2019 Revenue actuals
Disposal facilities (landfill)	R 70,080,020.00	R 74,038,476.00
Bulk and extra refuse	R 93,075,010.00	R 60,650,159.00
Trade refuse (incl. waste bins)	R 172,975,870.00	R 199,526,110.00
Refuse bags (retail)	R 45,240.00	R 7,411,952.00
TOTAL	**R 336,176,140.00**	**R 341,626,697.00**

5 Current waste-management initiatives

The following information highlights some of the current waste-management initiatives undertaken in South Africa across government and industry bodies in addition to international programs.

5.1 Government initiatives

- **Source to Sea –** a network of partners and stakeholders (including City of Cape Town, ICLEI, Sanparks and WESSA) which connects Table Mountain National Park to important estuaries within the Zandvlei catchment area.
- **Roadmap for South Africa** – Department of Science and Technology's (DST) National Waste Research, Development (R&D) and Innovation aims to contribute to a secondary resources economy to downstream manufacturing a secondary resource economy (DST, 2014). Anticipated impact on waste management is 20% reduction (by weight) in industrial waste and a 60% reduction (by weight) in domestic waste to landfill (by 2025).
- **Working on Waste** – one of the initiatives by the DEA implemented under the auspices of the Expanded Public Works Programme (EPWP). The initiative is a proactive preventative measure that recognises that inadequate waste services may lead to litter, which is not only visual pollution but may lead to health hazards and environmental degradation.
- **Good Green Deeds Programme** – a national program which aims to combat waste management challenges such as illegal dumping and littering.
- **Operation Phakisa** – Chemicals and Waste Economy (Waste Phakisa) which contains a number of detailed action plans aimed at delivering results by 2023. The objectives include increasing the total contribution of the waste economy from R24.3 billion to R35.8 billion and creating 127,000 new direct and indirect jobs. It also includes plans to provide support to 4,300 SMMEs with 70% targeted at youth and at least 30% targeted at women; and ultimately seeing more than 20 million tonnes of waste diverted away from landfill towards reuse, recycling and recovery.
- **Wastepreneur project** – DEA provides training to waste recycling and informal waste collector entrepreneurs
- **CoCT Green Litter Bin Education and Awareness Project for Informal Settlements**
- **Genius of Systems for People's Access to a Clean Environment (SPACE)** – pilot project being implemented in the Langrug informal settlement in Franschhoek using biomimicry principles to clean up grey water, stormwater and solid waste challenges within the community using low-tech and easily maintained solutions.

Some examples of past pilots:

- a separation-at-source pilot project implemented in Mantsopa Local Municipality in The Free State
- the City of Tshwane, Gauteng implemented mainstream source separation. This service is offered to 40,000 households. Johannesburg, Gauteng has recently implemented mandatory source separation in certain suburbs (DEA, 2018)
- Royal Bofokeng, in the Rustenburg Municipality implemented a separation-at-source programme (Department of Environmental Affairs, 2018)

- USE-IT is a non-profit organisation working with the eThekwini Waste Materials Recovery Industry Development Centre developing holistic approaches to solid waste management through a number of recycling programmes (Jambeck et al., 2018)
- an anaerobic Bokashi bin (in Khayelitsha) or concentrated food waste in central composting facilities permaculture and community farms.

5.2 International and regional projects

- **SADC Secretariat** is in the process of developing a regional programme on waste management (still being finalised)[1].
- **Institute for Waste Management of Southern Africa (IWMSA)** – a multi-disciplinary non-profit association that is committed to supporting professional waste management practices. The organisation comprises voluntary members who promote environmentally acceptable, cost-effective and appropriate waste management practices.
- **The Africa Institute** co-ordinates regional efforts in Africa regarding the Rotterdam, Basel and Stockholm chemical conventions.
- **The Southern African Telecommunications Association** has drafted guidelines for e-waste disposal. These guidelines allow for identification of various sources of e-waste and prescribe procedures for e-waste handling. The guidelines also call for the establishment of a SADC e-waste recycling plant that recycles waste in an environmentally sound manner.

5.3 NGO's and community groups initiatives

- **GreenCape** delivers the Western Cape Industrial Symbiosis Programme (WISP), which is a free facilitation service that connects companies that have an unused resource (materials, energy, water, assets, logistics, expertise) to companies that can use that resource in their production. The programme identified six waste streams typically not taken up by large companies due to either logistical constraints or lack of market. This creates diversion and recycling opportunities to technology providers. The streams include:
    - Slag: 540,000 tonnes per year
    - Paper/pulp effluent: 240,000 tonnes per year
    - Foundry sand: 74,000 tonnes per year
    - Treated wood: 760 tonnes per year
    - Laminated glass: 200 tonnes per year
    - Cardboard cores: 170 tonnes per year

- **The National Recycling Forum (NRF)** is a non-profit organisation created to promote the recovery and recycling of recyclable materials in South Africa. Members of the NRF include

[1] https://www.sadc.int/issues/environment-sustainable-development/waste-management/

representatives of the formal recycling industry in South Africa; government departments; regional recycling forums; local government-based organisations and government utilities; and co-opted advisory members.

- **African Marine Waste Network** is a project of Sustainable Seas Trust NPO. Focusing on preventing land-based sources of marine plastic pollution through network building and enterprise development https://africanwastenetwork.org.za.

5.4 Industry initiatives

Industry groups and associations include:

- Western Cape Recycling Action Group (WCRAG)
- Industry Waste Forum
- e-Waste Association of SA https://www.ewasa.org
- National Oil Recycling Association of South Africa (NORA-SA) http://www.nampak.com
- The Polyolefin Recycling Company – an NGO established in 2011 to reduce the amount of polyolefin packaging going to landfill by increasing the sustainable collection, recycling, recovery and beneficiation of polyolefin plastics (polymer identification codes 2, 4 and 5) www.polyco.co.za

Initiatives include:

- **The Declaration of the Global Plastics Associations for Solutions on Marine Litter –** Declaration completed in 2011. Since then, 75 plastics organisations and allied industry associations in 40 countries have voluntarily signed and now operate as the Global Plastics Alliance (GPA). South Africa is a signatory. https://www.marinelittersolutions.com/about-us/joint-declaration/
- **PACKA-CHING** A community-based project spearheaded by the packaging industry to introduce recycling into informal settlements and lower income areas around South Africa through a mobile recycling unit travelling between communities in exchange for money on an e-wallet.
- **The South African Alliance to End Plastic Pollution** Plastics SA strategic alliance to tackle plastic waste.
- **Operation Clean Sweep©:** a voluntary programme that promotes proper pellets containment along the entire plastics value chain. The programme is being implemented across the plastics industry value chain in order to avoid plastic pellet spill.

6 Solid waste generated in South Africa

6.1 Audit methodology

The aim of this section of the report is to understand the current 'state of waste management systems and practices' and suggest robust, local and real solutions for the City of Cape Town and eThekwini to reduce health and environmental risks arising from inadequate management of solid waste. The audit methodology was designed to ensure the waste generation rates are calculated at the municipal level, including the amount and type of waste inadequately managed (or 'mis-managed').

6.1.1 Household sampling distribution

Based on information collected during previous projects, the following split was used:

- **Urban areas:** These areas could host a centralised waste management facility (landfill, transfer station)
    - Formal residences
    - Informal residences
- **Rural areas:** These mostly include isolated settlements.

As many areas as possible were visited for sample collection purposes within the time constraints in order to get municipal generation rates. The aim was to collect representative urban (including formal and informal settlements) and isolated community samples for the two municipalities. These samples are not representative of the individual suburbs from which they were collected but contribute to overall generation rates for the municipality. Samples were also collected from commercial premises in each of the suburb visited. The number of samples collected by community/area are presented below in Table 28 and

Table 29. The number in brackets represents the number of matching interviews conducted.

Table 28: Samples collected from Cape Town, South Africa (Source: APWC)

Area	Household Samples	Commercial samples	Collection system in place	Urban/ Rural
Camps Bay	25	0	Yes	Urban formal, affluent
Durbanville	25	0	Yes	Urban formal, affluent
Kuils River	25	0	Yes	Urban formal, middle income
Athlone	25	0	Yes	Urban formal, middle income
Durbanville	5	1	Yes	Rural, formal, affluent, middle income
Khayelitsha	27	0	Yes & No	Formal township, informal settlement, low income

Philippi	19	0	Yes & No	Formal township, informal settlement, low income
Commercial	0	20	Yes	Urban formal, middle, low & affluent income
Total	**150(139)**	**21 (21)**		

Table 29: Samples collected from eThekwini Municipality, South Africa (Source, APWC)

Area	Household Samples	Commercial samples	Collection system in place	Urban/ Rural
Quarry Rd	10	0	No	Urban informal settlement
KwaShembe	10	0	No	Urban informal settlement
Umhlanga	20	0	Yes	Urban formal, affluent
Phoenix	21	0	Yes	Urban formal, middle income
KwaMashu	14	0	Yes	Formal township, low income
Wentworth & Bluff	25	0	Yes	Urban formal, low & middle income
Lamontville	25	0	Yes	Urban formal, low & middle income
Westville	20	0	Yes	Urban formal, affluent
Ntshonweni	10	2	Yes & No	Rural, formal, low & middle income
Commercial*	0	13*	Yes	Urban formal, middle, low & affluent income
Total	**153(137)**	**15 (4)**		

*The two commercial premises are in addition to Ntshonweni. Two large commercial centers were sampled that represent about 13 shops.

Council staff from each municipality and the APWC Country Manager were asked to mark out high—, middle- and low-income areas in each municipality on a map. The total sample was split between these areas. Once in an area, streets were selected randomly. No more than five samples were collected from each street. The actual allocation of households as low, middle or low income was done on the basis of their response to the interviews.

The sample collection from each city was limited by the ease of collection of samples, the ability to transport samples, as well as the presence and absence of collection systems. The APWC team was in South Africa for five weeks and assessed waste from both eThekwini (nine suburbs) and Cape Town (seven suburbs). The number of samples collected from each site, as well as the collection system available, is listed in Table 28 and

Table 29.

6.1.2 Commercial sampling distribution

In addition to the household samples, 36 commercial samples were collected. Commercial premises were divided into four major categories and the sample taken from across each category. The four categories were administrative buildings like offices, shopping centres, restaurants and hotels. Due to waste being discharged at a single collection points for each complex, it was not possible to determine the exact number of samples taken from each type of premises.

Domestic waste samples were collected household by household to determine the waste generation and disposal rate per household.

Waste collection methods had to be modified based on the locality being assessed.

6.1.3 Collections from areas with a house-to-house collection system

APWC approached the respective municipality in each town to assist with the collection of waste immediately before it was picked up by the waste trucks. The APWC crew worked with Solid Waste Department in the City of Cape Town and DSW in eThekwini to collect all samples. In all localities with collection services, APWC collected waste prior to the arrival of the council collection truck. In formal areas, households were not informed about the audit prior to the sample collection to ensure they did not change their behaviour in anticipation of the audit. However, the APWC staff undertaking interviews carried letters from council to inform households about the audit prior to the collection. All ward councillors were also informed of APWC's intent to be in the area and undertake collections.

Each collection team comprised the following staff:

- APWC collection supervisor;
- APWC collection runner;
- Local staff member to ensure smooth running of collections.

The APWC collection supervisor collected the following data for each house sampled:

- GPS location;
- Waste quantity per household (as number of bags or bins);
- Interview tag provided;
- Photo.

The sample collection recording sheet template is provided at Appendix A. At the end of each day, the sample collection sheet was scanned and sent to the APWC office in Sydney for data entry as per the permissions granted through the Cefas research permit as a subcontractor. The methodology remained consistent for both households and commercial premises.

Identifying the households from which waste was collected was not an issue for interviewers because all formal households in South Africa have registered addresses, including a number and street name.

6.1.4 Collections from areas with no collection service

Communities in two different areas in both eThekwini and the City of Cape Town were sampled as representative of areas with no collection system. Due to security concerns, a small number of samples were collected in each area. The method used is as follows:

a) On day one, APWC staff approached a community representative and sought support to undertake waste data collection in their community. After permission was given, the requirements of the sampling process was explained and advice sought as to the best day to provide bags for sampling to the community;
b) APWC returned on the appointed day and provided each household with a bag to use to dispose of their waste from that day onwards. Households were requested not to dispose of any bulky or problem waste that they were having trouble disposing of into the black bags.
   The bags were collected the next day and discarded. (Based on APWC experience, households tend to use the initial bag to complete a household 'spring clean'.) Households were then provided with a fresh bag;
c) The APWC team returned after five days to retrieve the bags from each household. As each household brought their waste bag, the bag was labelled and provided to the sorting team.

In eThekwini this work was undertaken in communities identified by Green Corridor with staff provided by EcoChamps. APWC acknowledges that this work would not have been possible without the support of these two organisations and would like to thank them for their support.

6.1.5 Collections from commercial premises and litter

Commercial samples were only obtained from premises that had a collection service. The methodology of collection was the same as that used during the household sample collection for houses with a collection service. As part of the sampling in both eThekwini and Cape Town, a shopping centre with communal waste collection was also sampled. Street litter samples were collected in both municipalities. Street litter samples were collected from both commercial and household areas and comprised of the street litter bags filled with council cleanups.

6.2 Household interviews

Interviews were conducted with all households from which waste was collected. The interviews were conducted using the interview sheet provided at Appendix B. As noted in section 6.1.3, each household location was captured using GPS and a photograph.

APWC notes that interviews in formal urban areas were challenging because people were at work during the day. Therefore, interviewing was undertaken at times when residents were likely to be at home.

The APWC methodology assesses the amount of waste requiring immediate management, that is, the waste being placed in bags or drums. It also assesses household behaviours based on interviews in order to understand what happens to uncollected waste or why refuse is not placed in bags, including the reason for these behaviours.

The standard APWC procedure is to seek voluntary participation by households in the interview process. The participation rate was high in informal and low-income areas, as well as in middle-income areas and APWC was able to match many of the households. The participation rate was low in formal and high-income areas, and where a resident was not home or not willing to participate, interviewers surveyed the adjacent or nearby house. The low, middle and high income areas were separated based on the SA department of Statistics definitions of low, middle and high income households for each municipality.

Image 18: ECOCHAMPS flyer

APWC would like to extend our sincere thanks to the staff at City of Cape Town Solid Waste Management Department and eThekwini's Durban Solid Waste who accompanied our collection staff, as well as EcoChamps who assisted the APWC interview team in gaining support for the project.

All interview sheets were in English and local staff members were trained to undertake the interview in their home language where necessary. All interviews were undertaken in groups of two led by local staff accompanied by an APWC employee. The household interviews were the most time-consuming part of the data collection process, with each interview taking approximately 20 minutes to half an hour. Waste is an emotive issue and the interviews allowed people to express their opinions candidly. APWC deployed up to seven local staff to ensure that all interviews were completed on time.

It was sometimes difficult to gain access to residents when conducting interviews, some were sceptical that interviewers were working under the authority of the council. The interviewers carried both a letter of support from the council as well as the council ward members announcing

the interviews through various channels such as social media. 139 households were interviewed in Cape Town and 137 in eThekwini representing a success rate of 92.6% and 89.5% respectively.

6.3 Sample sorting

All waste was collected in plastic bags. Once collected, the bags were labelled and brought to the local sorting facility listed in Figure 54 below.

Figure 54: Sorting location for South Africa samples (Source: APWC)

Bag tags were used to identify all samples. Samples were lined up in order to ensure none were missing. All samples were cross-referenced with the collection sheet to ensure consistency between sample collection and sorting.

After checking all samples were present and in order, the collection supervisor scanned the collection sheets and emailed them to APWC headquarters. The physical sheets were handed over to the sorting supervisor to ensure all data was kept at the same place.

Material from each bag was sorted separately into the 49 categories, listed below in

Table 30.

Table 30: Household sorting categories (Source, APWC)

Consolidation	Category	Consolidation	Category
Metal	Aluminium cans	Hygiene	Feminine hygiene
	Aluminium recyclable		Pharmaceutical
	Steel cans		Nappies
	Metal other		Medical waste
Fishing	Fishing/seafood, metal		Other sanitary waste
	Fishing/seafood, plastic	Organics	Food
	Water pouches		Wood/timber
Paper and Cardboard	Cardboard		Other organics
	Cigarette butts	Other	Hazardous
	Liquid paperboard (LPB)		Textiles
	Paper		White goods
Plastic	PET bottles		Ceramics
	HDPE bottles		Animal faeces
	Expanded polystyrene		Containerised used oil (volume and weight)

Consolidation	Category	Consolidation	Category
	Plastic bags		EOL renewable energy equipment
	Plastic oil containers		End-of-life vehicles
	Polypropylene (PP)		Tyres
	Flexible/film		Other
	Other plastic	Glass	Glass bottles eligible for CDS
Batteries	Lithium batteries		Glass bottles wine and spirit
	Used lead-acid batteries		Glass fines
	Other batteries		Glass jars
E-waste	Computer equipment		Glass other
	Mobile phones		
	Electrical items and peripherals (including TVs)		
	Toner cartridges		

The sorting area consisted of a raised table covered with a tarpaulin or plastic sheets. The bagged waste was opened and the contents sorted into the categories in

Table 30 above. Each bag was handled separately and material from only one bag was placed on the table at any one time.

Image 19: APWC sorting in progress

Separated materials were placed in appropriate containers, weighed on a set of electronic scales (accurate to two decimal points) and the weight recorded. APWC brought its own pre-calibrated electronic scales from Australia to ensure accuracy. Every set of scales is calibrated pre and post deployment. Volume was calculated by placing the material in a pre-calibrated bucket. All recorded volume was then checked during analysis against volume obtained using conversion factored published by the US EPA (United States Environment Protection Agency).

Beverage containers from all general waste samples were kept in a separately labelled basket to ensure there was no cross-contamination. They were then stored and counted separately regardless of whether they had liquid in them.

Containers were sorted by size, material (e.g. plastic, aluminium) and product type (e.g. milk, juice).

Further, all plastic bags were sorted into different types of bags and all containers were further sorted by size, material type and product type. Cigarette butts, coffee cups and takeaway containers were also segregated. This further sort was undertaken to 294 categories. The sorting sheet is provided at Appendix C whereas Table 30 represents the high-level categories. All sorting sheets were scanned and emailed to the APWC headquarters at the end of each day.

6.4 Work, Health and Safety

APWC's parent company has an Integrated Management System covering quality, health, safety and environment (QHSE), which was used during these audits. The system has been developed to be consistent with the requirements of the international standards ISO9001 (Quality), ISO14001 (Environment) and AS4801 (Occupational Health and Safety).

We are proud of our excellent work, health and safety record, and our commitment to quality, environmental protection and sustainability. Therefore, the following steps were undertaken to ensure that APWC staff, along with those undertaking training, were always safe.

- Site-specific safe work method statements (SWMS) were developed;
- A pre- and post-work commencement risk assessment was undertaken;
- APWC collection and sorting supervisor undertook QHSE inductions for project staff;
- All staff were trained in the waste audit code of conduct developed by APWC, which includes a requirement to sign a confidentiality agreement prohibiting them from removing items from sorted material or from revealing any information they might obtain while sorting or auditing.

Adjustments were made to some standard operating procedures to suit the local conditions while continuing to ensure the safety of all staff, contractors and secondees. APWC's collection and sorting supervisor had full control over local safety requirements to ensure all work was being conducted in a manner protecting staff health and safety.

APWC notes that one of our staff and one staff member from the Aller River Project was robbed in a community location in Durban while undertaking some interviews. APWC undertook a full review of the safety procedures as a result of this incident. We note, however, that no injuries were sustained as a result of the incident.

7 Results

APWC sampled household and commercial premises in Cape Town and eThekwini during the auditing period to obtain data to ascertain waste composition and disposal practices from the two communities. The number of samples collected include:

Council Area	Number of Samples – Household	Number of samples - Commercial
•eThekwini •Cape Town	•150 •150	•21 •15

Samples include a representation of low-, middle- and upper-income households for a) serviced households b) poorly service areas; and c) un-serviced households. The map below represents the locations where samples were collected across Cape Town and eThekwini.

Figure 55: Samples collected in Cape Town

Figure 56: Samples collected in eThekwini (Source: APWC)

7.1 Waste generation rates

7.1.1 Calculating household generation rate

In order to ascertain waste generation rates for the City of Cape Town and eThekwini, APWC adopted the following measures:

- APWC deliberately oversampled high-income areas of Cape Town and eThekwini, as these areas contribute more to waste production and allow the development of more precise estimates;
- To estimate the total generation for the municipalities, we needed to correct for this sampling bias;
- Figure 57 shows the relationship between average community incomes and waste generation (Note: there is a degree of uncertainty in this relationship).

We can see from Figure 57 that low-income communities have a household waste generation rate of around 1 kg per household per day, middle-income communities have a generation rate of around 1.5 kg per household per day and high-income communities of around 2 kg per household per day.

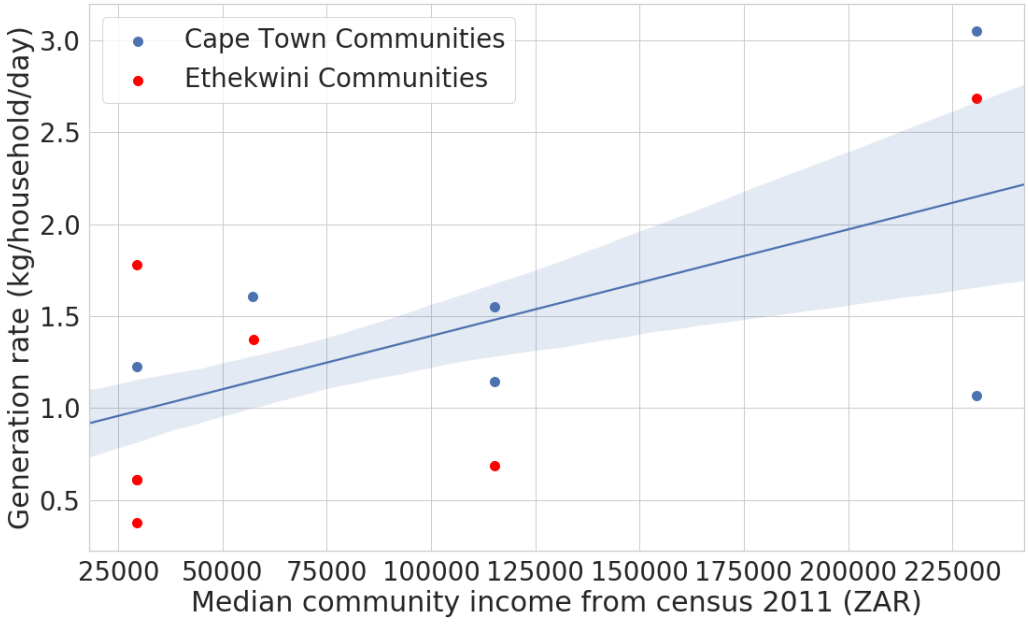


Figure 57: Waste generation rate vs median community income

For reference, New York, which is one of the most waste-intensive cities on Earth, generates around 4.5 kg/household/day of waste.

In per capita figures, this is 0.23 kg/pp/day, 0.35 kg/pp/day, 0.47 kg/pp/day for low-, middle- and high-income communities respectively. These figures are substantially different from 0.41, 0.74

and 1.29 kg/capita/day respectively given by (Fiehn & Ball, 2005). We were unable to locate this reference, so we could not verify if these were estimates of *household* generation rates or *total* generation rates.

From the 2011 Census, we derived the following figures for the number of wards at each income level in Cape Town and eThekwini respectively:

Table 31: Number of wards with different income levels (Source, APWC)

Cape Town Median Income (ZAR)	Number of Cape Town wards at this income level	eThekwini Median Income (ZAR)	Number of eThekwini wards at this income level
14,400	20	7,200	1
28,800	29	14,400	35
57,600	28	28,800	47
115,200	14	57,600	15
230,400	24	115,200	8
460,800	1	230,400	4
921,600	0	460,800	0

Using the figures above for the numbers of communities at different income levels, we obtained the following data (Table 32) for household waste generation levels (note: 80% confidence intervals are in brackets). To calculate the overall contribution for households, we used the 2016 Community Survey figures of 1,264,950 households in Cape Town and 1,125,765 households in eThekwini.

Table 32: Number of wards with different income levels (Source, APWC audit 2019)

Location	Household generation rate (kg/hh/day)	Household waste generation rate (tonnes per day)	Household waste generation rate from landfill audit (tonnes per day)(figures from lit review)	Total generation rate from landfill audit (tonnes per day)(figures from lit review)
Cape Town	1.3 (0.9–1.8)	1,680 (1,155–2,250)	1,801[2]	10,569[3]
eThekwini	1.1 (0.7–1.4)	1,184 (786–1,600)		3,946[4]

2 World Bank 2019, *Within the Circular Economy* appendix 'Organics in Waste Stream'
3 World Bank 2019, *Within The Circular Economy*

4 Jan 2018 – Dec 2018, Biasar Rd, Marianhill, Buffelsdraai, Illovu landfill sites

In Cape Town, our estimate of household waste generation accounts for just 16% of total waste generation, while in eThekwini it accounts for 30%. This shows that overall, there is a much higher generation of waste types other than household waste in Cape Town as compared to eThekwini.

7.1.2 Total waste generation

APWC conducted samples of businesses and households, however we were unable to estimate total generation rates from the combined samples as we did not conduct a sample of industrial or construction sites or waste generated through quarantine, manufacturing or large-scale commercial activity such as mining.

Of interest, however, are some trends in consumption, discussed below.

There is a consistent relationship between residential and commercial consumption of beverages across different beverage types, as shown below i.e. the highest number of beverages are consumed in glass bottles, followed by PET containers and aluminium cans regardless of whether they are being consumed at home or in commercial premises. This can be useful if any policy or legislation around specific types of containers being eligible for incentives/rebates were being considered. The data can be extrapolated to determine generation rate of containers in different sectors.

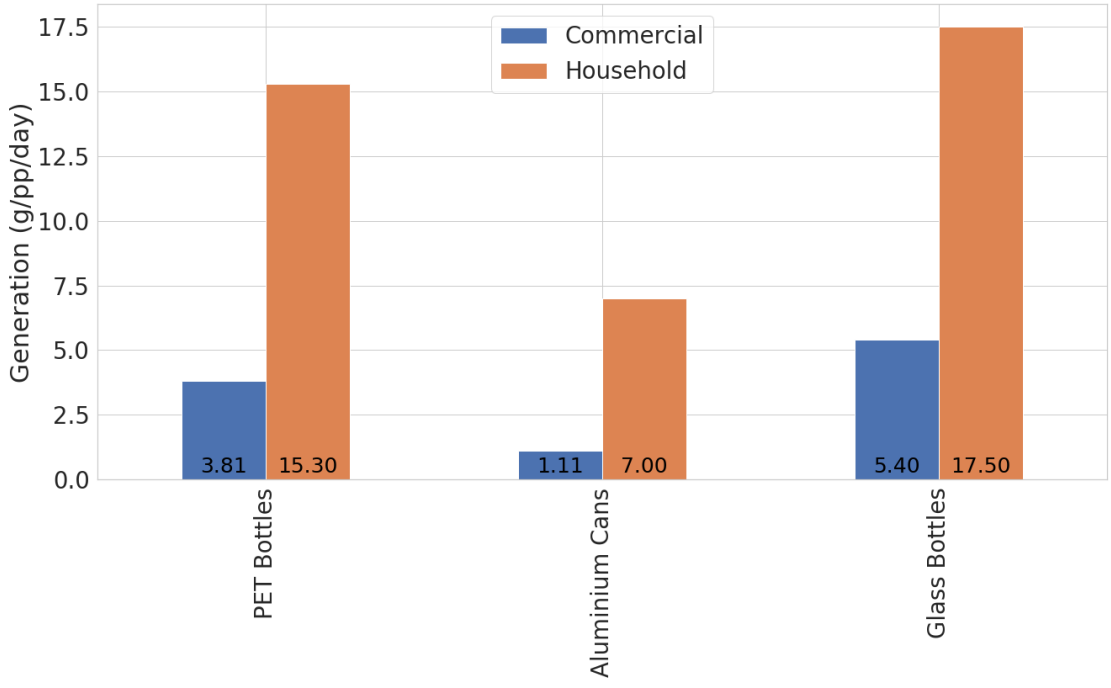


Figure 58: Per capita generation rates for commercial and household consumption of beverages (Source: APWC)

By contrast, we do not find such a consistent relationship across other items, such as paper, cardboard and other metals (as shown in Figure 59):

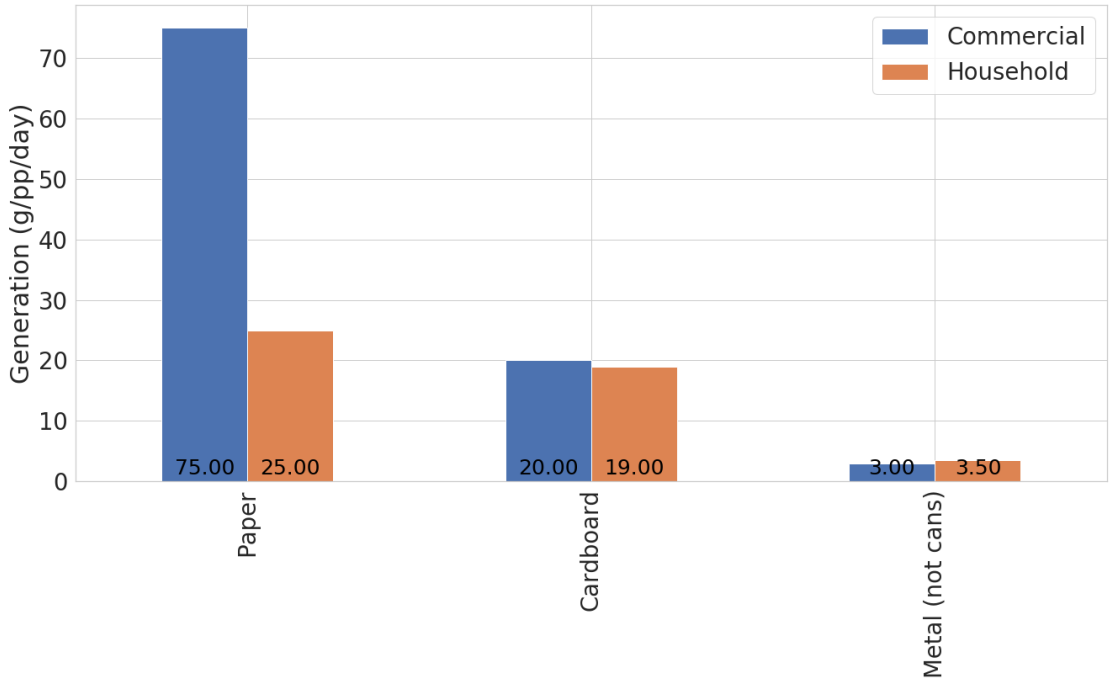


Figure 59: Per-capita generation rates for commercial and household recyclable bottles and cans (Source: APWC)

This is consistent with practical thinking, given different types of businesses will have different packaging needs. However, drink container generation is based on employee behaviour. The expectation would be that the drink containers generated increase given people are at work during the day.

In each case, commercial per-capita generation of drink containers is around 24% of residential generation (specifically, 25%, 16% and 30% for PET bottles, aluminium cans and CDS eligible glass bottles, respectively). Census 2011 data indicates that 40% of eThekwini and 50% of Cape Town residents are employed; therefore, we estimate the total production of drink containers is approximately 10% higher than household production.

For paper, cardboard and other metals, it was found that non-household-sources generated waste ranged from 25% of the residential per capita to 300% the residential per-capita rate, varying greatly between business types.

7.2 Recycling of Household Waste – eThekwini

During APWC interviews, only three out of 153 households reported making use of recycling pick-up services in eThekwini and due to random selection of samples it was not possible to ascertain if there was a dedicated service being provided to each area. Although the waste samples collected may have been subject to collection efforts in the informal sector, we did not adjust for this. This is because the current question is to estimate recycling rates and we assumed that the materials recovered at the kerbside are still being brought to the recycling centres where these numbers are being captured. If substantial quantities of containers are collected from houses before refuse collection, the production of recyclable containers will be higher than the following

estimates (which means, unless these collected items do not enter the formal recycling system, the recovery rates will be lower).

The eThekwini Integrated Waste Management Plan 2016–2021 records estimated quantities of recovered recyclables from July 2014 to June 2015. Kerbside recycling for this 12-month period was estimated to be 10,865 tonnes of paper, plastic and cardboard. However, data obtained by APWC (as per eThekwini quarterly report) for a 12-month period from 2018–2019 estimates 1,350 tonnes of the same waste categories were generated.

It is not clear why this has decreased to such a large extent, but drop-in centres appear to have maintained a similar level of recovery. We do find significant quantities of recyclables reported by 'external recyclers' in 2019, although not enough to account for the large difference of reported recovered quantities between 2015 and 2019.

Table 33: Waste recovery and generation estimates. Estimates marked with '+' indicate that we expect that the commercial and industrial sectors contribute additional material of this type (Source, APWC)

Waste Category	2018/2019 Kerbside recycling stats (tonnes per year)	2018/2019 Buyback centres	Garden Refuse centres	Drop-off centres	External recycling stats (tonnes per year)[5]	Business recycling July 2018–June 2019	APWC estimate of total municipality household generation (tonnes per year)
Plastic recyclable[6]	1,350[7]	797	83	11	5,515	423	25,000 (15,400 – 30,800)
Paper	*	1015	245	121	13,627	375	71,280 (33,000 – 132,000)
Cardboard	*	1665	154	93		774	44,500 (20,900 – 83,600)
Glass bottles CDS	139[8]	2,004	374	320	24	428	48,400 (33,500 – 67,000)
Aluminium cans	*	245	23	12	4.5	131	2,100 (1,400 – 2,900)
Metal[9]		6	22		44.4		6,700 (3,080 – 12320)
Oil[10]			.005				-

Table 34: Estimated recovery percentages e-eThekwini (Source: APWC)

Waste Category	Recovery Estimate
Plastic recyclable[11]	43% (35%–70%)

5 Extrapolated from May and June 2019 data
6 APWC categories: PET bottles, HDPE bottles, PP bottles (mostly PET bottles)
7 Combined plastic, paper and cardboard
8 Combined glass and aluminium cans
9 APWC category: aluminium recyclable (does not include cans)
10 No oil found in APWC samples
11 APWC categories: PET bottles, HDPE bottles, PP bottles (mostly PET bottles)

Waste Category	Recovery Estimate
Paper	8% (4%–17%)
Cardboard	15% (8%–32%)
Glass bottles CDS	8% (6%–11%)
Aluminium cans	25% (18%–37%)
Metal[12]	1% (0.6%–2.5%)
Oil[13]	-

Note: Materials noted 'or less' are likely to be generated at higher rates than we were able to capture, and therefore the recovery percentage is lower.

It is important to note that these figures are likely to be underestimates for paper, cardboard and metal as large quantities of these materials are produced during the course of commercial and industrial activity and our data was unsuitable for estimating total generation quantities of this type.

7.3 Recycling of Household Waste – Cape Town

7.3.1 The Impact of providing kerbside collection services

Of the samples collected by APWC, only the area of Camps bay had a recycling collection service in place. Data captured from interviews in Cape Town found that 17 of 152 responding households reported making use of a clear recycling bag service; nine of these houses were in the high-income suburb of Camps Bay. It was discovered that substantially smaller quantities of CDS-eligible glass bottles, aluminium cans and PET bottles were found from those households that reported using this service.

Therefore, due to the small numbers reported making use of this service, and the fact that many of these households were concentrated in a single location, strong conclusions cannot be drawn from this data.

We also caution that correlation is not causation. Households with kerbside recycling may have many factors that differentiate them from households without kerbside recycling. Extending recycling programs to households currently not served by them based on the fact that having a recycling service in place improves recovery of recyclables may not result in the same effect.

12 APWC category: aluminium recyclable (does not include cans)
13 No oil found in APWC samples

Table 35: Potential capture rate of recyclable materials (Source, APWC)

Waste category	Houses with kerbside recycling (kg/hh/day)	Houses without kerbside recycling (kg/hh/day)	Percent reduction in houses with kerbside recycling
Glass bottles (CDS-eligible)	0.0	0.048	100%
Aluminium cans	0.0008	0.004	78%
PET bottles	0.021	0.088	76%

Figure 60 below highlights that differences in the recyclable categories listed were much larger than differences between the two houses in other types of waste. This indicates that the use of the clear plastic bag is possibly having an impact on the number of bottles and cans found in the general waste bags. This can be easily confirmed by performing an audit on homes with recycling services versus those without recycling services, with a larger sample size for homes with recycling services.

Note that some categories, such as 'organics' and 'glass other', also showed large differences between waste types, which is to be expected when making multiple comparisons with small sample sizes.

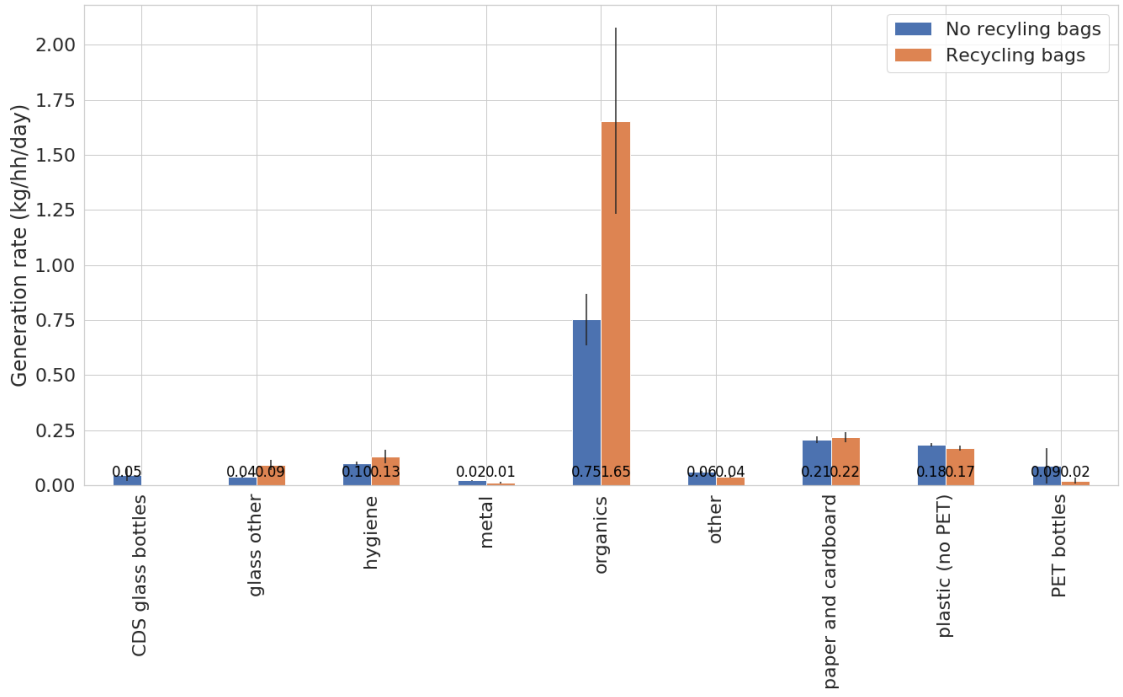


Figure 60: Comparison of waste streams for households using kerbside recycling service and those not using the service (PET)

**Note that overall quantities of aluminium cans were too small to display on this graph. The data is derived from contents of general waste bags.*

7.4 Recovery Rates

At the time of writing, APWC was not in possession of a breakdown of waste recovery by category in Cape Town. Data was instead sourced from the World Bank (2019).

The World Bank 2019 report *Within the Circular Economy* provided a graph showing around 515,000 tonnes of waste diverted from Cape Town landfills in 2019. The composition of this waste was unclear, and it cannot have been limited to dry recyclables, for which the generation estimate totalled 470,856.

Table 36: Estimation of recyclables generation rate in Cape Town (Source, APWC)

Waste category	World Bank SWM quantities (tonnes per year)	World Bank total quantity (tonnes per year)	APWC estimate of total municipality household + commercial generation (tonnes per year)
Plastic[14]	-	-	40,800 (28,300–56,500)
Paper	-	-	61,900 (28,600–114,230)
Cardboard	-	-	56,900 (26,200–105,00)
Glass bottles CDS	-	-	17,400 (12,000–24,100)
Aluminium cans	-	-	1,430 (990–1,980)
Other aluminium recyclable	-	-	1,540 (1,100–4,300)
Other metal	-	-	8,200 (3,800–15,200)
Total dry recyclables	258,141	470,856	188,210 (101,000–321,400)

7.5 Waste composition

7.5.1 Cape Town waste composition by weight

The overall commercial and household waste composition by weight for Cape Town is displayed in Figure 61. As shown, organics (including food and garden waste) forms the largest component of the waste stream, at 32% for commercial waste and 53% for household waste. Paper and cardboard contribute 32% of commercial and 13% of household waste. Plastics other than PET/HDPE (such as soft, flexible plastics) comprise a quarter of all Cape Town's commercial waste, however household weight was less than half of the commercial percentage, at 11%. Interestingly, these three recyclable waste streams were the largest contributors to waste by weight across both commercial and household waste, at 88% and 78% respectively. Finally,

14 APWC categories: PET bottles, HDPE bottles, PP bottles (mostly PET)

hygiene waste accounted for 6% of all household waste, with nappies contributing to the large majority of this category.

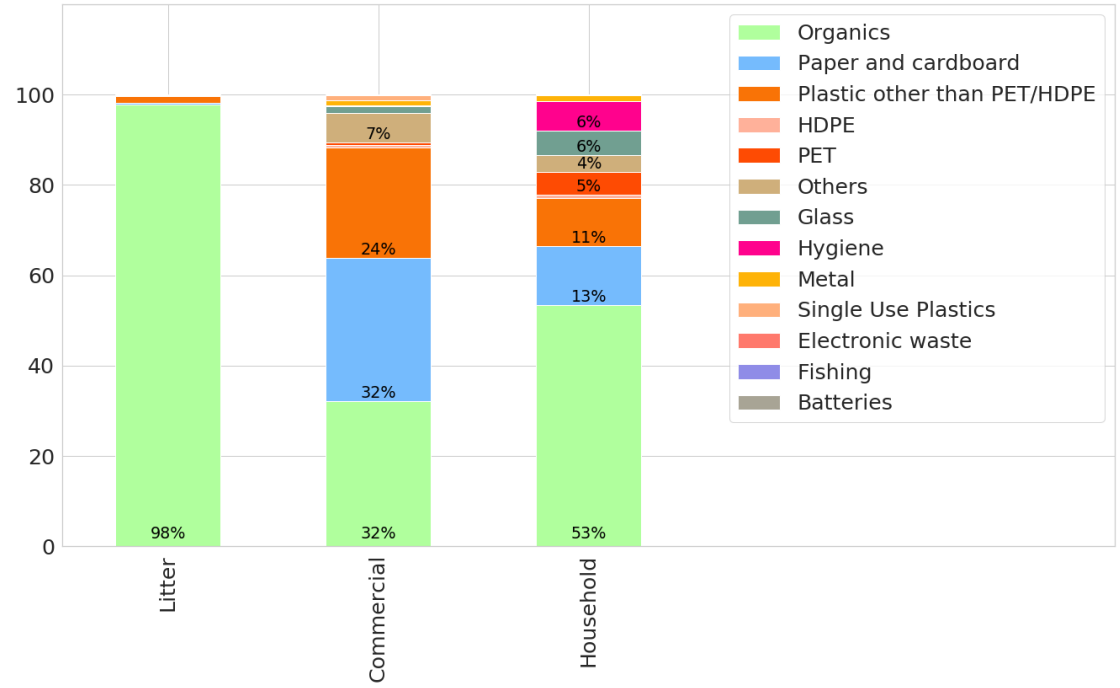


Figure 61: Waste composition Cape Town (by weight) (Source: APWC)

As shown in Figure 62, further analysis of the data sourced from 150 households found approximately 0.8 kg of organic waste is generated per household per day in Cape Town; 50% of this is food waste.

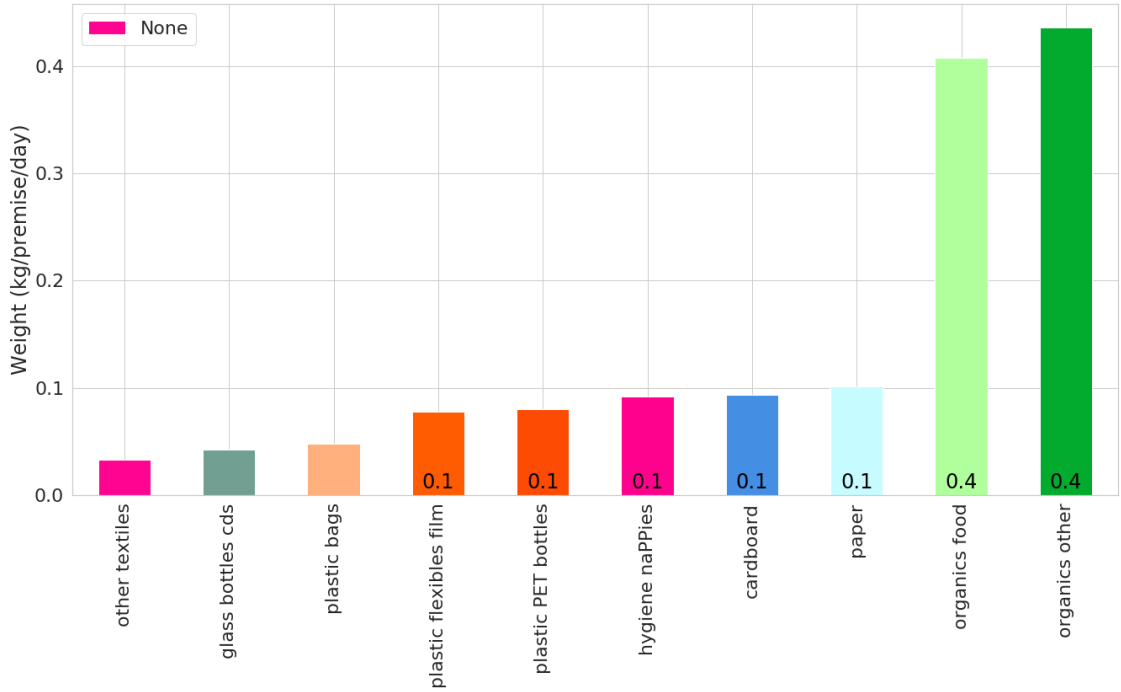


Figure 62: Cape Town household top 10 items (by weight) (Source: APWC)

**Note: Organics other represent all organics that don't fall under "food"or "wood and timber"*

The other recyclable components of the waste stream includes paper and cardboard at 0.2k g/household/day. Plastics including PET bottles and flexible film are generated in equal quantities at 0.1 kg/household/day each, and plastic bags contribute approximately 50 g/household/day. On average, nappies contribute 0.1 kg/household/day.

7.5.2 eThekwini waste composition by weight

Figure 63 overleaf highlights a similar scenario to Cape Town in eThekwini for commercial waste, with organic waste as the largest contributor at 40% of waste by weight, followed by paper and cardboard at 30% and plastics other than PET/HDPE at 15%. Again, these three waste categories comprise 85% of the total waste stream for commercial waste.

Similarly, organic waste contributes the majority of waste by weight for households at 46%, however in addition to paper and cardboard, and plastics other than PET/HDPE, hygiene waste contributed 12% of the overall waste composition.

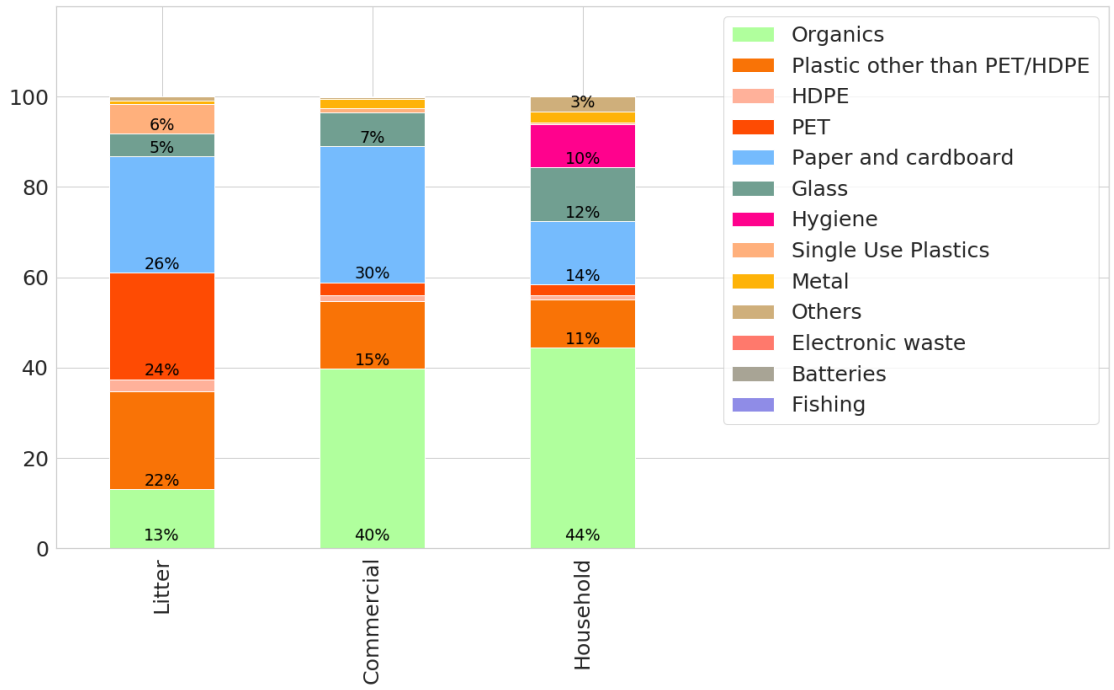


Figure 63: Waste composition eThekwini (by weight) (Source: APWC)

Further analysis of data obtained for households in eThekwini shown in Figure 64 found that organics, specifically food waste, was the largest component of waste generated, at 0.4 kg/household/day. Nappy generation was approximately 100 g/household/day. This figure is similar to the Cape Town data, with overall composition of nappy waste at 6%, whereas this figure doubles for eThekwini, at 12%. Other recyclables with similar weight generation to Cape Town includes paper at 0.1 kg/household/day. Of the remaining top 10 waste streams, plastics (including PET bottles and flexible film) are generated in equal quantities at

0.1 kg/household/day each, and plastic bags contribute approximately 50 g/household/day. On average, nappies contribute 0.1 kg/household/day.

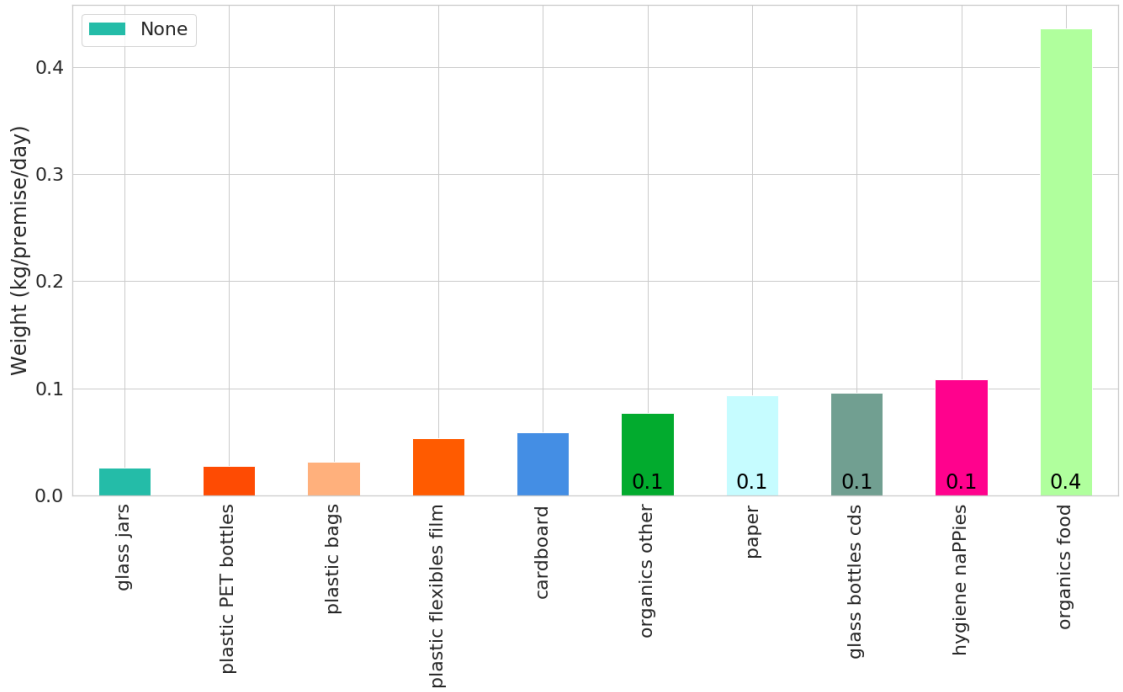


Figure 64: eThekwini household top 10 items (by weight) (Source: APWC)

7.5.3 Waste by volume

Cape Town's top 10 household waste items by volume are shown in Figure 65.

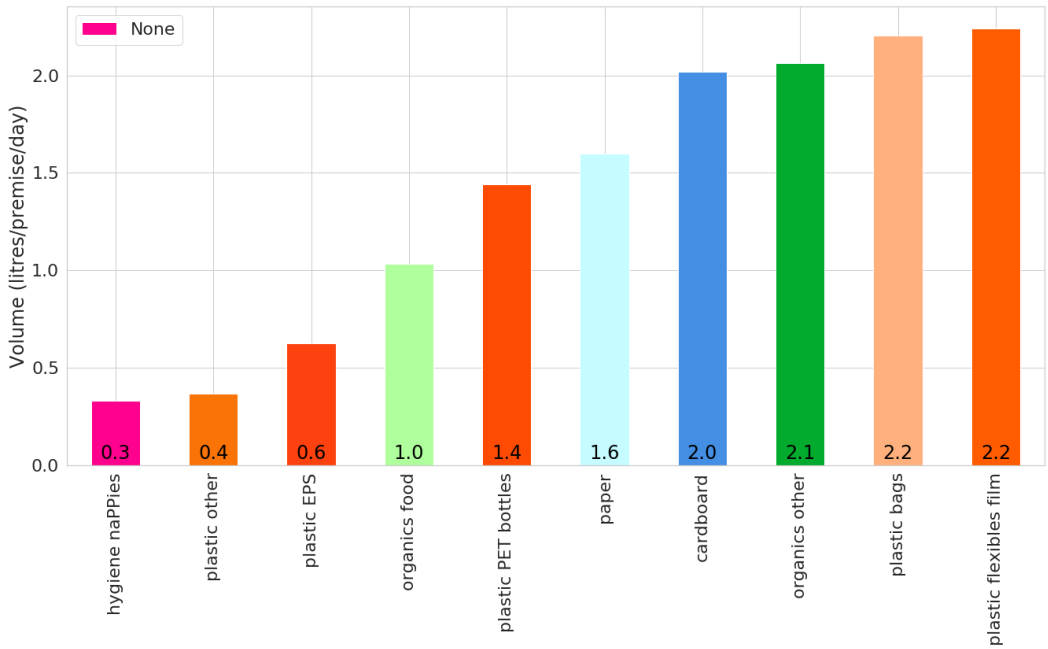


Figure 65: Cape Town household top 10 (by volume) (Source: APWC)

Plastics, organics and paper and cardboard dominate the waste composition by volume. Plastic flexible film and plastic bags combined account for the majority of the waste generated at 4.4 litres/household/day. Paper and cardboard combined account for 3.6 litres/household/day and organics food and organics other combined account for 3.1 litres/household/day. PET bottles, which hold a commodity value is South Africa, make up an average of 1.4 litres/household/day.

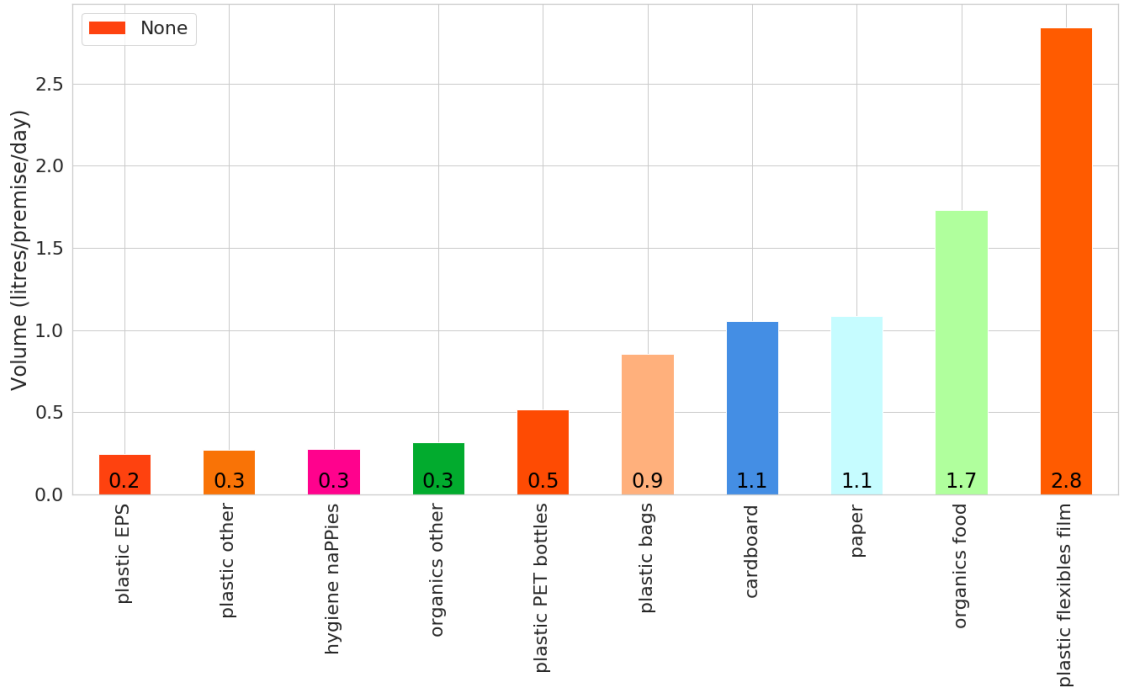


Figure 66: eThekwini Household top 10 items (by volume (Source: APWC)

Waste by volume for eThekwini displays a slightly different trend to that found in Cape Town. There are similarities in the amount of plastic flexible film generated, with eThekwini producing an additional half a litre per household per day compared with Cape Town.

However, the volume of plastic bags is significantly less at 0.9 litres/household/day compared with 2.2 litres/household/day. The total amount of 'organics' is also less at 2.0 litres/household/day. Interestingly, the amount of organic food waste is higher in eThekwini, however 'organics other' is 1.8 litres less than Cape Town. The generated volume of plastic PET bottles is 0.9 litres less and plastic EPS is 0.4 litres less per household per day.

7.5.4 South Africa's priority waste streams

Organics dominate all waste collected – 53% of household waste in Cape Town and 44% in eThekwini was organic in nature

Hygiene items (including nappies and feminine hygiene) form 6% of the household waste stream in Cape Town and 10% of the waste in eThekwini

Cape Town and eThekwini respectively have 13% and 14% **paper** in their household waste.

11% of household waste in both eThekwini and Capte Town falls in the category **"other plastics".** These include single use plastics.

Figure 67: South Africa's priority waste streams (Source: APWC)

Figure 67 highlights organics, plastics other than PET/HDPE and paper and cardboard amount to a large majority of the waste composition by weight in Cape Town and eThekwini. Litter audits showed that 88% of waste collected was made up of these components in eThekwini. A further 7% was PET containers, which amounts to the total litter waste stream of 95% recyclable material.

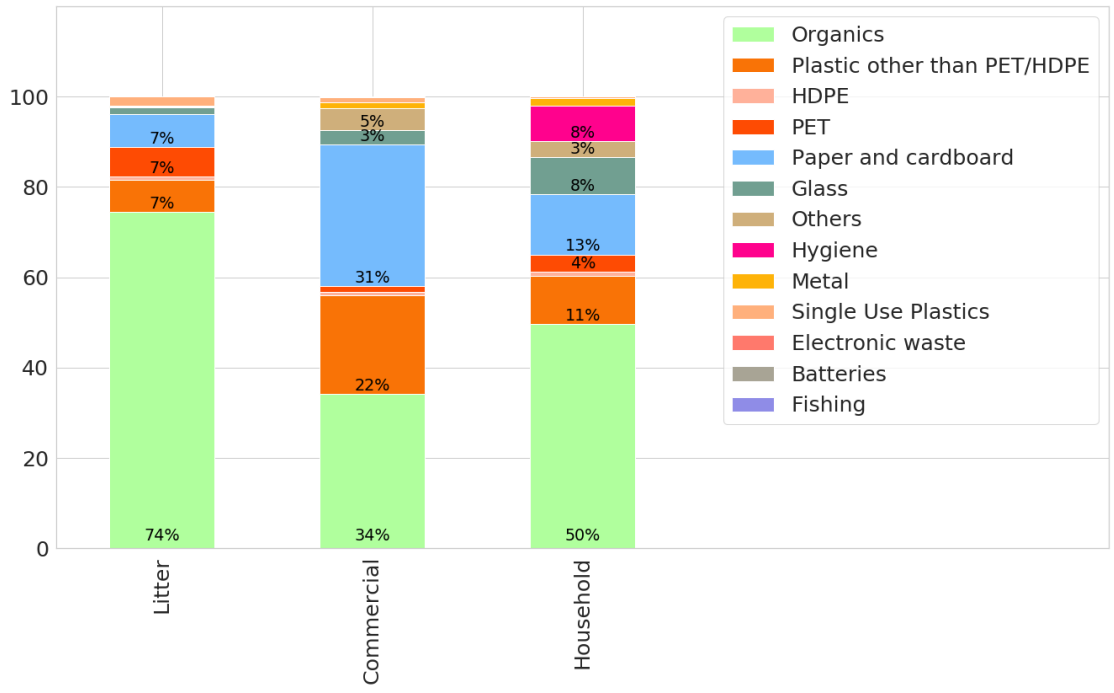


Figure 68: Overall waste composition by weight (Source: APWC)

Commercial waste is similar, with organics, plastics other than HDPE/PET, and paper and cardboard amounting to 87% of the waste composition. Household waste again was dominated

by organic waste, plastics other than PET/HDPE and paper and cardboard totaling 78%. In addition, nappies and glass accounted for a further 16% of composition by weight across households in Cape Town and eThekwini.

7.5.4.1 Organic Waste

As shown in Figure 68 above, the data captured for Cape Town and eThekwini explicitly outlines the largest contributor to commercial and household waste is organic waste comprised of food waste and other organics such as garden waste. Data from litter audits also identifies organic waste as the largest litter item captured with the audit.

Figure 69 provides a further insight into the waste disposal methods for garden waste by households in Cape Town. Thirty-three per cent (33%) of households with no collection services reported dumping green waste directly to land and the remaining 67% of households burned garden waste. For households with access to some form of collection service, burning of garden waste was favoured over compositing. Only 3% of households with a weekly collection service composted green waste, however 7% reported to using burning as a method to dispose of the garden material.

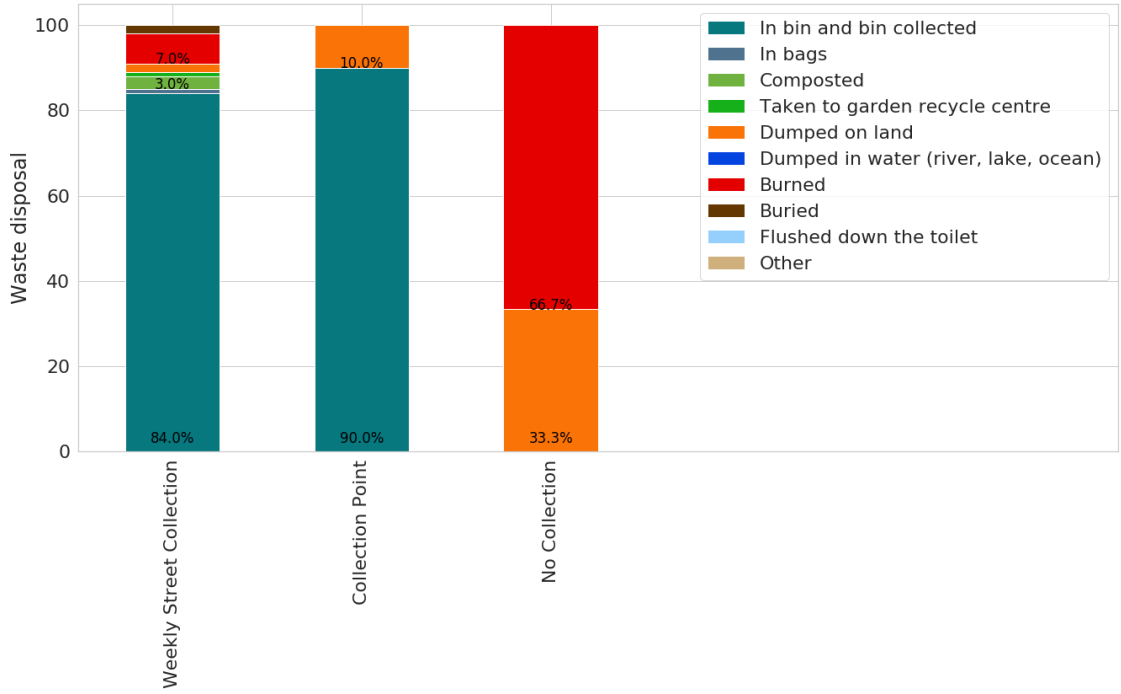


Figure 69: Waste disposal method – garden waste, Cape Town (Source: APWC)

As per the literature review, we understand that the Western Cape's DEA and DEA & DP recent organic waste diversion plan aims to divert 50% of organic waste from landfill by 2022, and 100% by 2027, which will require implementation and reporting on the municipal level. The data collected by APWC strongly supports this initiative as this will lead to a greater impact on overall

improvement in waste management requirements for the Western Cape, as well as drastically increasing landfill life.

Data obtained for eThekwini interviews presents a different picture. eThekwini Municipality has established 10 DSW garden reuse sites across the municipality. The garden sites provide residents with an alternative option for disposing of their garden waste, household and bulky items but they must use their own vehicles to transport waste.

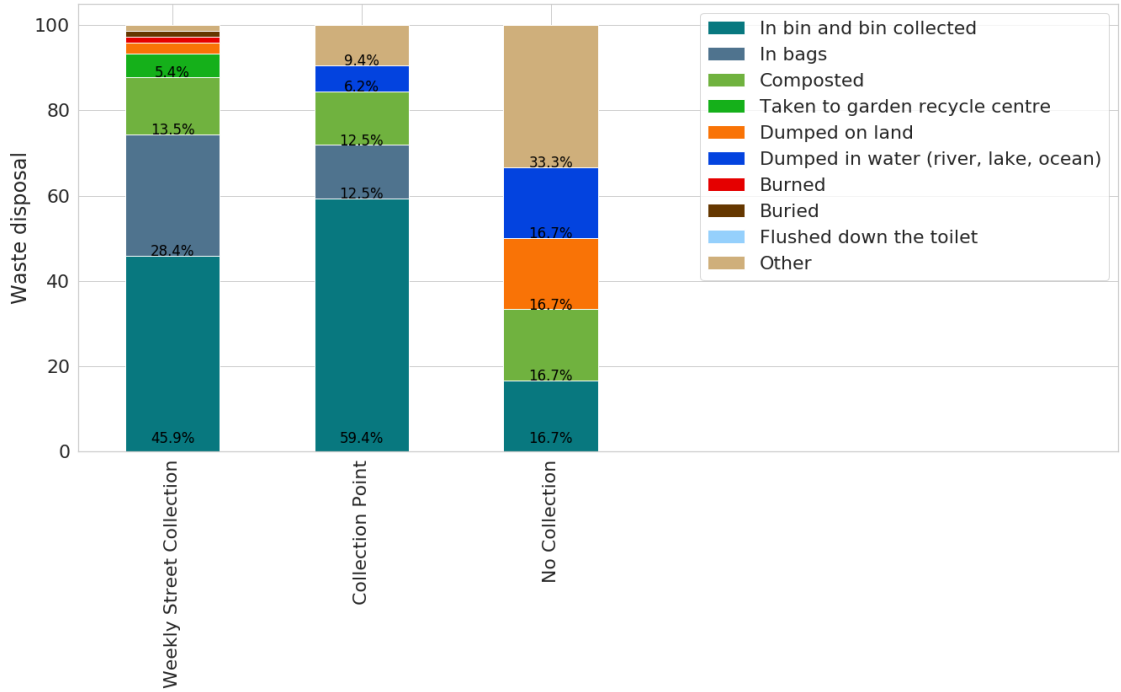


Figure 70: Garden waste disposal method in eThekwini (Source: APWC)

Image 20: Bellair Garden Site, eThekwini

Despite the garden sites being available daily across eThekwini, a large majority of the waste stream contains organic garden material. A further look at the data highlights that only 5% of households take their waste to the garden centre. Households with no collection service reported the highest levels of composting, at 17% followed by those with a weekly service at 13.5% and

with a collection point at 12.5%. Households with no collection service note the highest incidence of inappropriate disposal of green waste with reported levels of dumping on land at 17% and 17% dumped in waterways.

An education program focusing on bringing more green waste to the DSWs would prove helpful in improving resource recovery.

7.5.4.2 Paper and cardboard

At present, paper and cardboard make up a significant proportion of the waste composition in Cape Town and eThekwini. Unlike plastics such as PET, which has a high commodity value, the value of paper and cardboard, in particular mixed paper, is currently at an all-time low. Anecdotal evidence suggests that informal waste pickers do not collect this waste stream, which may be one of the contributing factors to the high content in some jurisdictions. The commodity pricing for cardboard and paper dropped significantly between 2017 and 2018. According to Waste Management and Resource Recovery Association of Australia (WMRR), for two years prior to 2018, mixed paper was achieving around AUD$125/tonne. This value has since dropped significantly, to approximately AUD$20/tonne. Similar pricing changes have been mirrored globally, as stringent restrictions and bans have commenced in countries accepting scrap imports, with commodity prices decreasing.

According to RecyclePaperZA (the paper recycling association of South Africa), South Africa is in the enviable position of being able to recycle up to 90% of its recovered wastepaper locally into paper packaging, serving the agricultural, manufacturing and retail sectors. A country like Sweden has high collection rates but only recycles 11%; the majority feeds waste-to-energy plants.

Although, this is the case, RecyclePaperZA still reports an over-capacity of both pulp and paper and they expect a slow start to 2020 due to uncertainty in pricing of recycled paper and cardboard. A greater support to the local paper and pulp industry should be considered in future policy measures as paper dominates both household and commercial waste streams in the communities sampled.

7.5.4.3 Plastics in the waste stream

Plastics other than PET and HDPE occur in very large quantities across both Cape Town and eThekwini. Further investigation of count and volume data shows most of these flexible films (single layer), plastics bags and other plastics (mostly multi layer plastics). All of these plastics fall under the overarching category of “single use plastic packaging”.

Figures 71 and 72 below show that PET bottles are found in households in Cape Town but not in commercial premises indicating a more efficient recovery system in place. Most likely, it is because the informal pickers have a longer time to access commercial waste as opposed to household where the picking of plastic bottles is opportunistic and occurs just prior to the garbage truck arriving at the premises.

In eThekwini, both household and commercial premises have some amount of PET bottles remaining indicating potential loss of revenue from recyclable materials going to landfill.

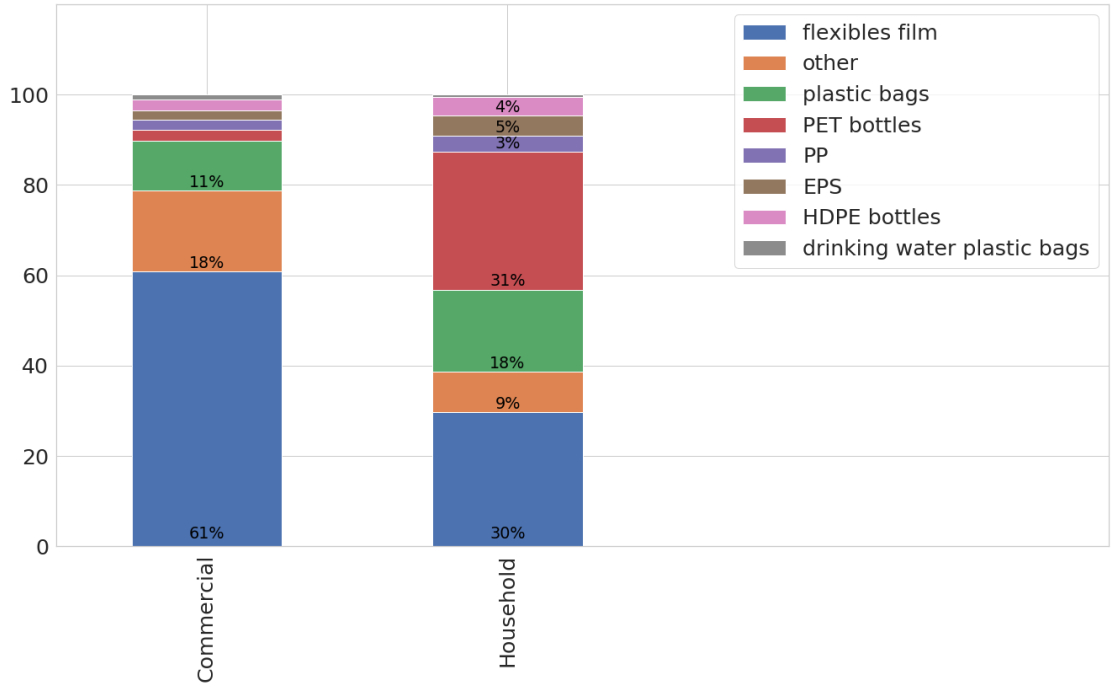


Figure 71: Plastic composition Cape Town (Source: APWC)

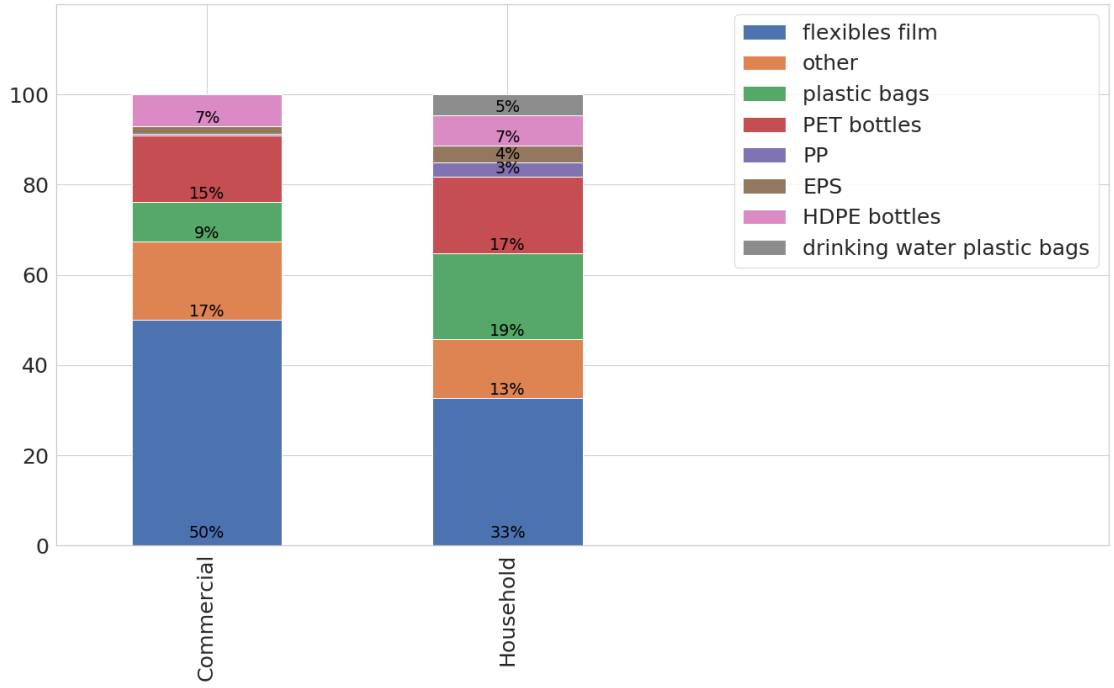


Figure 72: Plastic composition eThekwini (Source: APWC)

Globally, single-use plastics are increasingly in the spotlight as a major and problematic waste source. Many countries have either banned or are reviewing the possibility of implementing a single-use plastics ban.

As per Figure 73, single-use, heavy, glossy, branded plastic bags make up 32% of the commercial single-use plastics waste composition, followed by food takeaway container lids at 24%. Cigarette packets dominated the household waste single-use plastic stream at 47%.

Twelve per cent (12%) of the composition related to single-use lightweight supermarket plastic bags and 9% for coffee cups. Despite a plastic bag levy being introduced in 2003, these figures highlight plastic bag consumption and generation is still prevalent within the waste stream, which aligns with findings of other research relating to plastic bags in South Africa.

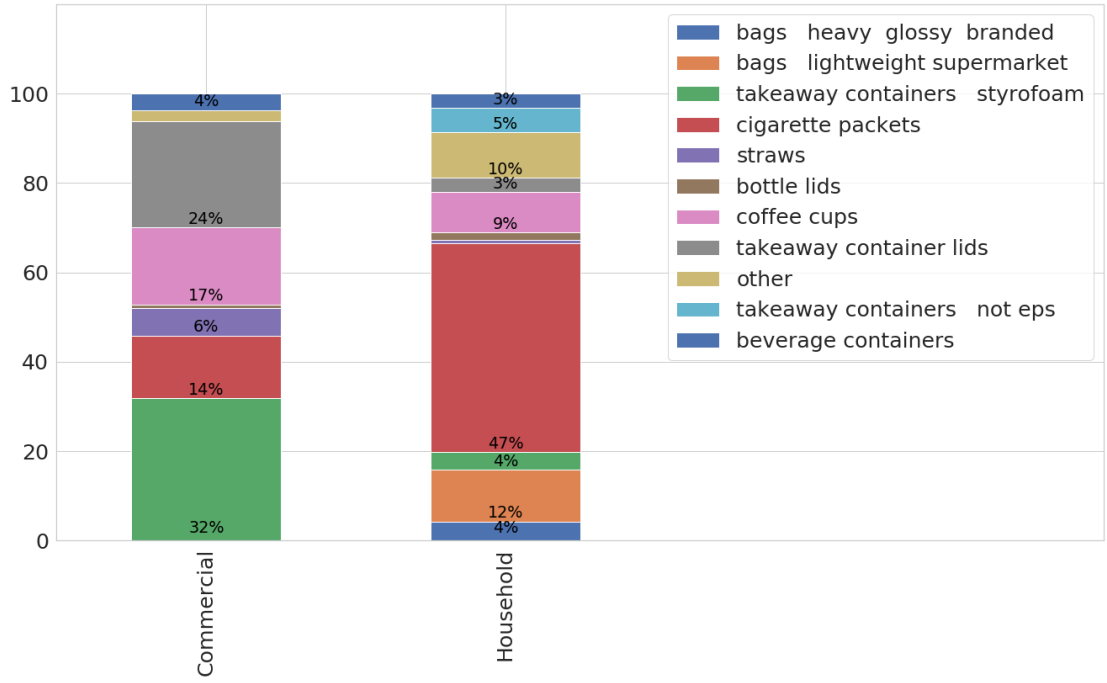


Figure 73: Single use plastics composition (Source: APWC)

7.5.4.4 Metals in the waste stream

Figure 74 below highlights that 55% of all metals captured within the commercial waste stream and 40% of households were of aluminium origin. Nearly 50% of the total household metals consisted of steel cans, such a pet food and canned goods. Overall, metals form less than 1% of the current waste stream.

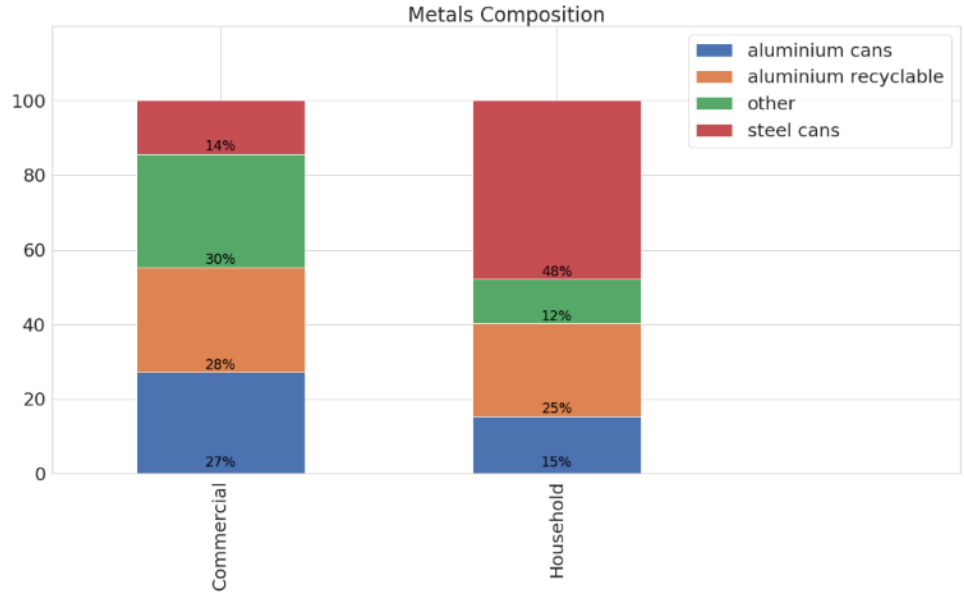


Figure 74: Metal composition from APWC 2019 audit in Cape Town and eThekwini (Source: APWC)

7.5.4.5 Nappies

Data shows that hygiene waste, in particular nappies, accounts for 6% of the total waste composition in Cape Town and 12% in eThekwini. Across both communities, the most common methods of disposal (as highlighted in Figure 75 and Figure 76) were bagging or placing nappies in bins for collection at the kerbside.

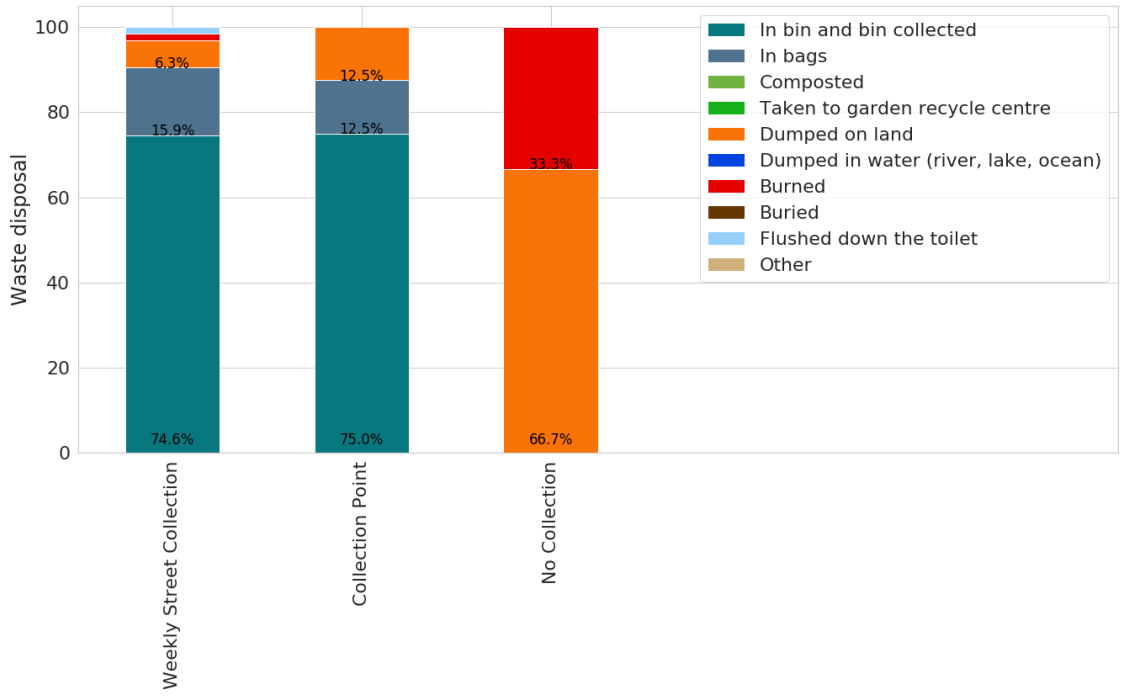


Figure 75: Disposal method for nappies in Cape Town (Source: APWC)

There is a difference in disposal methods based on the mode of collection. Almost 90% of households do the right thing and place nappies in the collection bags in instances where a collection service is provided. This is consistent for Cape Town and eThekwini.

However, the major difference between the two municipalities lies in what happens to nappies that are not collected appropriately. In Cape Town, these nappies are either dumped on land (67%) or burnt. However, in eThekwini, 100% of the nappies that are not placed in bags for collection are dumped in the waterways. This was evident during APWC visits to the communities where collections were undertaken.

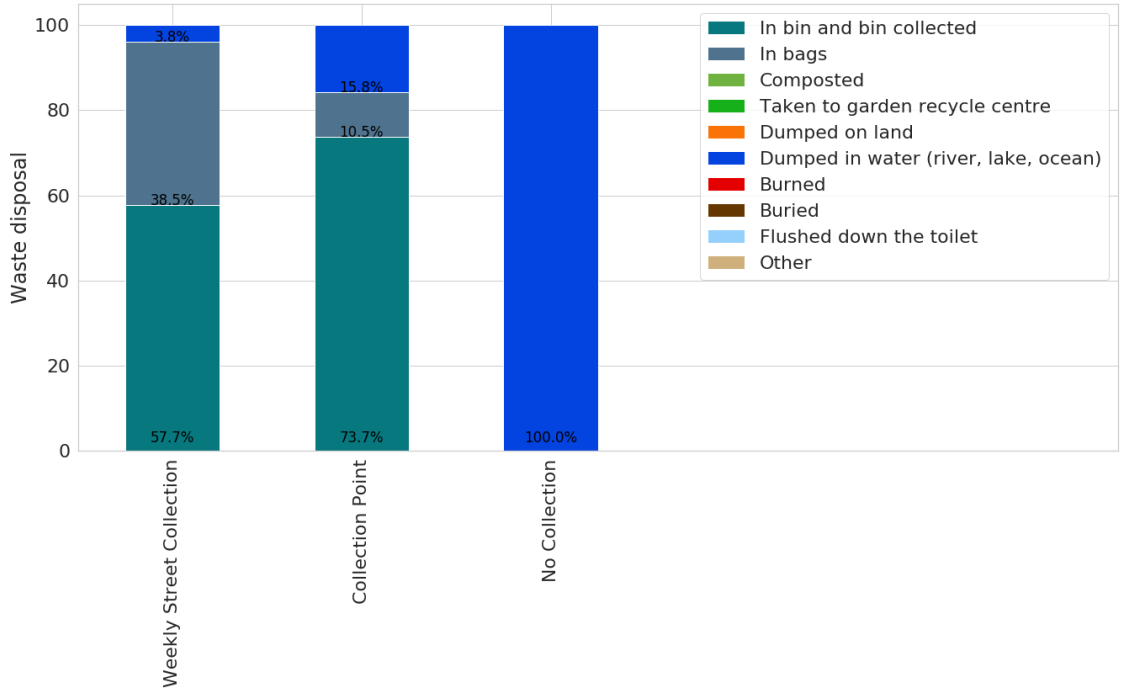


Figure 76: Disposal method for nappies in eThekwini (Source: APWC)

Globally, nappies are a problematic waste stream and disposal practices require urgent attention. Solutions must, however, be formulated with caution. In South Africa, for example, reforming nappy consumption and disposal practices can potentially negatively impact on a highly marginalised cohort of the population. Lower income families and those living on the poverty line are more likely to have a larger number of children in disposable nappies. Further, access to water for washing and sanitation facilities is also a consideration. For legislative changes to be effective – especially a nappy ban – reusable and compostable nappies must be made available to communities at an affordable price and at a competitive cost commensurate with that of the traditional plastic-containing nappy. Compostable nappies, if introduced, will need to be compostable at the community scale and hence sufficient infrastructure must be in place for this to be successful.

Nappy bans are coming into force around the world, with the Vanuatu government in 2018 announcing an extension of the plastics ban to include plastic-containing nappies in February

2019. One possible solution for South Africa is to consider a combination of reusable nappies, such as modern cloth nappies (MCN) and compostable nappies that can be disposed with food organics and other organics. More than 54% of household waste in Cape Town and 46% in eThekwini is organic waste. Combining these two waste streams could address up to 60% and 58% of the waste streams, respectively. However, appropriate infrastructure is required for appropriate processing of organic waste.

7.6 What happens to waste not collected by a collection service?

As expected, 100% of waste is improperly managed where there are no waste collection services available in Cape Town. Figure 77 suggests that 77% of households dump waste to land and 23% of households burn remaining waste. However, despite weekly street collections, 21% of households in Cape Town improperly manage waste, with 7.9% of households dumping waste to land and 4.2% burning waste as a form of disposal.

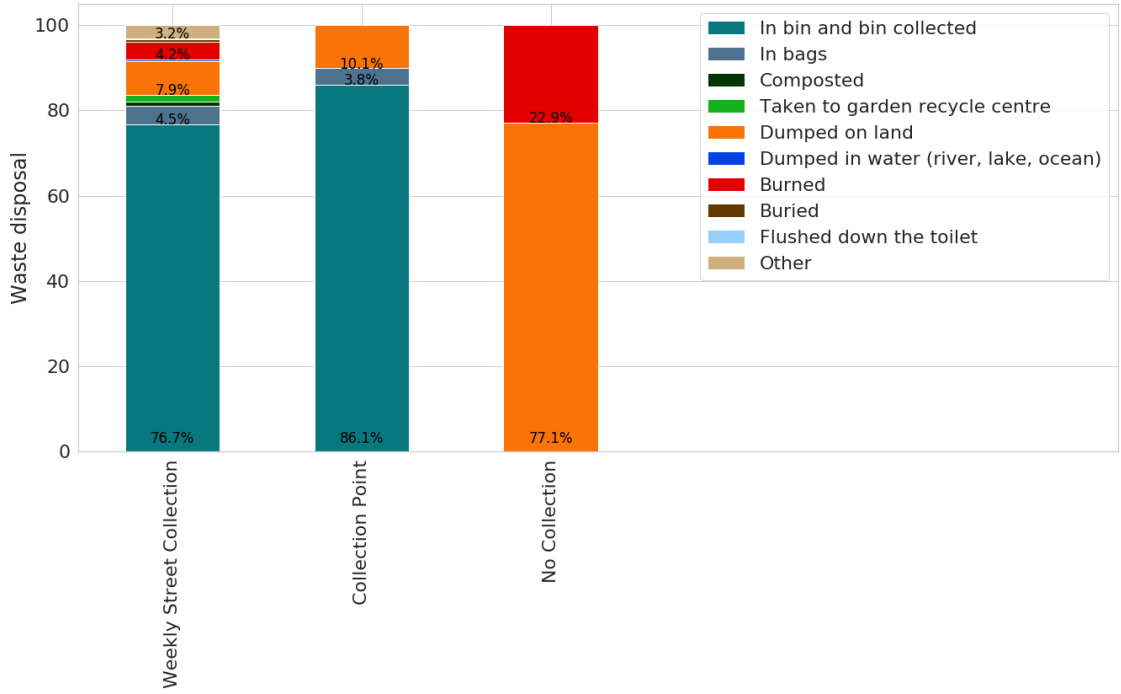


Figure 77: Cape Town waste management by collection type (Source: APWC)

Figure 79 below highlights that despite the high organic composition of waste, very little composting is currently taking place. A small majority of households with weekly street collections take organic waste to garden recycling centres. By contrast, a majority of households with access to weekly street collections and collection points dispose of waste within bins awaiting collection. Only 4.5% of weekly street collections and 3.8% of collection point waste is bagged. However, 7.9% of household waste with weekly street collections is dumped on land and 4.2% is burned. A further 10.1% of waste for households with collection points is also dumped at land.

Despite no collection services available, 15.8% of households in eThekwini properly manage waste by placing it in a bin or bag for collection when compared with Cape Town. APWC data shows of the 84% of waste that is improperly managed, 37.9% of waste is dumped into waterways, 15.8% is burned, 5.3% dumped on land and a further 5.3% is composted. Where weekly waste services are in place, 46% of waste remains improperly managed. A smaller percentage (5.3%) of improperly managed waste is burned and another 5.3% is dumped to land.

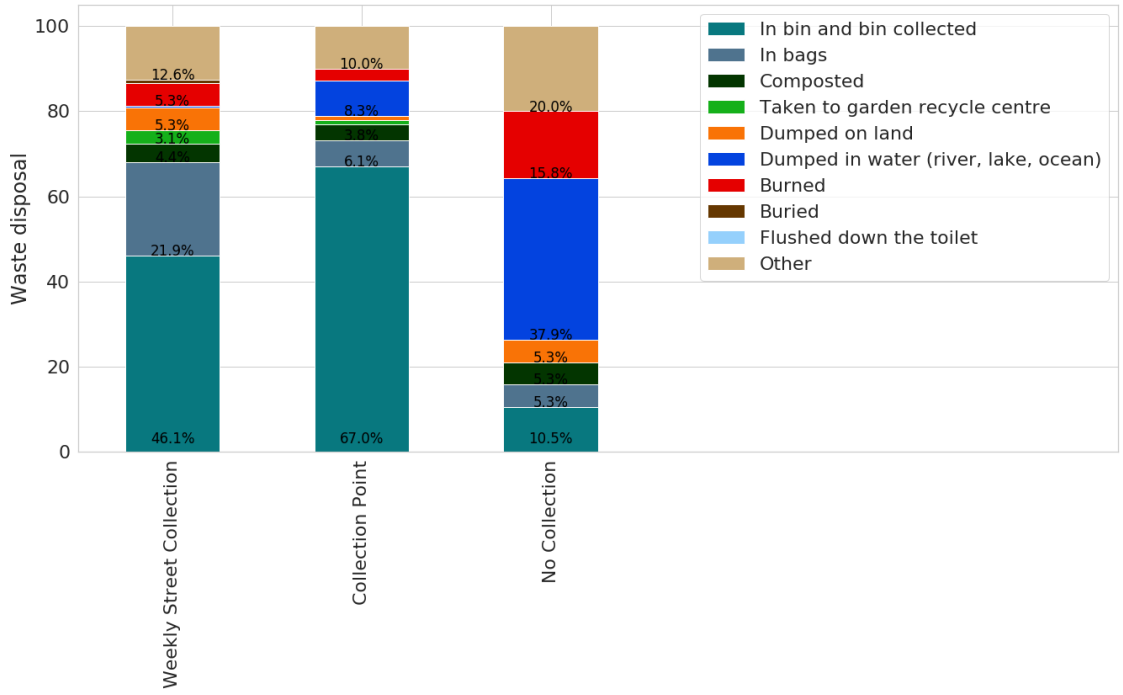


Figure 78: eThekwini waste management by collection type (Source: APWC)

Figure 79 again highlights that despite the high organic composition of waste by weight and volume, only a small amount of composting is currently taking place, which is similar to the Cape Town results. A small percentage (3.1%) of households that have weekly street collections take organic waste to garden recycling centres.

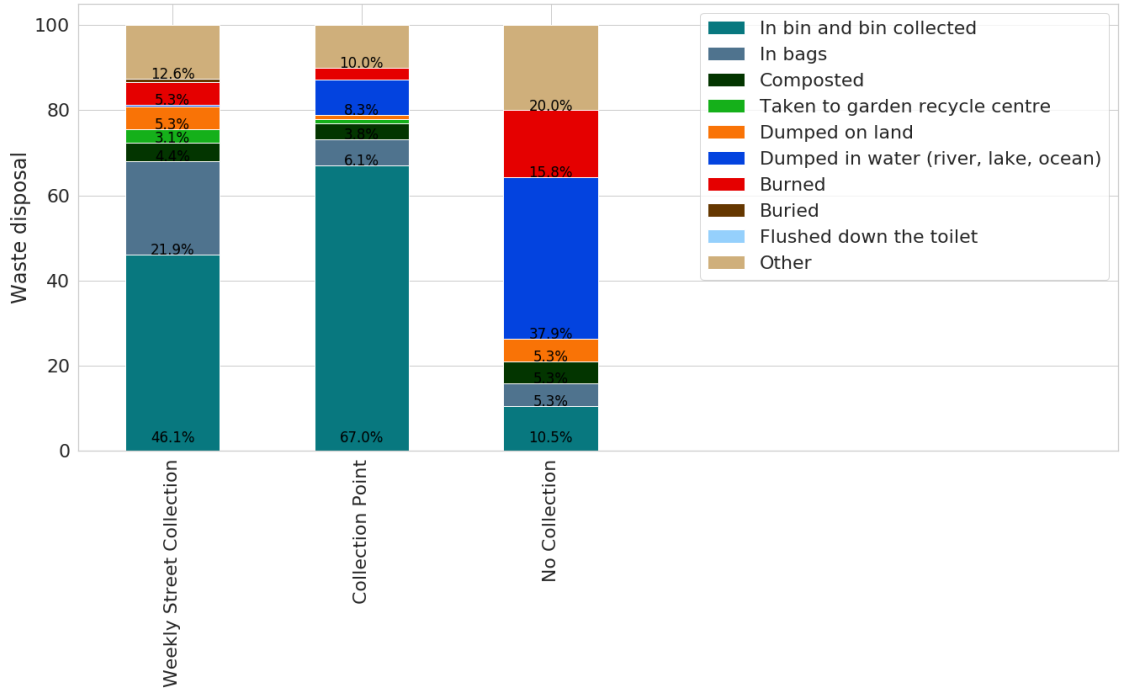


Figure 79: eThekwini waste management by collection type (Source: APWC)

All data above indicates that despite ongoing commitment to improving waste services, much effort is required towards education and improving waste collection infrastructure.

8 Key challenges and opportunities

Source separation of organics

How would this happen?

Who would take charge?

How would the informal community be involved?

Who would buy this compost?

Solution for nappies

How is this impacting our waterways?

How would this impact women (already a marginalised section of the community)?

Would the solution include compostable nappies or reusable nappies or a mixture of both?

How would the industry react?

Paper and cardboard

Whats the best solution for SA in difficult market conditions?

Is a local solution possible?

What kind of legislative interventions are necessary?

How could the informal sector be involved?

Plastics other than PET and HDPE

Mostly soft plastics and plastic bags.

Do we have a solution for plastic bags?

Is phasing out bags an option?

Is an infrastructure response possible?

Several potential measures have been discussed in section 7 and summarised above. We note that currently there is a significant amount of recycling being undertaken through the informal sector and through the recycling centres. However, the financial incentives for recovery of plastics, glass and metal are minimal. The introduction of financial mechanisms such as deposit legislation could regulate the price paid to the waste pickers and may help lift the financial conditions for the informal sector.

For example, based on APWC interviews, some roadside pickers get about 30ZAR a kilogram for aluminium cans. On average, there are about 67 cans in a kilogram of empty aluminium cans. Even a deposit of 5ZAR would lead to an income of 335ZAR per kilogram of aluminium cans. The system design would be more complex and should be undertaken after extensive consultation. The consultation should include the minimum and maximum deposit amount.

9 Solid waste management gap analysis

A gap analysis of the waste management sector has been provided in Table 37 below. Please note that this list is based on stakeholder consultation and initial observation only. This list is presented to re-focus attention on matters requiring attention.

Table 37: Gaps in waste management in South Africa (Source, APWC)

Theme	Gaps
Policy & legislative framework Enforcement	• Despite strong legislation, enforcement capabilities on all levels are low, with significant system constraints to service delivery, lack of finance for infrastructure and operations. • Significant differences of waste services delivered between provinces, municipalities, rural and urban areas and socio-economic groups.
Data collection and decision making	• APWC discovered anomalies between the waste generation and composition rates observed in the study and previously published data.
Economic instruments	• South Africa currently has a range of strong legislative reforms currently in the pipeline. However, the two municipalities assessed can benefit from the introduction of economic instruments, specifically in the form of container legislation that may not improve recovery but would help improve the economic status of the waste pickers that are responsible for a large number of recycling effort in South Africa.
Collection services	• South Africa lacks a comprehensive collection service. There is disparity between the services being provided to different communities.
Equipment and maintenance	• The two municipalities assessed had a range of equipment available and the ability to maintain this equipment was not a considered a problem. Regardless, both municipalities face breakdowns of collection trucks and have regular maintenance schedules.
Education and engagement	• The two municipalities assessed had a number of education and engagement programmes in place. Regardless, data collected by APWC shows that there is a large amount of mismanaged waste in both the communities. Experience from across the world indicates that education efforts co-ordinated at the national level and implemented by the municipalities has the potential to have a high impact.
Recycling	• Improved recycling efforts are needed for: organics, paper and cardboard, nappies and plastics other than PET and HDPE. A number of projects are already underway to address the issue of nappies in South Africa, particularly in eThekwini.
Monitoring	• Currently all municipalities are required to report quarterly. However, no evidence was found that the data is being used to inform policy. Also, monitoring systems are required to be put in place to reduce mismanaged waste at the source entering the environment.

10 Recommendations

APWC makes the following recommendations based on collected data, stakeholder interviews and observation over the course of this project (Table 38).

Table 38: Draft key recommendations for South Africa waste management (Source, APWC)

Theme	Recommendations
Policy & legislative framework and institutional arrangements	• Although a strong legislative regime exists, enforcement capabilities on all levels are low, with significant system constraints to service delivery, lack of finance for infrastructure and operations. • APWC recommends a whole-of-system assessment using current data to determine what are the most feasible collection and disposal methods by material type to be conducted internally, with a focus on improving enforcement of existing legislation. • Increased national human resources capacity as well as clear delineation of enforcement roles in the municipalities would help with the enforcement capability.
Waste management financing	• Under-pricing of waste management is a key driver in waste behaviour and waste management practices on all levels (household, government, industry), resulting in low levels of waste separation at source. Collaboration between all sectors (household, producers) with competing agendas is required to improve recycling rates and decrease contamination in the waste stream. • Financial instruments such as container deposit legislation would help strengthen the informal sector, which is instrumental in current recovery efforts.
Capacity building	• Overall, South Africa has a need for more accurate and comprehensive data on waste generation, collection, disposal, recycling. • Comprehensive data is currently being collected. However, there needs to be more collaboration between the organisations requiring data to be collected and those collecting the data so that the data collection across organisations is comparable.
Collection service	• Both municipalities assessed had adequate infrastructure and had access to a range of skilled staff providing maintenance services. However, both municipalities suffer from mismanaged waste. APWC believes that rather than trying to provide the

	same level and type of collection services to different communities, there might be opportunity to introduce different collection measures. Example: pre-paid bags for informal communities rather than collection points.
Recycling	• A range of materials has been identified through the data collected by APWC that clearly shows focus areas, i.e. organics, paper and cardboard, nappies, plastics other than PET and HDPE.
Informal sector	• Integrating the informal sector could play a key role in unlocking growth in waste diversion and employment opportunities. • Introduction of financial mechanisms such as deposit legislation might lend itself to improved financial security for the informal sector.

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Appendix A: Household collection sheet

Household collection sheet

	Date	Auditor		Weather			
	Sample number	GPS location recorded?	Photo?	Interview sheet provided?	Interview sheet returned?	Bags provided?	Comments
1							
2							
3							
4							
5							
6							
7							
8							
9							

Appendix B: Household interview sheet

Area or Island Name: ..... Date:..... Sample number (H1 to H200)_____

Weather .....(Sunny/Windy/Rainning)

1. CONTACT INFORMATION

Household name/number	
Total number of people in the household	
No. of adults in the household	
No. of children in the household	
Location	
House type	
House ownership	

2. NATURE OF THE WASTE GENERATED

Daily Diet:

Preference 1 .....P or Buy
Preference 2.....P or Buy
Preference 3.....P or Buy
Weekly number of soft drink cans consumed .....
Weekly number of water bottle consumed .....
Weekly expense on groceries: **VUV**.....**Per**..... **OR**..... (Total)
Weekly expense on transportation: **VUV**.....**Per**.....**OR**..... (Total)
Weekly expense on electricity: **VUV**.....**Per**..... **OR**..... (Total)

3. MEASURE OF INCOME

Source of Income	
No. of people employed in the family	
Estimated monthly income	

4. WASTE MANAGEMENT

No. of bins in the house	
What is the waste level in your house when the collection comes	
Do you burn any waste	

Choose one. Do you

- Take your bin out to a collection point

- Throw it along the road/creek/ocean
- Bin gets collected from your house
- Other (describe how you dispose of your waste and where)

How do you dispose of the following:

- Green waste
- General waste
- Bulky waste
- Nappies

5 AWARENESS LEVEL

Are you aware of the waste collection/recycling services available? (Y/N) if yes, how many?
Did you get any information about the collection services
How did you get this information or where did you hear about it from?
Do you have a radio?

6. APPRECIATION OF THE COLLECTION SERVICE

Rate your collection service from 1 to 10. 1 is really bad.
What's the reason for the score?
Do you have any suggestions for improvement?

7. WILLINGNESS TO PAY FOR THE SERVICE

How much you are willing to pay if the waste collection is charged (monthly)?
Do you support an idea of introducing a rubbish bag for people to put in their waste like in NZ, Australia, Kiribati and Vanuatu
These rubbish bags cost between 20 cent to 1 dollar. How much you can afford if we sell the rubbish bag?

8. CDL & RECYCLING

In order for cans, plastic bottles, and bulky waste to be recycled and sent overseas, we need to support the cost by introducing a waste levy like other countries, e.g. 10 cent for soft drinks, $100 for import cars, $50 for washing machines and refrigerators. Do you support this plan?

Appendix C: Further sort sheet

Beverage containers	Cigarette Butts	Cigarette Packets	Straws	Coffee Cups	
Bags - heavy glossy typically branded carry bags	Bags - supermarket type light weight carry bags	Takeaway containers (plastic and paper)	Takeaway container lids		
BEVERAGE CONTAINER ONLY FURTHER SORT					
	<150	>151 - 500	>501-1000	1001-3000	>3001
Alumimium					
Alcoholic sodas & spirit-based mixers					
Beer					
cider/fruit based etc					
flav water/soft drink (carbonated)					
flav water/soft drink (non-carb)					
Other					
Steel					
Alcoholic sodas & spirit-based mixers					
Beer					
cider/fruit based etc					
flav water/soft drink (carbonated)					
flav water/soft drink (non-carb)					
Other					
LPB					
milk					
flavoured milk					
fruit juice (>90% fruit &/or Veg juice)					
fruit drink					
flav water/sports drink, non-carb					
Other					
PET					
milk					
drink pouches					
flav. Milk					
flav water/ sports drink etc (non-carb)					
flav water/soft drink (carbonated)					
plain water (carbonated or non-carb)					
fruit juice (>90% fruit &/or Veg juice)					
fruit drink					
Other					
HDPE					
milk					
drink pouches					
flav. Milk					
flav water/ sports drink etc (non-carb)					
flav water/soft drink (carbonated)					
plain water (carbonated or non-carb)					
fruit juice (>90% fruit &/or Veg juice)					
fruit drink					
Other					
Other Plastic					
milk					
drink pouches					
flav. Milk					
flav water/ sports drink etc (non-carb)					
flav water/soft drink (carbonated)					
plain water (carbonated or non-carb)					
fruit juice (>90% fruit &/or Veg juice)					
fruit drink					
wine bladders					
Other					
Glass					
Alcoholic sodas/spirit-based mixers					
Beer					
Cider/fruit based etc					
Flav water/soft drink (carbonated)					
Plain water (carbonated or non-carb)					
fruit juice (>90% fruit &/or Veg juice)					
fruit drink					
Wine (glass only)					
Wine cooler					
Spirit					
Other					

Appendix D: Inclusions and exclusions in CDL

MATERIAL CATEGORY	0 - 150ml	>150 - 500ml	>500ml - 1lt	>1L - 1.5lt	>1.5lt - 2lt	>2 - 2.5lt	>2.5lt - 3lt	>3L
Aluminium	EXCL							EXCL
Alcoholic sodas & spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
cider/fruit based etc	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
flav water/soft drink (non-carb)	EXCL							EXCL
Other	EXCL							EXCL
Steel	EXCL							EXCL
Alcoholic sodas & spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
cider/fruit based etc	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
flav water/soft drink (non-carb)	EXCL							EXCL
Other	EXCL							EXCL
LPB	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
flavoured milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
flav water/sports drink, non-carb	EXCL							EXCL
Other	EXCL							EXCL
HDPE	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Other	EXCL							EXCL
PET	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Other	EXCL							EXCL
plastic other	EXCL							EXCL
milk	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
drink pouches	EXCL							EXCL
flav. Milk	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
flav water/ sports drink etc (non-carb)	EXCL							EXCL
flav water/soft drink (carbonated)	EXCL							EXCL
plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
wine bladders	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
Other	EXCL							EXCL
Glass	EXCL							EXCL
Alcoholic sodas/spirit-based mixers	EXCL							EXCL
Beer	EXCL							EXCL
Cider/fruit based etc	EXCL							EXCL
Flav water/soft drink (carbonated)	EXCL							EXCL
Plain water (carbonated or non-carb)	EXCL							EXCL
fruit juice (>90% fruit &/or Veg juice)	EXCL			EXCL	EXCL	EXCL	EXCL	EXCL
fruit drink	EXCL							EXCL
Wine	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
Wine cooler	EXCL							EXCL
Spirit	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL	EXCL
Other	EXCL							EXCL

Appendix E: Council service provision

	Cape Town	eThekwini
Mayor		
Councillor in charge of sanitation		
Director of sanitation (if exists)		
Do they currently have a JICA volunteer?		
Total population of town in 2019 as estimated by council		
Total households in town as estimated by council		
% coverage (*Percentage of households with a rubbish service*)		
No. of trucks Trucks for collection of household waste, commercial waste, trees and branches and bulky waste?		
Staff		
Collection start time		
Collection map		

	Cape Town	eThekwini
How is waste placed out to be collected?		
Type of household service Frequency of service		
Service charge hhld		
Type of service Commercial		
Service charge commercial		
Total expense for waste management		
Total income from fees collected		
Who is responsible for collecting fees?		
What percentage of fees is collected? Or do all people pay their fees?		
Are their fines for littering		
Needs of council to improve waste service?		
Organisations active in the space?		
Market waste		
Biosolids pumping		
No. of pickers at the landfill		
Equipment at landfill		

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