South Africa
State of Waste Report

First draft report








environmental affairs

Department:
Environmental Affairs
REPUBLIC OF SOUTH AFRICA

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South Africa State of Waste. A report on the state of the waste. First draft report

First published in 2018

ISBN XXX-X-XXX-XXXXX-X

Citation of the Report

Department of Environmental Affairs. 2018. South Africa State of Waste. A report on the state of the environment. First draft report. Department of Environmental Affairs, Pretoria. XX pp.

Publication

This publication is available on the website of the Department of Environmental Affairs at https://www.environment.gov.za and http://sawic.environment.gov.za. The report is also available on DVD. A charge may be made according to the pricing policy which can be seen on the website.

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Printed and bound in South Africa by XXXXXXXXXXXX on behalf of the Government Printer.

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Communications: Department of Environmental Affairs

Executive Summary

This first South African State of Waste Report (SoWR) provides snapshot of the state of waste generation and management in South Africa, the key driving forces and pressures, and how South Africa is performing in terms of short and medium terms responses to contemporary changes in the waste sector.

The SoWR differs slightly from its predecessor, the *3rd National Baseline Report* (2012), in that it not only presents the quantities of the different waste types generated, but also looks at the drivers and pressures of the state of Waste in South Africa, the current management of waste, the resulting impacts, and short and medium-term actions or responses to identified drivers, pressures and impacts. It is therefore similar in structure to the 2nd South Africa Environment Outlook (SAEO).

The main report consists of the following five chapters:

- **Chapter 1: Introduction**

This chapter provides an introduction to the report. It briefly discusses the purpose of a SoWR in terms communicating credible, timely and accessible information about waste generation and level of compliance of waste infrastructure to decision-makers and society. It highlights the value of understanding not only the quantities of waste generated, but also its management now and in the immediate future. Further to this, the importance of monitoring the state of waste on an ongoing basis and at defined intervals.

The chapter briefly introduces Drivers-Pressures-State-Impact-Response (DPSIR) reporting framework developed by the European Environment Agency (EEA), and on which this SoWR is largely structured. In terms of this framework, the current or future ‘state’ (S) is the result of specific ‘drivers’ (D) and ‘pressures’ (P), positive or negative, which ‘impact’ (I) on human health and the environment. The ‘responses’ (R) represent the solutions (e.g. policies, investments) for what should then be done to improve or maintain the desired state (S)

Importantly, the chapter also outlines the assumptions and limitations in compiling this 1st SoWR.

- **Chapter 2: Drivers and Pressures**

This chapter provides a brief overview of the drivers and resulting pressures directly affecting the generation and management of waste in South Africa. This includes population growth, economic growth, income, level of urbanisation and the globalisation of the recyclables market.

According to Stats SA, it was established that while South Africa’s population is growing on a year-on - year basis (from 53 million in 2013 to 56.5 million in 2017), that the annual population growth has been declining (from 2.3% in 2013 to 0.9% in 2017). This is important given the linkages between waste generation and population size and growth.

It was also established that the South African economy, measured in terms of Gross Domestic Product (GDP), has also been growing year-on-year from R 3.5 trillion in 2013 to R 4.7 trillion in 2017. This is important given that economic growth is the driving force for several waste generating economic sectors, such as construction.

Given the strong correlation between income level and standard of living, the consumption of goods and services, and the amount of waste generated, the income of individuals and South African households was also considered. According to Stats SA, it was established that the majority of individuals (91%) are from low income households, while only 8.2% and 0.6% of individuals are from middle-income and high-income households respectively.

Solid waste is generally considered to be an ‘urban’ issue as waste generation rates tend to be much higher in urban areas. It was found that South Africa, like most developing countries, is experiencing continuing urbanisation with the proportion of the South African population living in urban areas expected to increase to approximately 71.3% by 2030 and 80% by 2050.

The chapter provided a brief overview of the globalisation of the recycling market, and in particular the trade in recovered plastic, paper, scrap metal and Waste Electrical and Electronic Equipment (WEEE).

- **Chapter 3: State**

This chapter provides a brief overview of the state of waste in South Africa, including the main types and quantities of waste generated, and the level of compliance of waste management infrastructure.

Waste Types

The chapter starts by defining what is meant by 'waste', and the definition of 'general' waste and 'hazardous' waste.

Waste Generation

Taking cognisance of the driving forces and pressures, it is estimated that in 2017 South Africa generated 42 million tonnes of general waste in 2017. It is estimated that only 4.9 million tonnes (11%) of general waste was recycled during this period. However, taking into account only the mainstream recyclables, namely paper, plastics, glass and metals, the recycling rate is estimated to be 34%. These calculated tonnages of general and hazardous waste generated are based on information collected from a range of sources and a different methodology to the *3rd National Baseline Report* (2012) as more information/studies are known to us now and waste regulations have changed in recent years.

The largest contribution to total quantity of general waste was 'other' (35%), which comprises predominantly biomass from the sugar mills, sawmills, and paper and pulp industry. This is followed by organic waste (16%), construction and demolition waste (13%), scrap metals (8%), and commercial and industrial waste (7%).

Since the *3rd National Baseline Report* (2012), there have been numerous waste characterisations studies in some of the major metropolitans. In 2017, South Africa generated approximately 38 million tonnes of hazardous waste, with only about 7% of hazardous waste generated re-used or recycled. The remainder was treated and/or landfilled. The majority of the hazardous waste that was generated was mineral waste, fly ash and dust and bottom ash, mainly from coal-fired power stations (96.1%).

One of the challenges noted in the previous *3rd National Baseline Report* (2012), is that particular waste types, namely brine, slag, WEEE and sewage sludge, appear on both general and hazardous waste lists. As a result, the estimated quantities of these 'unclassified' wastes (27.8 million tonnes) are presented separately from the general and hazardous waste streams so as to prevent skewed data. This is also in part due to the promulgation of the Waste Classification and Management Regulations of August 2013 which have resulted in less "unclassified wastes" and resulting in a significant decrease in waste quantities.

Waste Imports and Exports

In 2017, an estimated 137,490 tonnes of general waste, mainly paper, plastic, glass and metals, was imported, while an estimated 258,557 tonnes of general waste, mainly paper, plastics and metals was exported (SARS).

South Africa also imports and exports hazardous wastes. This trade is regulated by the Basel Convention.

Waste Collection Services

The rendering of a regular waste collection service is the responsibility of the municipality.

In 2016, approximately 59% of households had their waste collected by the local authority, service provider or a community member, while 2% of households had their waste collected from a communal container or central collection point. Approximately 34% of households disposed of their waste at a communal dump or their own dump, and the remaining 5% of waste was dealt with through other means (Stats SA, 2016).

Waste Management Facilities

The final point in the waste management chain is the point at which waste is reused, recycled, recovered, treated or disposed to landfill.

Based on WMLs, the majority of the existing waste management facilities are landfills (82%), which reflects the current preference for landfilling. Treatment facilities account for approximately 11% of all licenced facilities. The majority of licenced treatment facilities are Wastewater Treatment Works (WWTW) and facilities for the treatment of Health Care Risk Waste (HCRW). Recycling and

Recovery Facilities only account for 7% of licences. This may be in part due to smaller operations not requiring a WML.

Status of Legal Compliance

The section of this chapter provides a brief overview of the current status of legal compliance and enforcement in terms of the provisions of the National Environmental Management: Waste Act 2008 (Act No. 59 of 2008) (NEM:WA). In total, 186 contraventions of the provisions of the NEM:WA were recorded in 2016/2017 (SAWIC, 2018b).

The Environmental Management Inspectors (EMIs) are the officials appointed to carry out environmental compliance and enforcement functions in terms of the NEM:WA. In total, the number of EMIs has increased from 2,294 in 2015 to 2,880 in 2017.

Compliance monitoring inspections are undertaken by the EMIs to determine whether or not, waste management facilities are compliant with the conditions of their licence. In 2017, 2158 inspections of waste related facilities were undertaken. Note that this includes waste related inspections undertaken for the pollution and EIA sub-sectors, as well as waste.

- **Chapter 4: Impacts**

This chapter provides a brief description of the impacts, positive or negative, resulting from the waste-related challenges facing South Africa. In general, it was found that improper management of waste can result in a range of negative impacts which can adversely affect human health and the environment. This includes littering and illegal dumping of waste, air and water quality impacts, land contamination, and impact on land uses and development surrounding waste management facilities.

- **Chapter 5: Responses**

This chapter provides a brief description of current and future action to avoid or mitigate the negative impacts resulting from the waste-related challenges facing South Africa.

Legislative Instruments

This section depicts the past two decades of pertinent legislation, policies and plans from a high-level perspective that have shaped the waste industry in South Africa over the past 30 years.

The NEM:WA, which came into effect on 01 July 2009, was the first comprehensive act to regulate waste management in a proactive way in South Africa. Prior to the NEM:WA, waste management was governed by the Environment Conservation Act, 1989 (Act No. 73 of 1989) (ECA), which was considered largely unsuccessful and inadequate, and later the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA).

Since NEM:WA first took effect, there have been rapid amendments and improvements in waste management governance as the legal framework started to develop around non landfill technologies. The subsections below, highlight in chronological order, some pertinent regulations regarding waste management in recent years.

Compliance and Enforcement

This section briefly discusses the importance of compliance and enforcements in realising the desired outcomes of the legal instruments, as well as the short and medium-term focus areas.

Economic Instruments

This section focuses specifically on the National Pricing Strategy for Waste Management (NPSWM) and the economic instruments that are or could being used to reduce waste generation and increase the diversion of waste away from landfill.

Currently the preferred instrument is Extended Producer Responsibility (EPR), where the producers of the goods have a responsibility to safely manage those products after the end of useful life.

Avoidance, Recycling and Recovery

This section provides an overview of some activities that the public and private sector are currently engaged in with respect to avoidance, recycling, and recovery of waste. This includes capacity building and awareness campaigns, source separation, and integrating the informal waste sector.

The intention of this section is to highlight or showcase key projects that could potentially be replicated in other parts of the country.

Acronyms and Abbreviations

ACM	Asbestos Containing Material
BIR	Bureau of International Recycling
COGTA	Department of Cooperative Governance and Traditional Affairs
CH_4	Methane
CO_2	Carbon Dioxide
CRR	Cumulative risk rating
DEA	Department of Environmental Affairs
DWA	Department of Water Affairs
DPSIR	Drivers-Pressures-State-Impact-Response
DTI	Department of Trade and Industry
EADP	Western Cape Government Environmental Affairs and Development Planning
ECA	Environment Conservation Act
EEA	European Environment Agency
EEE	Electrical and electronic equipment
EIA	Environmental impact assessment
EMI	Environmental Management Inspectors
EPR	Extended Producer Responsibility
GDP	Gross domestic product
GHG	Greenhouse gas
GVA	Gross value added
GW	General Waste
HCRW	Health Care Risk Waste
HW	Hazardous Waste
IDPs	Integrated Development Plans
IndWMPs	Industry Waste Management Plans
ITAC	International Trade Administration Commission of South Africa
IWMP	Integrated Waste Management Plans
LFG	Landfill gas
Ml	Megalitres
N_2	Nitrogen
NDP	National Development Plan
NECES	National Environmental Compliance and Enforcement Strategy
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:WA	National Environmental Management: Waste Act 2008 (Act No. 59 of 2008)
NEM:WAA	National Environmental Management: Waste Amendment Act (No. 26 of 2014)
NPSWM	National Pricing Strategy for Waste Management
NWIR	National Waste Information Regulations, 2012 (GN R. 635)
NWMS	National Waste Management Strategy
OECD	Organisation for Economic Coordination and Development
PCBs	Printed circuit boards
PROs	Producer responsibility organisations
PPP	Purchasing Power Parity
SAEO	South African Environmental Outlook
SARS	South African Revenue Service
SAWIS	South African Waste Information System
SoWR	State of the Waste Report
UNEP	United Nations Environment Programme
VOCs	Volatile Organic Compounds

WCMR	Waste Classification and Management Regulations (GNR. 634 of 2013)
WEEE	Waste electrical and electronic equipment
WMLs	Waste management licences
WWTW	Wastewater treatment works

Contents

1 Chapter 1

Introduction

A State of Waste Report (SoWR) is designed to communicate credible, timely and accessible information about waste generation and the condition of waste infrastructure to decision-makers and society.

1.1 INTRODUCTION

As the South African population, together with the level of income and urbanisation, increases, so too does the amount of waste that is generated.

Poorly managed waste can potentially have a significant impact on human health and the environment, as well as the economy. The mismanagement of waste can result in negative externalities and downstream costs, which are often much higher than if the waste had been appropriately managed in the first place.

In light of this, there is a need to better understand the total amount of waste generated in South Africa, and the tonnages of waste recycled, treated, landfilled and exported.

In 2012, the national Department of Environmental Affairs (DEA) published the third national baseline report on waste. This report showed that South Africa produced approximately 108 million tonnes of waste in 2011 (DEA, 2012). The majority of this waste (98 million tonnes) was landfilled, which resulted in only a 10 % recycling rate.

Of the estimated 108 million tonnes of waste, approximately 59 million tonnes was general waste, 1 million tonnes was hazardous waste, and 49 million tonnes was 'unclassified' waste.

The 'unclassified' wastes referred both to general and hazardous wastes which had not been classified at the time of the study. These wastes were therefore reported as 'unclassified' in order to prevent skewed results.

This first State of Waste Report (SoWR) follows a similar approach to the third national baseline report with respect to the calculation of the tonnages of waste recycled, treated, landfilled and exported. However, whilst this SoWR uses a similar methodology, the results are neither directly comparable with those of the third national baseline report (2012), nor the two preceding baseline reports in 1991 and 1997 because the methodology for the calculations of general and hazardous waste in this SoWR (as detailed in Appendix A) are based on information collected from a range of sources and more information/studies are known to us now. Furthermore, the waste regulations have changed and 1st and 2nd baseline reports included 'by-products', which has subsequently been excluded from the definition of 'waste'. The scope of this report, therefore, is limited to the current legal definition of waste, in accordance with South Africa's current overarching waste legislation, which is the National Environmental Management: Waste Act 2008 (Act No. 59 of 2008).

This SoWR also differs from the 3rd baseline report in that it follows a similar structure to that of the 2nd South African Environmental Outlook (SAEO) (2016) in terms of using the Drivers-Pressures-State-Impact-Response (DPSIR) reporting framework, which is described in more detail in the section to follow.

1.2 STATE OF WASTE REPORTING

1.2.1 Purpose

A SoWR is designed to communicate credible, timely and accessible information about waste generation and the condition of waste infrastructure for decision makers and society.

This first SoWR does not consider all of the waste related challenges facing South Africa, but rather focuses on the major challenges, drawing attention to these, in order to inform the policy agenda in the short to medium term.

The SoWR is an important step in the process of refining the information and knowledge base on which the policy agenda and decisions about waste are made, with the intention of stimulating debate and raising awareness on the key issues and challenges related to waste generation and management in South Africa.

1.2.2 Value of State of Waste Reporting

With the growth in the generation of waste in South Africa, the management of this waste becomes increasingly important. Poor management of waste poses risks not only to human health, but also to the natural environment and the economy.

Waste management is, however, a complex and interrelated system that is neither easy to measure nor model. This is, in part, due to waste being a process output in some situations, and a process input in other situations.

The proper management of waste requires, not only a good understanding of the types and quantities of waste generated, but also of how this waste is managed now and in the immediate future.

In order to meaningfully assess the effectiveness of responses to the waste related challenges South Africa faces, monitoring the state of waste should ideally take place on an ongoing basis. Monitoring at defined time periods, such as over a 5 year horizon, allows not only for the comparison of the state of waste between two discrete periods, but also the identification of trends and reflection on the overall progress of responses.

By means of a SoWR, documentation is provided on waste generation and management, thereby providing a snapshot of the waste generation rate and condition of waste infrastructure during a specific period. The SoWR therefore provides decision makers with an understanding of the state of waste, critical to guiding and informing strategic interventions.

1.2.3 Method

Given that this is the first South African SoWR, the method is guided to a large extent by the SAEO (2016), and local and provincial State of Environment Reports (SOERs) and Integrated Waste Management Plans (IWMPs).

However, this report varies from the SAEOs and SOERs, in that it is not based on the integration of sector (theme) chapters. However, like the SAEO and SOERs, the SoWR was compiled by sector specialists, and the process was coordinated by the DEA.

The specialist research and reporting for this edition of the SoWR was undertaken in 2018.

Stakeholders were invited to participate in the process either through contributions in the form of waste-related information and data, or specifically as reviewers of the draft report. The engagement process focussed on relevant national and provincial government departments, producer responsibility organisations (PROs) and other organisations that play an important role in the waste sector.

Wider sector consultation was undertaken through the circulation of the draft report for public review, and in a series of national stakeholder workshops.

The benefits of assembling stakeholders and reviewers from a wide range of fields and organisations included not only the collection of waste-related information from a range of sources, thereby improving the accuracy of the report, but also ensures that the report is objective.

In addition, the report was also peer-reviewed by a sector specialist, with the aim of improving the quality and ensuring that it meets the required standards.

1.2.4 Report Structure

This SoWR comprises five main parts as follows:

1. **Executive summary:** provides a summary of the main report, highlighting some of the key findings;
2. **Introduction:** provides an introduction to the report, including the context, approach, and structure of the report;
3. **Drivers and pressures:** provides a brief description of the main drivers and resulting pressures that cause waste-related challenges in South Africa;
4. **State:** provides a brief overview of the state of waste in South Africa, including the main types and quantities of waste generated, and the condition of waste management infrastructure;
5. **Impacts:** provides a brief description of the impacts, positive or negative, resulting from the waste-related challenges facing South Africa;
6. **Responses:** provides a brief description of current and future action to avoid or mitigate the negative impacts resulting from the waste-related challenges facing South Africa, and/or to enhance the positive impacts; and
7. **Conclusion:** provides a conclusion to the report, including the outlook for waste management in South Africa based on the findings of this report.

1.2.5 DPSIR Reporting Framework

As with the SAEO (2016), this SoWR is guided by the Drivers-Pressures-State-Impact-Response (DPSIR) reporting framework. The European Environment Agency (EEA) developed the DPSIR reporting framework for reporting on the "state" (S) of the environment (EEA, 1999). The current or future "state" (S) is the result of specific driving forces (D) and pressures (P), positive or negative, which impact (I) the environment. The responses (R) represent the solutions (e.g. policies, investments) for what should then be done to improve or maintain the desired state (S), as shown in Figure 1 below.

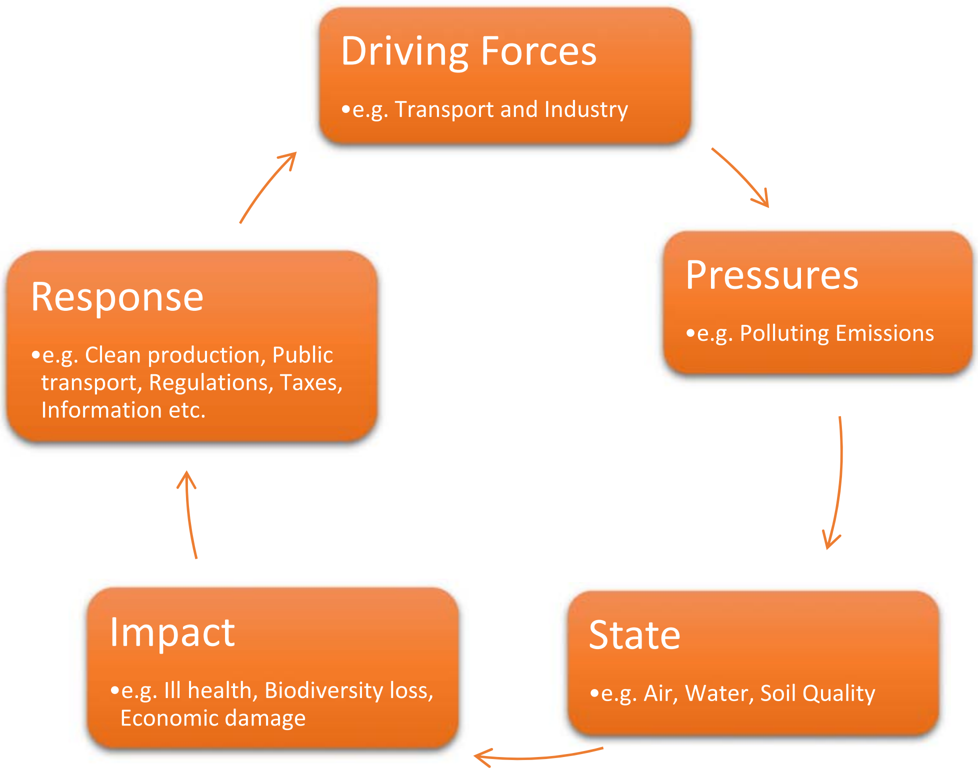


Figure 1: Difference in general waste generation between 2011 and 2017

1.2.6 Indicators

As mentioned previously, the waste sector is a complex and interrelated system. As such, it is neither practicable, particularly at a national level nor at each and every component level, to describe the sector in its entirety.

For this reason, the SoWR, like the SAEO, uses indicators as proxies to represent the state of waste. These indicators have been carefully selected based on the indices typically reported on in IWMPs, and the availability of credible and accurate data, to provide a representative snapshot of the state of waste in South Africa. The effectiveness of the responses to the waste-related issues or challenges facing South Africa can then be assessed by tracking these indicators over time.

While it is beneficial for each iteration of the SoWR to report on the same indicators as the previous edition to maintain consistency, changes in the drivers and pressures, as well as the availability of data, may necessitate the adjustment of existing indicators or the addition of new indicators.

1.2.7 Assumptions and Limitations

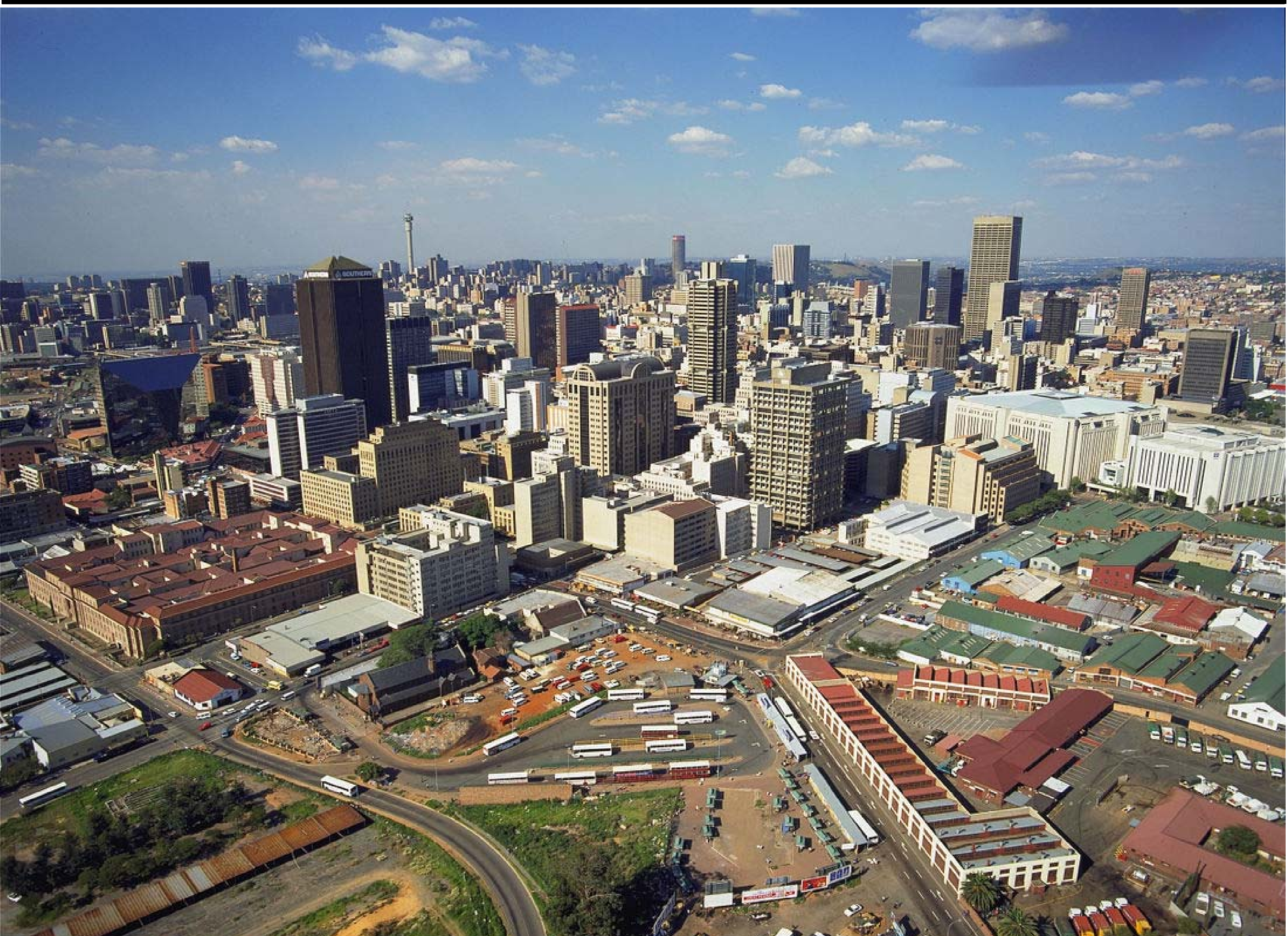
This SoWR is aimed at a wide range of audiences, allowing both non-specialists and decision makers to better understand, contribute meaningfully, and make informed decisions on waste-related issues and challenges facing South Africa.

The information presented does not reflect the detail and expert knowledge used in order to compile the report. As a consequence, the report may not adequately answer all questions or deliver extensive detail for all audiences.

2 Chapter 2

Drivers and Pressures

The drivers and pressures directly affecting the generation and management of waste in South Africa



2.1 INTRODUCTION

The following chapter briefly describes the main drivers and pressures affecting the generation and management of waste in South Africa.

In this context, 'drivers' are defined as the human-induced agents driving change in the waste sector. These are typically the underlying socio-economic and political forces of change that determine where and how people generate and manage waste.

'Pressures' are defined as the human activities and processes that act on the waste sector and directly cause changes in the generation and management of waste. Pressures differ from drivers in that they relate directly to the generation and management of waste, as opposed to the driving forces that determine the scope or extent of the pressures.

Given that these two elements are inextricably linked, and cannot be discussed independently of one another, they will be discussed together in this chapter.

2.2 POPULATION

The link between population size and growth, and the generation of waste is well understood. With the population growth, there is an increase in the consumption of natural resources, and consequently the quantity of waste generated.

2.2.1 Population Size

Figure 2 below presents the estimated population of South Africa from 2013 to 2017. (StatsSA, 2017a). During this 5 year period, the estimated population of South Africa increased from 53 million to 56.5 million people.

While the total population has increased year on year, the annual population growth rate is generally declining from 2.3% in 2013 to 0.9% in 2017. This is in line with international trends.

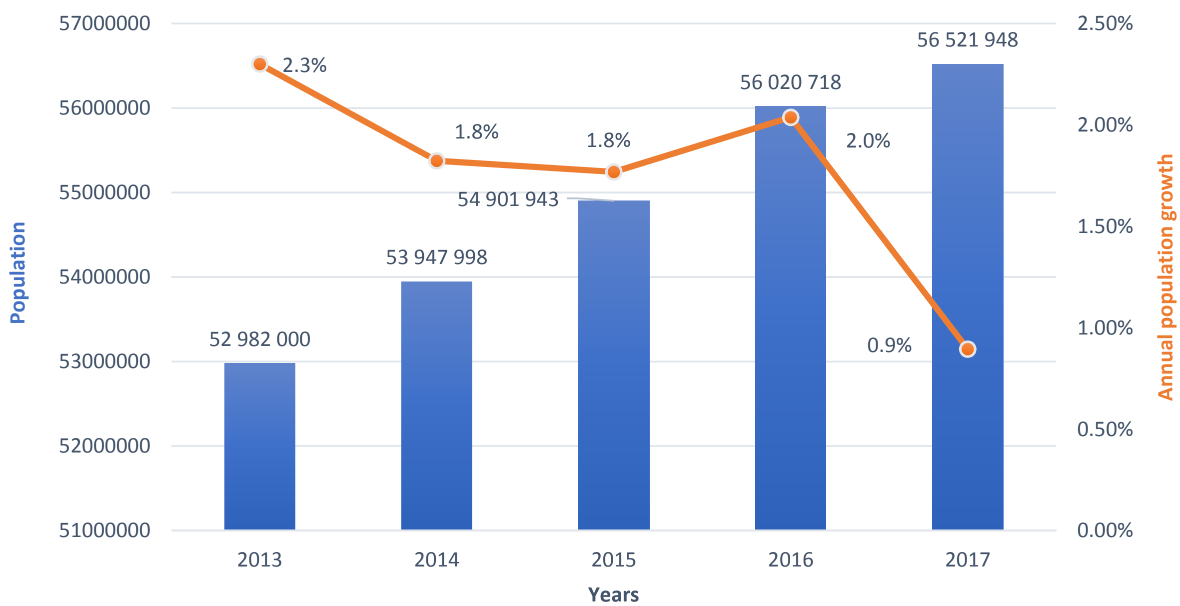


Figure 2: Estimated total population and annual growth from 2013-2017

2.2.2 Population Growth

In addition to national population growth, it is also important to consider the growth rate in each of the nine provinces as some provinces may experience higher growth rates than others. As a consequence, the generation of waste is expected to be greater now and in the future in provinces with higher growth rates. Figure 3 below shows the average population growth rate in each province between 2013 and 2017 (StatsSA, 2017a). Gauteng has experienced the greatest average population growth over the last 5 years (3.1%) and interestingly, the Eastern Cape experienced an average decrease in the population growth rate (-0.2%) during this period.

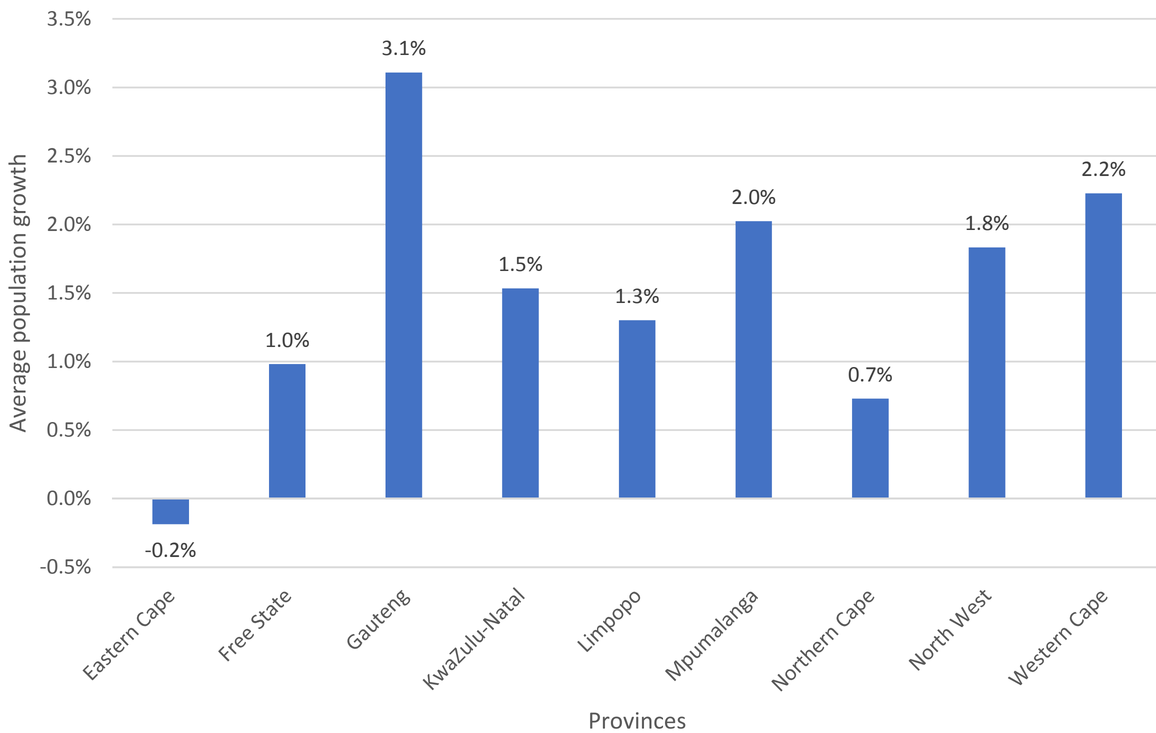


Figure 3: Average population growth per province from 2013 to 2017

2.2.3 Population Density

Population density is also an important consideration for two reasons. Firstly, the population is not evenly distributed across South Africa. Secondly, densely populated areas typically generate greater quantities of waste (mainly general waste) than less populated areas. As a consequence, the pressure on waste collection and waste management facilities is greater in densely populated areas than less populated areas.

Figure 4 below shows the population density of each province in 2017 (StatsSA, 2017a). Similar to the population growth rate, Gauteng has the highest population density (785.5/km^2), followed by KwaZulu-Natal (117.4/km^2), Mpumalanga (58.1/km^2), Western Cape (50.3/km^2), Limpopo (45.9/km^2), the Eastern Cape (38.5/km^2), North West (36.8/km^2), Free State (22.1/km^2) and in contrast, the Northern Cape has the lowest population density (3.3/km^2).

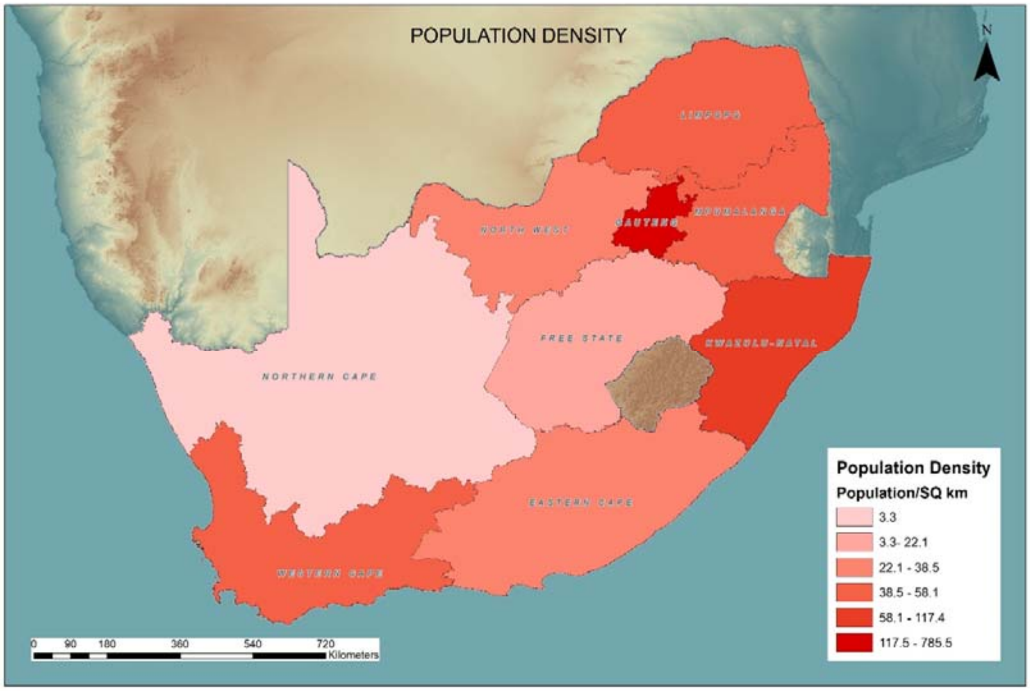


Figure 4: Population density of each province in 2017

2.3 ECONOMY

Another key driver of waste generation is the growth of the economy, either directly through manufacturing and industry, or indirectly through higher incomes. Typically, Gross Domestic Product (GDP), or the monetary value of all goods and services produced in a given period, is used as an indicator of the economic performance of a county or region.

Figure 5 below presents the GDP of South Africa from 2013 to 2016 at current prices (StatsSA, 2017b). As shown, the GDP increased from R 3.54 trillion in 2012 to R 4.65 trillion in 2017.

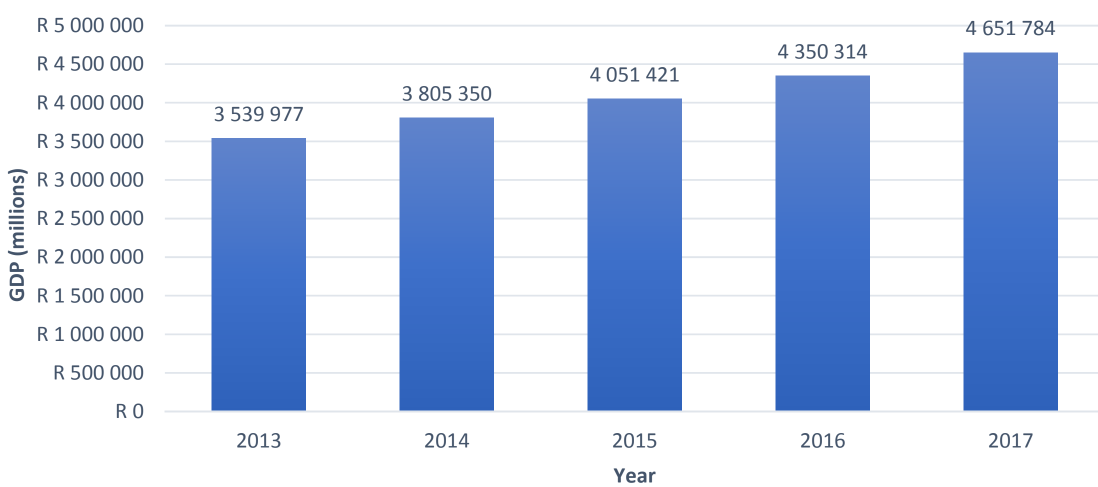


Figure 5: GDP of South Africa from 2013 to 2016 at current prices

Figure 6 below presents a breakdown of the contribution of each province to the national GDP. In 2016, Gauteng was the largest contributor to South Africa's GDP at 35%, with the Northern Cape as the lowest GDP contributor at only 2%.

As waste generation is linked to production of goods and services, provinces with a higher GDP are likely to place greater pressure on waste collection and management facilities than those provinces with a lower GDP.

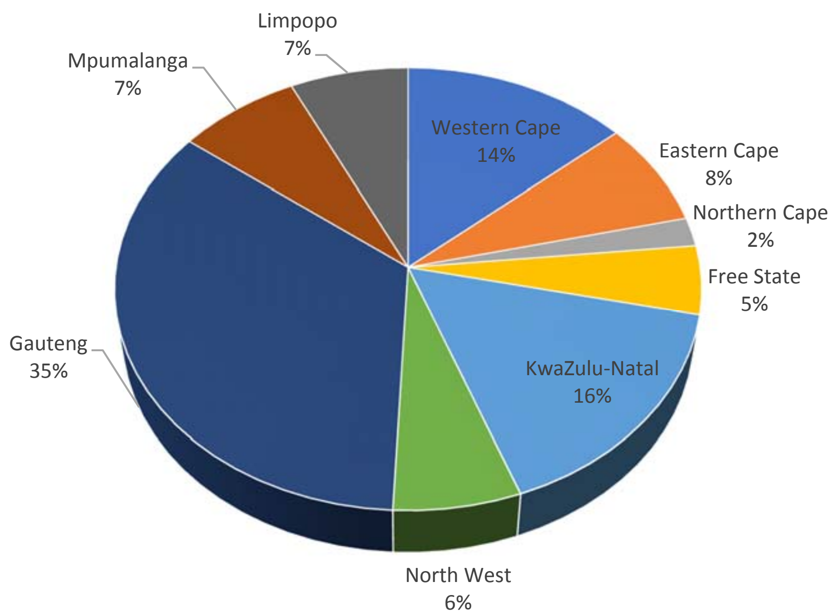


Figure 6: Contribution of each province to the national GDP in 2016

As some waste types are sector specific, it is important to also understand the contribution of various economic sectors to national GDP. For example, construction and demolition waste is largely generated by the construction sector. As such, the generation of construction and demolition waste should be linked to monetary value of the construction sector.

Figure 7 below presents a breakdown of the contribution of key economic sectors to the national GDP in 2016 (StatsSA, 2017b). Finance, real estate and business services was the largest contributor to the national GDP (20%), followed by general government services (18%), and trade, catering and accommodation (15%).

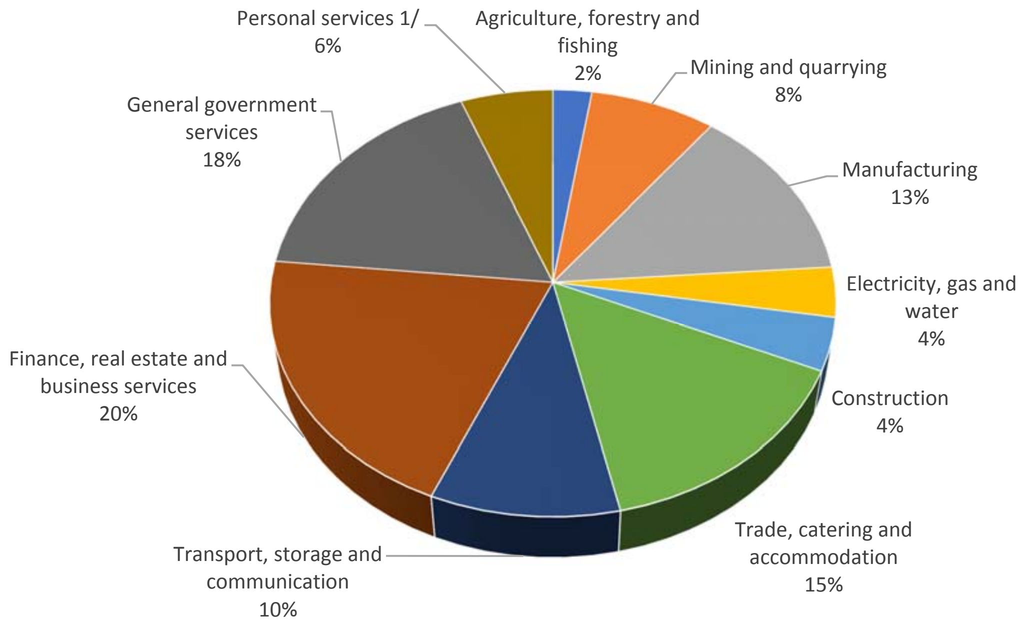


Figure 7: Contribution of key economic sectors to the national GDP in 2016

2.4 INCOME

There is a strong correlation between income level and standard of living, the consumption of goods and services, and the amount of waste generated (World Bank, 2012). The same is true in South Africa, where the domestic waste generation rate varies between different income groups, with waste generation per capita in low, medium and high income group being 0.41, 0.74 and 1.29 kg/c/day respectively (Fiehn & Ball, 2005).

Figure 8 below presents a breakdown of the monthly incomes of individuals in 2011 (StatsSA, 2011). It shows that the majority of individuals have no income (41%). This includes the proportion of the population that are not economically active (i.e. 15 years < or > 65 years of age). It is estimated that 91% of individuals are from low-income households, 8.2% are from middle-income households, and 0.6% are from high income households.

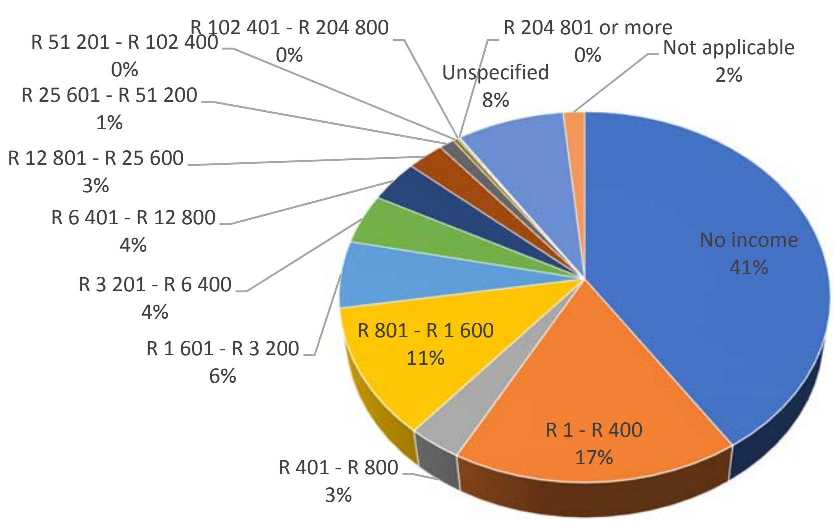


Figure 8: Breakdown of individual monthly incomes

Figure 9 below presents a breakdown of individuals from low, middle and high-income households based on monthly individual incomes (StatsSa, 2011). In most provinces, the majority of individuals are from low income households (84.6% - 95.5%), with between 4.3% and 14% of individuals from middle income households, and a low number of individuals from high income households (0.2% - 1.4%).

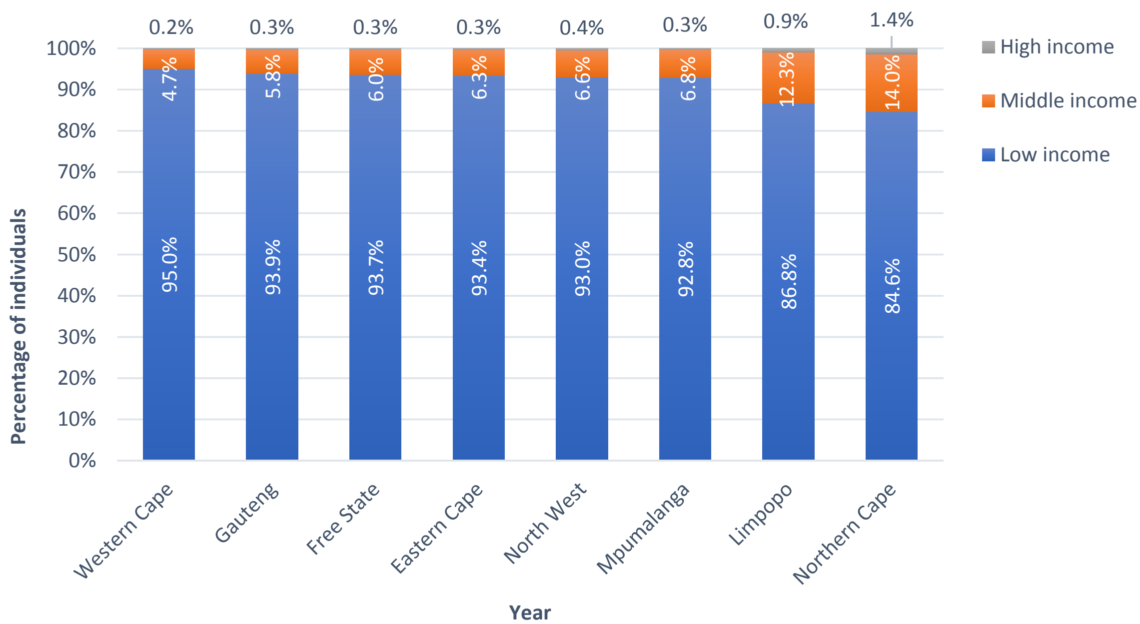


Figure 9: Percentage of individuals from low, middle and high-income areas

2.5 URBANISATION

As with economic development, urbanisation is inextricably linked, and therefore a key driver, of domestic solid waste generation (World Bank, 2012). Municipal solid waste (MSW) is generally considered to be an 'urban' issue as waste generation rates tend to be much higher in urban areas. This is largely because on average, residents in urban areas are usually wealthier, purchase more store-bought goods, and undertake less reuse and recycling than residents in rural areas, e.g. there is a far higher middle and higher income total population in Gauteng.

South Africa, like most developing countries, is experiencing continuing urbanisation (COGTA, 2015). According to the United Nations (2015), the proportion of the South African population living in urban areas will increase to approximately 71.3% by 2030 and 80% by 2050. In addition to the large urban areas, namely the Johannesburg, City of Tshwane and Ekurhuleni, Cape Town, eThekwini, and Nelson Mandela Bay, other growing urban populations include the KwaZulu-Natal coastal belt areas, Manguang, Buffalo City, Msunduzi, Polokwane, Rustenburg, Mbombela, Sol Plaatjie and the Cape South Tourism Belt (COGTA, 2015).

Figure 10 below presents the change in the absolute population between 1996 and 2001 in South Africa's inner core, outer core, semi-periphery, periphery and deep periphery (Harris P. and Todes A (2012) cited in COGTA, 2015). It can be seen that the majority of the population live in the inner core and that these areas experienced a much greater increase in the population between 1996 and 2011 than the other areas.

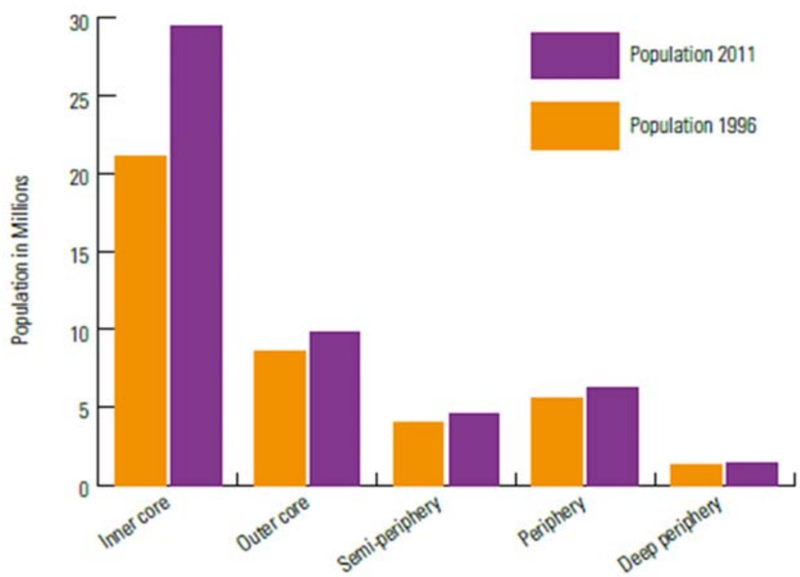


Figure 10: Change in absolute population between 1996 and 2012

While the urban population is growing larger, it is also becoming younger with nearly two-thirds (64%) of South Africa's youth living in urban areas (COGTA, 2015). The youth are moving to the urban core areas in search of employment opportunities and higher incomes, while the aged or the population that is no longer economically active tend to migrate towards secondary cities or more rural settlements.

It is estimated that South Africa's large cities and towns dominate the country's economy, producing over 80% of the national gross value added (GVA) (COGTA, 2015). Further to this, the large cities and towns are growing twice as fast as other cities and towns, with average incomes approximately 40% higher than the national average.

Employment in the South Africa's large cities and towns grew twice as much as elsewhere, accounting for nearly three quarters of net jobs created in South Africa between 1996 and 2012 (COGTA, 2015)

As a consequence of migration to urban areas, there is an increase in poverty experienced especially in townships, informal settlements, and inner cities, putting pressure on city waste collection and management resources (COGTA, 2015).

2.6 GLOBALISATION

The globalisation of the recycling market is another key driving force affecting waste management in South Africa. It places pressure not only on the local availability of recyclable materials, but also the market price of these materials (ISWA, 2012).

While there has been a long history of trade in metals and glass cullet, there has recently been an increase in the trade of other recyclable wastes, particularly paper and plastics. These wastes are generally collected in the developed countries, and transported to developing countries for processing, mainly South East Asia.

The exporting countries benefit from the sale of recyclable wastes for further processing and reuse, allowing them to meet their legislated recycling targets. The importing countries benefit from the import of cheaper raw materials, which are used to grow their local economies.

2.6.1 Recovered Plastic

In 2012, it was estimated that global trade in recovered plastics was 15 Mt, accounting for less than 5% of total plastic production (288 Mt) (ISWA, 2012).

Plastics are largely exported from Hong Kong, United States of America, Japan, Germany and the United Kingdom.

The majority of the plastics were, until recently, exported to China, which received approximately 56% of global imports. It is understood that China imported high quality plastic from the developed countries to supplement poor quality local materials.

2.6.2 Recovered Paper

The trade in cellulose fibre-based recovered paper dates back approximately 30 years (ISWA, 2012). Initially, the export of recovered paper was mainly from the United States of America, but this trade soon expanded to include the European Union, the United Kingdom, Australia, and New Zealand. The recovered paper was mainly imported by South-East Asia, and in particular China.

In 2013, it was estimated that 109 Mt of recovered paper was traded globally (IBR, 2013). The trade was dominated by Asia, which accounted for 70.5% of total paper imports and 17% of exports. This is followed by the European Union (24% of imports and 32% of exports), and North America (2.5% of imports and 44% of exports). Africa accounted for less than 0.1% of imports and 0.5% of exports.

2.6.3 Scrap Metal

In 2016, global ferrous or steel metal production was approximately 1,630 Mt. During this period, total scrap usage in production was 560 Mt (34%) (BIR, 2017). China was the largest user of scrap steel (90.1 Mt), followed by the European Union (88.3 Mt), United States of America (56.7 Mt), Japan (33.6 Mt), Korean Republic (27.4 Mt), Turkey (25.9 MT), and Russia (17.2 Mt) (BIR, 2017).

The global usage of scrap copper was approximately 8.3 Mt in 2015, while the use of scrap aluminium was approximately 15.6 Mt during the same period (BIR, 2015)

In order to meet the local steel production demand, a number of countries are importers of scrap steel. In 2016, Turkey was the largest importer (17.7 Mt), followed by India (6.4 Mt), Korean Republic (5.8 Mt), United States of America (3.9 Mt), and Taiwan (3.6 Mt) (BIR, 2017). The European Union was the largest importer of copper and aluminium scrap in 2015 (5.6 Mt), followed by China (3.9 Mt), and other Asian countries (2.1 Mt) (BIR, 2015). Importantly, the majority of the European Union trade in copper and aluminium scrap was interregional, between member states.

The main exporters of scrap steel are the European Union (17.8 Mt), United States of America (13.2 Mt), Japan (9.7 Mt), Russia (5.6 Mt), and Canada (3.6 Mt) (BIR, 2017). South Africa was the ninth largest exporter of steel scrap with 0.66 Mt, down 49.1% from 1.3 Mt in 2015. In 2015, total exports of aluminium and copper scraps was 13.6 Mt (BIR, 2015). The European Union was largest exporter (6.1 Mt), followed by Asia (excluding China) (2.2 Mt), and North America (3.4 Mt), with Africa only exporting 0.18 Mt.

2.6.4 Waste Electrical and Electronic Equipment

In 2016, it was estimated that 44.7 million tonnes of waste electrical and electronic equipment (WEEE) was generated (ISWA, 2016). This is equivalent to approximately 6.1 kg/capita, a 5.2% increase from an estimated 5.8 kg/capita in 2014.

Estimating the global trade in WEEE is a challenge because the global harmonised trade system does not distinguish between new and used electronics, and not all countries report on WEEE imports and exports in terms of the Basel Convention.

The import of WEEE into and export out of South Africa is covered in more detail in Section 3.6.1.1.

3 Chapter 3

State

Snapshot of the current state of waste generation and management in South Africa

3.1 INTRODUCTION

The following chapter presents a snapshot of the state of waste generation and management in South Africa, resulting from the driving forces and pressures described in Chapter 2.

This chapter provides a baseline against which the effectiveness of the responses presented in Chapter 5 can be measured.

3.2 WASTE TYPES

In terms of the Waste Amendment Act (2014), "*waste means -*

a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, by the holder of the substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or

b) any substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in paragraph (a) and (b) ceases to be a waste -

i. once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

ii. where approval is not required, once a waste is or has been re-used, recycled or recovered;

iii. where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or

iv. *where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste."*

In order to align with the South African Waste Information System (SAWIS), waste generation and management will be reported on in terms of the categories contained in Annexures 3 and 4 of the *National Waste Information Regulations* (2012).

These regulations divide waste into two broad categories, namely General Waste (GW) and Hazardous Waste (HW), based on the risk it poses.

3.2.1 General Waste

In terms of the Waste Amendment Act (2014), "general waste means -

waste that does not pose an immediate hazard or threat to health or to the environment, and includes:

a) domestic waste;

b) building and demolition waste;

c) business waste;

d) inert waste; or

e) any waste classified as non-hazardous waste in terms of the regulations made under section 69, and includes non-hazardous substances, materials or objects within the business, domestic, inert or building and demolition wastes."

3.2.2 Hazardous Waste

In terms of the Waste Amendment Act (2014), 'hazardous waste' means

"any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment and includes hazardous substances, materials or objects within the business waste, residue deposits and residue stockpiles".

3.2.3 Waste Classification

SANS 10234 is a globally harmonised system that sets standard criteria for the classification of hazardous substances and mixtures, including waste, according to health, environmental and physical hazards. It includes communication elements for labelling and information required for Safety Data Sheets (SDS). Unlike the Minimum Requirements, the GN R 634 do not prescribe any specific obligations based on whether a waste is hazardous or not, nor the type of landfill where these wastes must be disposed. Rather, the purpose is to ensure adequate and safe storage and handling of hazardous waste, and to inform the consideration of suitable waste management options.

The responsibility for waste classification rests with the waste generator, who must ensure that wastes are classified within 180 days of generation, except for certain wastes listed in the regulations that do not require classification and are considered to be 'pre-classified'. These are listed in Table 1.

Table 1: Waste that do not require classification (Pre-classified waste)

General Waste	Hazardous Waste
• Domestic waste; • Business waste not containing hazardous waste/chemicals; • Non-infectious animal carcasses; • Garden waste; • Waste packaging; • Waste tyres; • Building and demolition waste not containing hazardous waste/chemicals; and • Excavated earth material not containing hazardous waste/chemicals.	• Asbestos Waste; • PCB Waste or PCB containing waste (>50 mg/kg or 50 ppm); • Expired, spoilt or unusable hazardous products; • General waste (excl. domestic), containing hazardous waste/chemicals; • Mixed, hazardous chemical wastes from analytical laboratories, and laboratories from academic institutions in containers <100 litres; and • Health Care Risk Waste.

Regarding waste disposal to landfill, the regulations require that generators must ensure their waste is assessed and disposed of in terms of the both Norms and Standards (GNR 635 and GNR 636).

3.3 WASTE GENERATION

As mentioned previously, waste generation in South Africa is driven primarily by the growing population, economic growth and rising income levels, as well as increasing urbanisation.

The sections to follow present a snapshot of general and hazardous waste generated in South Africa in 2017.

These calculated tonnages of general and hazardous waste generated are based on information collected from a range of sources. For more detailed description of the data sources, methodology and limitations see Appendix A.

3.3.1 General Waste

Based on the methodology for the calculations in this SoWR (e.g. the fact that there have been detailed waste characterisation studies in recent years in some larger cities and changes in waste regulations), South Africa generated approximately 42 million tonnes of general waste in 2017.

It is estimated that 4.9 million tonnes (11%) of general waste was recycled in 2017. Taking into account only the mainstream recyclables, namely paper, plastic, glass and metal, the estimated recycling rate is estimated to be 34%.

Table 2: General waste by management option in 2017

Waste type		Generated	Recovered / Recycled	Landfilled	Percentage Recovered / Recycled
GW01	Municipal waste	1 770 009	-	1 770 009	0%
GW10	Commercial and industrial waste	3 179 157	-	3 179 157	0%
GW13	Brine				
GW14	Fly ash and dust				
GW15	Bottom ash				
GW16	Slag				
GW 17	Mineral waste				
GW 18	WEEE				
GW 20	Organic waste	6 656 234	812 206	5 844 028	12%
GW 21	Sewage sludge				
GW30	Construction and demolition waste	5 360 556	305 761	5 054 795	6%
GW50	Paper	3 635 825	1 414 378	2 221 447	39%
GW51	Plastic	2 247 323	332 713	1 914 610	15%
GW52	Glass	1 395 103	320 000	1 075 103	23%
GW53	Metals	3 345 565	1 622 059	1 723 506	48%
GW54	Tyres	221 751	64 061	157 690	29%
GW99	Other	14 868 997	-	14 868 997	0%
	Total general waste (t)	**42 680 520**	**4 871 178**	**37 809 341**	**11%**

Figure 11 presents the percentage contribution of each waste type to the total tonnage of general waste generated in 2017. The largest contribution to total quantity of general waste was 'other' (35%), which comprises predominantly biomass from the sugar mills, sawmills, and paper and pulp industry. This is followed by organic waste (16%), construction and demolition waste (13%), scrap metals (8%), and commercial and industrial waste (7%).

It is worth noting that general municipal waste (MSW) only accounts for 4% of total general waste, because organic, paper, plastic, glass, scrap metal and tyre wastes, were reported separately where possible.

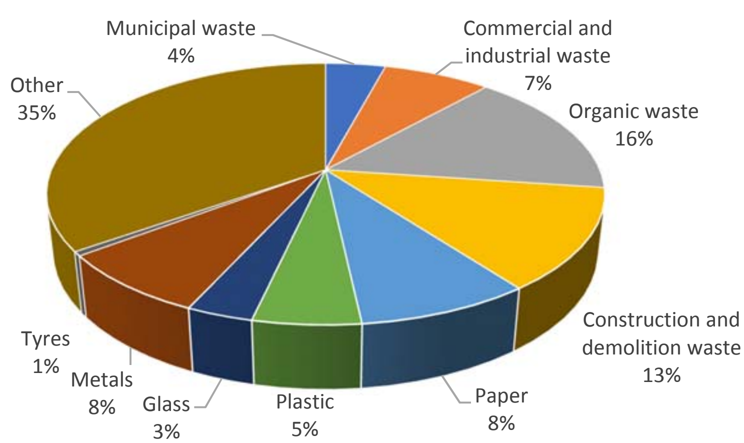


Figure 11: Breakdown of general waste generated in 2017

3.3.2 Hazardous Waste

Based on the calculations, South Africa generated approximately 38 million tonnes of hazardous waste in 2017.

Approximately, 7% of hazardous waste generated in 2017 was re-used or recycled, with the remainder treated and/or landfilled. It is estimated that approximately 90% of batteries (predominately lead acid batteries) and 70% of waste oils were reused or recycled. Further to this, approximately 7% of fly ash and bottom ash was used in the construction industry in the manufacturing of cement and bricks.

Table 3: Hazardous waste by management option in 2017

Waste type		Generated	Recovered / Recycled	Treated / Landfilled	Percentage Recycled
HW 01	Gaseous waste	62	-	62	0%
HW 02	Mercury containing waste	978	-	978	0%
HW 03	Batteries	35 932	32 339	3 593	90%
HW 04	POP Waste	547	-	547	0%
HW 05	Inorganic waste	316 781	-	316 781	0%
HW 06	Asbestos containing waste	36 322	-	36 322	0%
HW 07	Waste Oils	133 000	93 100	39 900	70%
HW 08	Organic halogenated and /or sulphur containing solvents	121	-	121	0%
HW 09	Organic halogenated and/or sulphur containing waste	9 159	-	9 159	0%
HW 10	Organic solvents without halogens and sulphur	842	-	842	0%
HW 11	Other organic waste without halogen or sulphur	221 310	-	221 310	0%
HW 12	Tarry and Bituminous waste	288 108	-	288 108	0%
HW 13	Brine				
HW 14	Fly ash and dust	31 117 409	2 178 219	28 939 191	7%
HW 15	Bottom ash	5 491 308	384 392	5 106 916	7%
HW 16	Slag				
HW 17	Mineral waste				
HW 18	WEEE				
HW 19	HCRW	48 749	-	48 749	0%
HW 20	Sewage sludge				
HW 99	Miscellaneous	368 537	-	368 537	0%
	Total hazardous waste (t)	**38 069 165**	**2 688 049**	**35 381 115**	**7%**

Figure 12 presents the percentage contribution of each waste type to the total tonnage of hazardous waste generated in 2017. The majority of the hazardous waste that was generated was fly ash and dust and bottom ash, mainly from coal-fired power stations (96.1%).

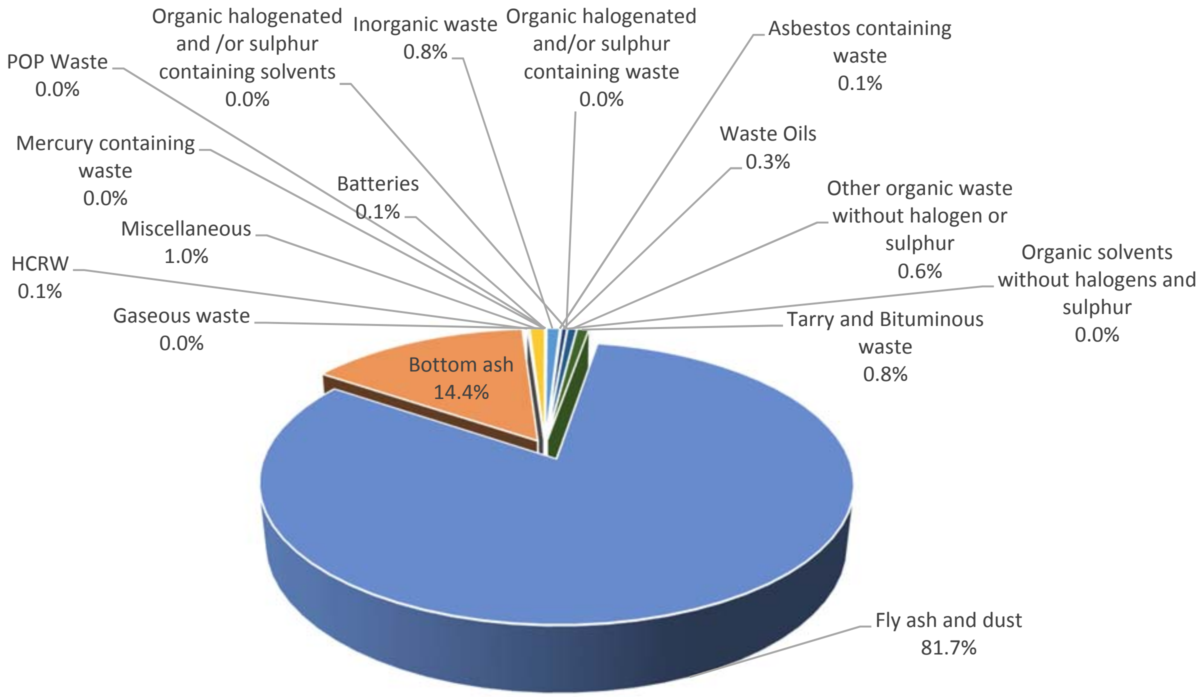


Figure 12: Breakdown of hazardous waste generated in 2017

3.3.3 Unclassified Waste

One of the challenges noted in the previous 3rd National Baseline Report, is that particular waste types, namely brine, slag, mineral waste, WEEE and sewage sludge, appear on both general and hazardous waste lists.

Whilst waste generators are now required, in terms of the *Waste Classification and Management Regulations* (2013), to classify waste in accordance with SANS 10234, this is not always done and the information is not always readily available.

As a result, the estimated quantities of these 'unclassified' wastes are presented separately from the general and hazardous waste streams in order to prevent skewed results. Should the information become available, as was the case with fly ash and dust, and bottom ash, the waste type will be moved to either the general or hazardous wastes lists.

Table 4 presents the estimated quantities of 'unclassified' wastes generated in 2017. The majority of 'unclassified' waste was slag (52%) mainly from mills and foundries, and brine (42%) with mineral waste (excluding tailings and waste rock dump) accounting for only 3%.

WEEE appears to be the only 'unclassified' waste stream that is being recycled (approximately 8 %).

Table 4: 'Unclassified' waste by management option in 2017

Waste type		Generated	Recovered / Recycled	Treated / Landfilled	Percentage Recovered / Recycled
GW/HW 13	Brine	11 646 567		11 646 567	0%
GW/HW 16	Slag	14 453 459		14 453 459	0%
GW/HW17	Mineral Waste	827 845		827 845	0%
GW/HW 18	WEEE	324 520	25 000	299 520	8%
GW/HW 20	Sewage sludge	540 006		540 006	0%
Total 'unclassified' waste (t)		**27 792 397**	**25 000**	**27 767 397**	**8%**

3.3.4 Trends

Figure 13 below presents the percentage difference in general waste generation calculations for each waste type between 2011 and 2017.

In interpreting the hanging chart, if the bar is above 0, the tonnage of waste generated of that particular waste stream is greater in 2017 than in 2011. Conversely, if the bar is below 0, then the tonnage of waste generated in 2017 is less than in 2011. Furthermore, the height of the bar indicates the extent of the difference in waste generation between 2011 and 2017.

As mentioned previously, the 3rd National Baseline Report is not directly comparable to this SoWR due to differences in data sources, assumptions, and calculations. For example, the estimated quantities of 'municipal waste' differed between 2011 and 2017, and the commercial industrial (C&I) waste, construction and demolition (C&D) waste, organic waste and recyclables were separated out where possible from the municipal waste stream.

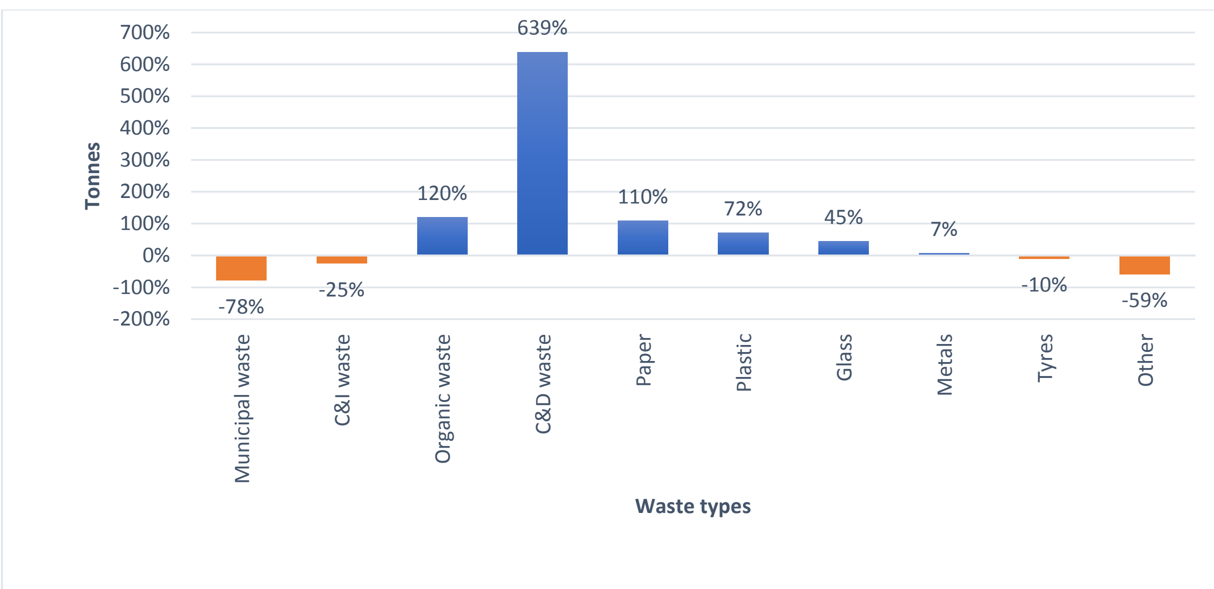


Figure 13: Difference in general waste generation between 2011 and 2017

Figure 14 below presents the difference in hazardous waste generation calculations for each waste type between 2011 and 2017. On average, the quantities of waste increased by between 9% and 13% from 2011 to 2017. Note that in 2011, fly ash and dust, and bottom ash was reported as 'unclassified' waste. Based on new information, these two waste types have been moved to the hazardous waste stream.

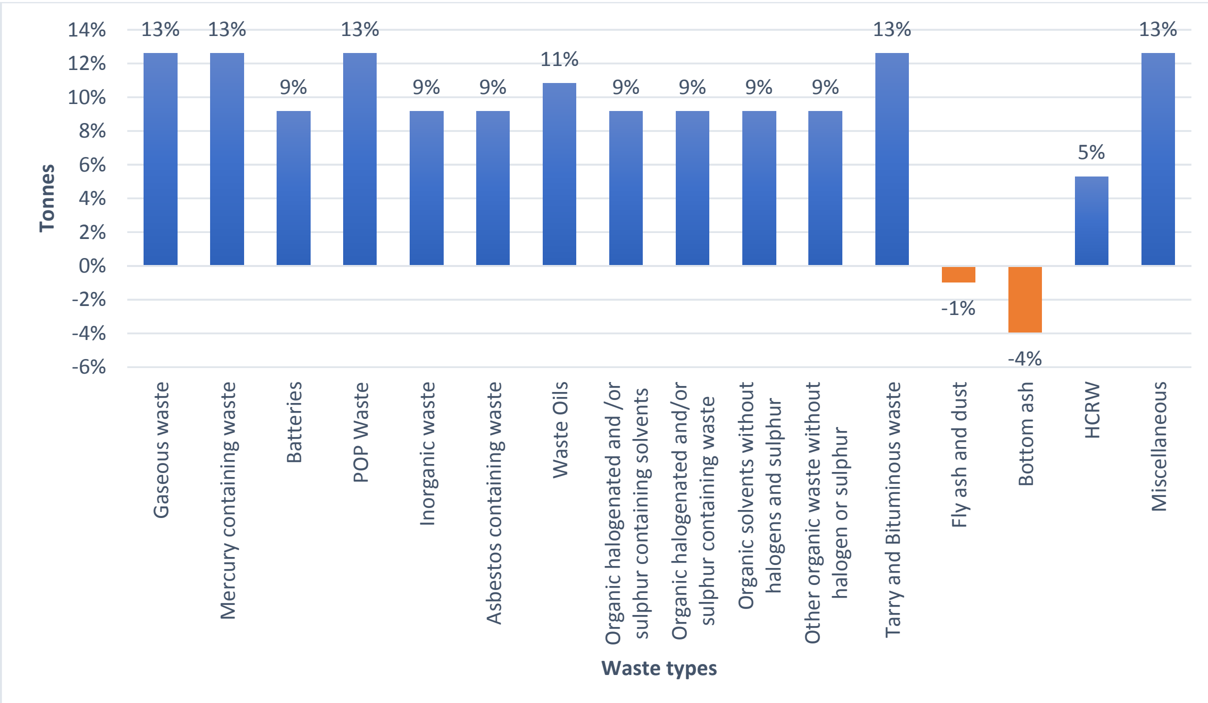


Figure 14: Difference in hazardous waste generation between 2011 and 2017

3.4 WASTE IMPORTS AND EXPORTS

As mentioned in Chapter 2, the global trade in recyclables, namely metal, glass cullet, plastic and paper has increased in recent years. It is therefore critical to also understand the state of waste imports to and exports out of South Africa.

3.4.1 General Waste

In South Africa, the importation and exportation of waste is regulated by the International Trade Administration Act (Act 71 of 2002) and Customs and Excise Act (Act 91 of 1964). For prohibited and restricted imports, which includes waste and scrap, an "import permit" is required.

The regulation of imports and exports is the responsibility of the Department of Trade and Industry (DTI), South African Revenue Service (SARS); and International Trade Administration Commission of South Africa (ITAC).

Table 5 below presents the tonnages of general waste imported and exported in 2017 (SARS, 2017). An estimated 137,490 tonnes of general waste, mainly paper, plastic, glass and metal, was imported, while an estimated 258,557 tonnes of general waste, mainly paper, plastic and metal was exported.

Table 5: Tonnages of general waste imported and exported in 2017 (in tonnes)

Waste type		Waste Generated	Imports	Exports	Total
GW01	General waste	1 770 009	2	4	1 770 009
GW10	Commercial and industrial	3 179 157			3 179 157
GW13	Brine				-
GW14	Fly ash and dust				-
GW15	Bottom ash				-
GW16	Slag				-
GW 17	Mineral waste				-
GW 18	WEEE				-
GW 20	Organic waste	1 166 731	4 048	298	6 656 234
GW 21	Sewage sludge				
GW30	Construction and demolition	2 172 319			5 360 556
GW50	Paper	3 571 632	58 548	129 375	3 635 825
GW51	Plastic	787 924	6 988	34 794	2 247 323
GW52	Glass	176 829	39 928	11	1 395 103
GW53	Metals	4 160 641	27 976	68 192	3 345 565
GW54	Tyres	165 763			221 751
GW99	Other	684 737		1 003	14 868 997
	Total general waste (t)	**25 287 037**	**137 490**	**258 557**	**42 680 520**

3.4.2 Hazardous Waste

In 1994, South Africa ratified the *Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and Their Disposal* ('Basel Convention').

The Basel Convention aims to protect human health and environment against the adverse effects of hazardous waste by providing provisions for the reduction of hazardous waste generation, promotion of environmentally sound management of hazardous wastes, restriction of transboundary movements of hazardous wastes, and regulation of transboundary movements in cases where it is permissible.

Vital to the Basel Convention is the concept of 'prior informed consent'. This requires (prior to the export of hazardous waste), the authorities of the State of export to have notified the prospective authorities of the State of import and transit, by providing them with detailed information on the intended movement. The transboundary movement of the waste may only proceed if and when all States concerned have given their written consent.

3.5 WASTE COLLECTION SERVICES

The minimum requirements for domestic waste collection are outlined in the *National Domestic Waste Collection Standards* (RSA, 2011).

While the main objective of the standards are to ensure that all households within the jurisdiction of the municipality are provided with equitable waste collection services, there is a recognition that it may be impractical to provide regular waste collection services to all areas due to various factors, such as distance, and the resulting costs.

In these cases, the municipality should allow for more feasible alternative ways of waste handling.

In 2016, approximately 59% of households had their waste collected by the local authority, service provider or a community member, while 2% of households had their waste collected from a communal container or central collection point. Approximately 34% of households disposed of their waste at a communal dump or their own dump, and the remaining 5% of waste was dealt with through other means.

Figure 15 presents a breakdown of waste collection services per province (Stats SA, 2016).

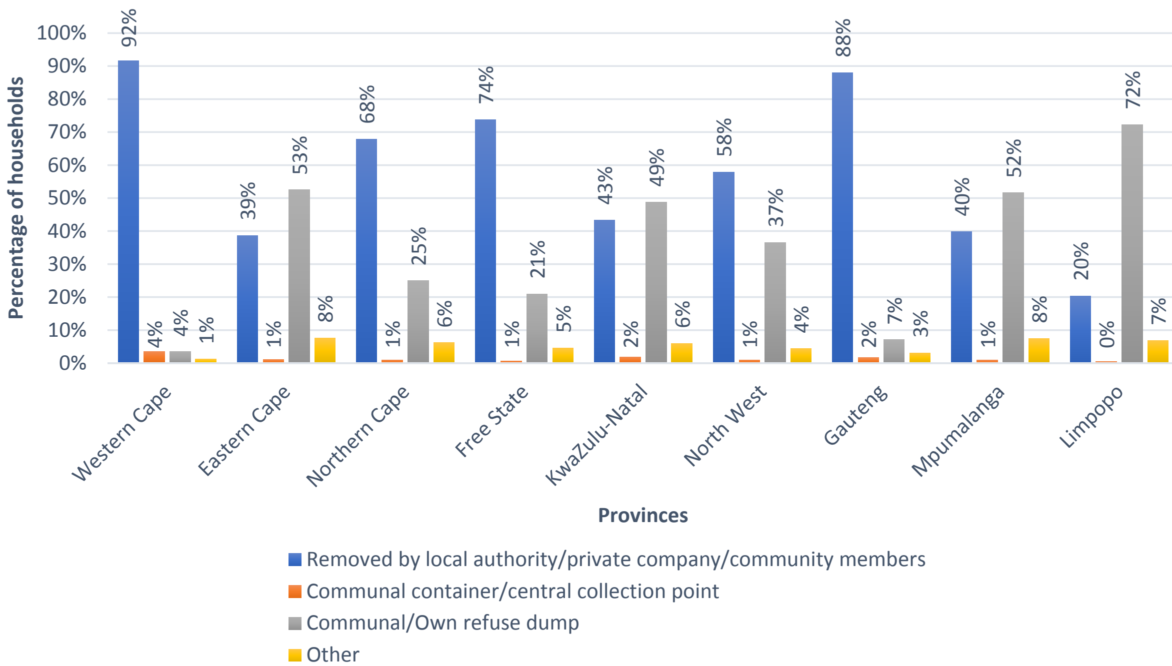


Figure 15: Breakdown of waste collection services in each province

In addition to rendering regular waste collection services, the municipality is also required to encourage and support separation at source, particularly in the metropolitan and secondary cities (RSA, 2011). Further to this, the municipality must also provide clear guidelines to households regarding the types of and sorting of the waste, and to encourage community involvement in recycling.

In terms of the collection of recyclable waste, the role of a municipality is to provide an enabling environment for households to recycle either through providing kerbside collection, or where that is not possible, to co-operate with the recycling sector to ensure that there are facilities where recyclables can be dropped off and collected by service providers.

3.6 WASTE MANAGEMENT FACILITIES

The final point in the waste management chain is the point at which waste is reused, recycled, recovered, treated, incinerated or disposed to landfill.

In South Africa, the approach to waste management is structured around the waste hierarchy (NWMS, 2011). The hierarchy comprises a number levels, each representing an approach to waste management, arranged in descending order in terms of priority, as shown in Figure 16.

The first step of the hierarchy, the most desirable option, is the avoidance and reduction of waste generation. The next step of the hierarchy is reuse where the waste is reused for a similar or different purpose without changing its form or properties. The next steps of the hierarchy are recycling where particular waste materials are converted into a new material to be used for a different purpose, and recovery where particular components or materials are recovered. The final level of the hierarchy is treatment and disposal. This is the least desirable option.

The upper four levels of the waste management hierarchy support the cradle-to-cradle approach to waste management in which the product is reused or recycled when it reaches the end of its life span, and in doing so, become an input for new product or material.

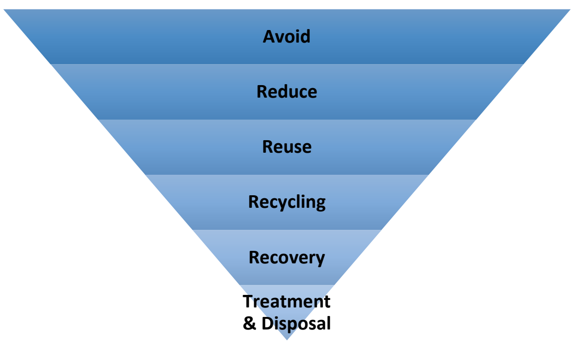


Figure 16: Waste hierarchy

The SAWIS is structured in the same way, where waste management companies are required to report in terms of management method, namely recycling and recovery, treatment, and disposal.

3.6.1 Recycling and Recovery Facilities

According to the national list of licenced waste management activities (SAWIC, 2018b), there are 66 licenced recycling and recovery facilities in South Africa. In contrast there are approximately, 611 facilities registered on the SAWIS, and 186 facilities reporting. The discrepancy between licenced facilities and the SAWIS registered facilities is due to the regulations for listed waste activities only requiring a WML if above a certain threshold.

Figure 17 presents the number of licenced recycling and recovery facilities in each province. Gauteng has the highest number of facilities (30), followed by Western Cape (9), and Eastern Cape and KwaZulu-Natal (7 each). In contrast, Limpopo and North West only have one licenced facility each, Free State (2) and Northern Cape (3).

The majority of these licenced sort, shred, grind and bail waste (37), including scrap metal. Eleven (11) of the licenced facilities scrap and recover motor vehicles, and 18 of the licenced facilities recover particular wastes or materials, such as oils, solvents, tyres and WEEE.

It is important to note that the majority of these licenced recycling and recovery facilities are privately owned.

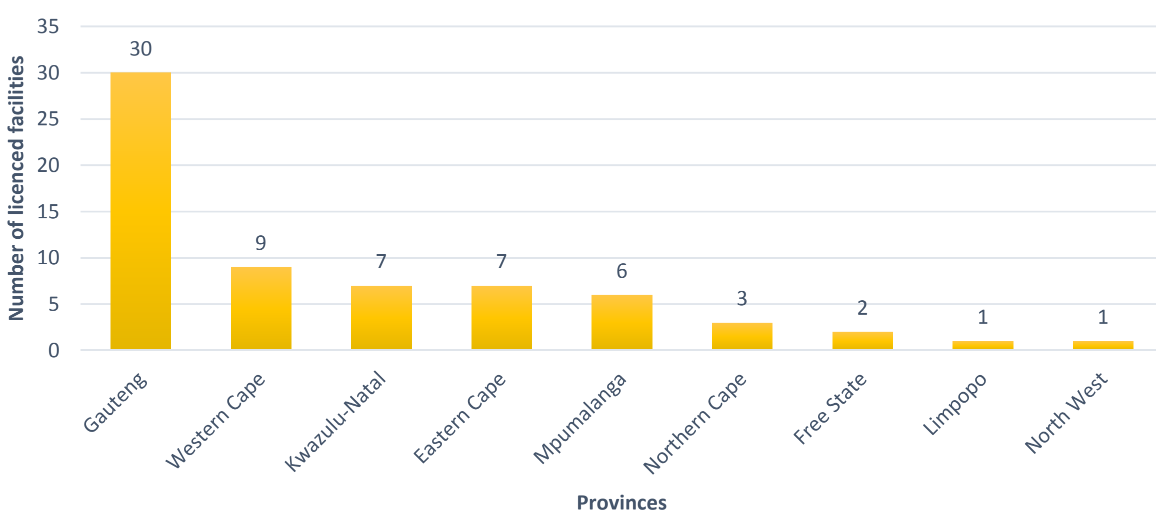


Figure 17: Number of waste recycling and recovery facilities per province

3.6.1.1 Waste Electrical and Electronic Equipment

The growth in the generation of Waste Electrical and Electronic Waste (WEEE) can be attributed to higher levels of disposable income, urbanisation and industrialisation in many developing countries (ISWA, 2016). Other factors contributing to the generation of WEEE, include falling prices, people having multiple devices, growth of cloud services or data centres, and short replacement cycles.

South Africa, which can be classified as a Mid Purchasing Power Parity (PPP) country, is estimated to have an average annual growth rate of electrical and electronic equipment (EEE) of 13% per year (ISWA, 2016). In 2016, it is estimated that South Africa generated 0.3 Mt of WEEE.

Figure 18 presents the estimated per capita WEEE generation rate for selected countries in Africa. It can be seen that South Africa has an estimated waste generation rate of 3-6 (5.7) kg/capita per years.

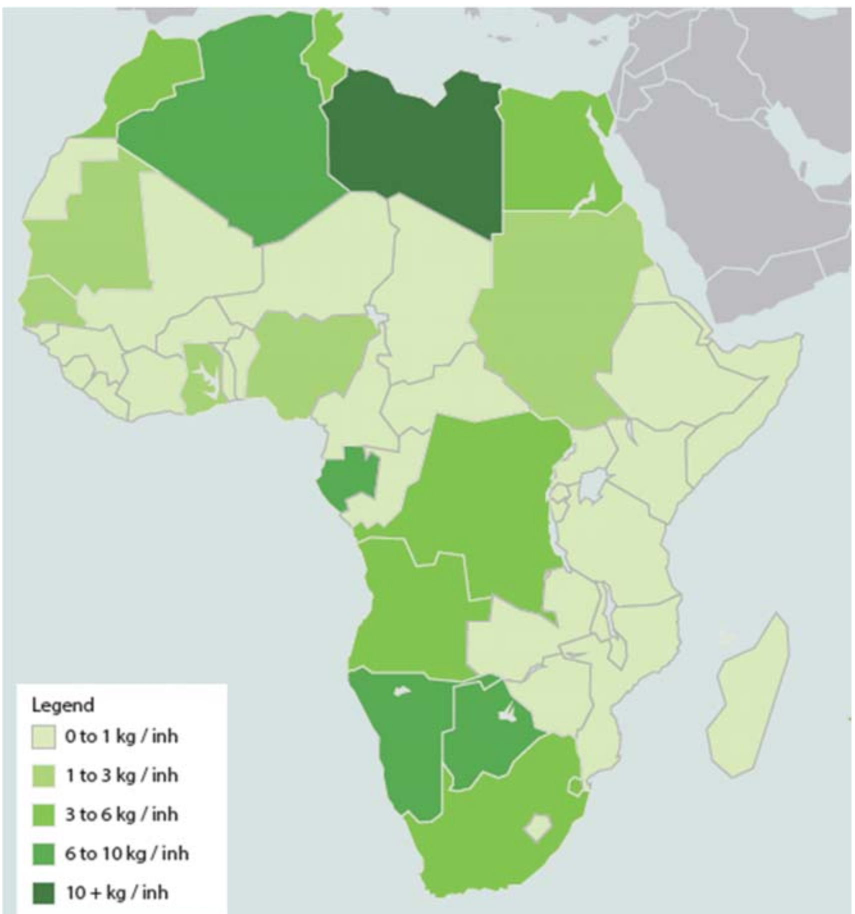


Figure 18: Estimated WEEE per capita generation in Africa

While WEEE can be a valuable source of secondary materials, it is also toxic if handled and discarded improperly.

In the last decade, the South African WEEE industry has become more integrated, formalised and diversified (Mintek, 2017). There are currently over a 100 companies formerly registered across the WEEE recycling chain from the point of collection to processing. The majority of companies are involved in the early stages of the value chain, particularly in collection, consolidation, dismantling and refurbishment activities.

Gauteng is currently the hub of WEEE collection, consolidation, pre-processing and processing in South Africa, handling approximately 55% of total volumes. The SADC region is however emerging as an important supplementary input to the South African recycling market.

For particular waste streams, such as lamps, the barriers to entry are high at the pre-processing and processing stages. Further to this, WEEE recycling is not seen as being profitable as a standalone business, which is why most small companies regard it as a secondary activity. This is the reason that most small companies also engage in refurbishment which is generally more profitable.

Approximately 17,773 t of WEEE was handled in 2015 by 27 firms in South Africa. ICT & consumer electronics made up the bulk of the waste stream (79%), which was sourced predominately from government departments (45%). These firms recovered mainly ferrous metals (47%), non-ferrous metals (16%), and printed circuit boards (PCBs).

However, while local firms are committed to process locally as far as possible, the complex fractions are exported, mainly to Europe and Asia. This includes 90% of PCBs, 60% of phosphor powders, and some ferrous and non-ferrous metals.

The local remanufacturing of WEEE plastics and glass in South Africa is also currently limited. For example, 80% of the 7,500 t of WEEE plastics produced in South Africa in 2015 was exported. With respect to glass, approximately 90% of the 800 t produced in 2015 (mainly lamps) was beneficiated locally, while the remaining 10% (mainly cathode ray tube glass) was landfilled.

3.6.2 Treatment Facilities

According to the national list of licenced waste management activities (SAWIC, 2018b), there are 111 licenced treatment facilities in South Africa.

In contrast there are approximately, 150 facilities registered on the SAWIS, and 62 facilities reporting.

Figure 19 presents the number of treatment facilities in each province. It can be seen that Gauteng has the highest number of facilities (26), followed by Western Cape (25), and Eastern Cape (14) and KwaZulu-Natal (12).

The majority of these facilities are licenced for the treatment of effluent, sewage or wastewater (71), followed by 26 licenced facilities for treatment of HCRW, and five (11) licenced facilities for the physical or physio-chemical treatment of waste. There are four (4) licenced composting facilities, and one licenced bio-gas installation.

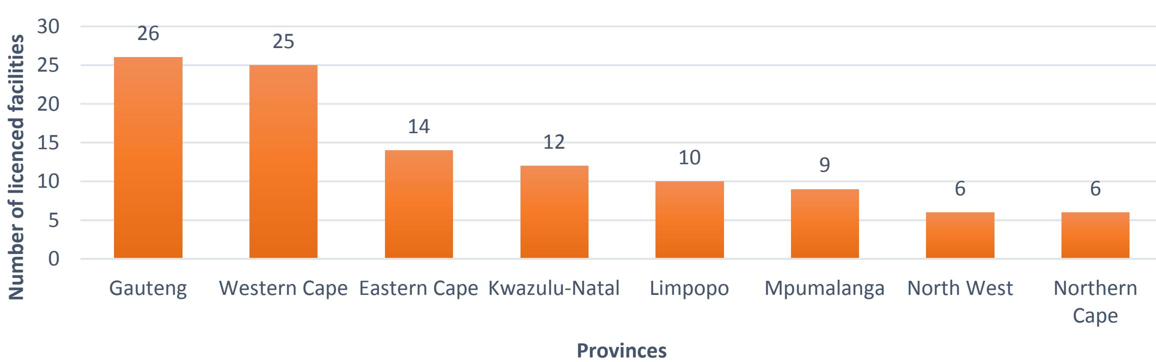


Figure 19: Number of waste treatment facilities per province

Wastewater Treatment Works

Sewage sludge is the main type of waste generated by wastewater treatment works (WWTW).

The classification of sewage sludge, either as general or hazardous, is dependent on if the microbiological content (pathogens), stability of the sludge, total metal content and/or polycyclic aromatic hydrocarbons (PAH) content exceed guideline limits. To a large extent, these factors are affected by the content of the effluent, sewage or wastewater being treated, design of the WWTW, and the effectiveness of the treatment process.

In South Africa, there are a total of 824 municipal and private WWTW (DWA, 2013), with a total hydraulic design capacity of 6,510 megalitres (Ml). In 2013, the total inflow into these WWTWs was 5,129 Ml, leaving a theoretical surplus 1,381 Ml or 22.2% as available for future demand.

Figure 20 presents the total number of WWTWs per province, as well as the total hydraulic design capacity (Ml/day), and total inflows (Ml/day). The Western Cape has the highest number of WWTWs (158) with the second highest total daily inflow (908 Ml/day). KwaZulu-Natal has the second highest number of WWTWs (158) with the third highest total daily inflow (715 Ml/day). In contrast, Gauteng has the second lowest number of WWTWs, with the highest total daily inflow (1085 Ml/day). This indicates that Gauteng has fewer number, but larger sized plants than the other provinces.

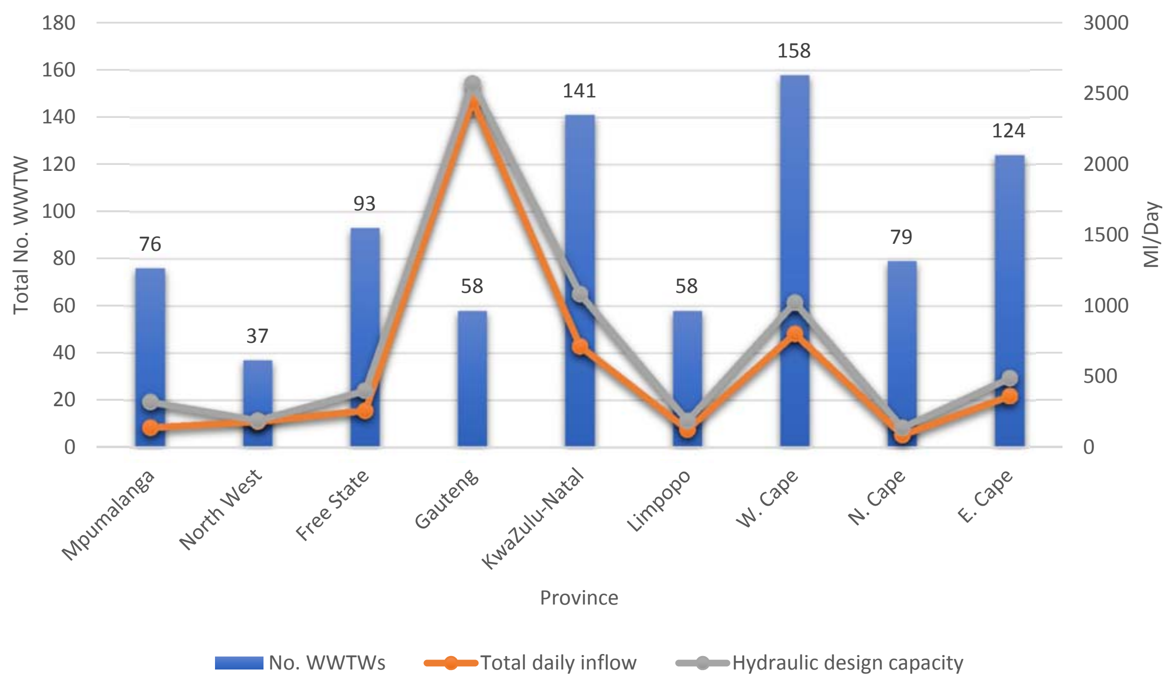


Figure 20: Number of WWTWs, total hydraulic design capacity and total inflows per province

Figure 21 presents a breakdown of the total number of WWTWs in terms of the hydraulic design capacity. The majority of WWTWs are small (0.5-2 Ml/day) and medium (2-10 Ml/day) sized, with a relatively lower number of large (10-25 Ml/day) and macro (>25 Ml/day) sized WWTWs. Only 19% of WWTWs are micro size (<0.5 Ml/day).

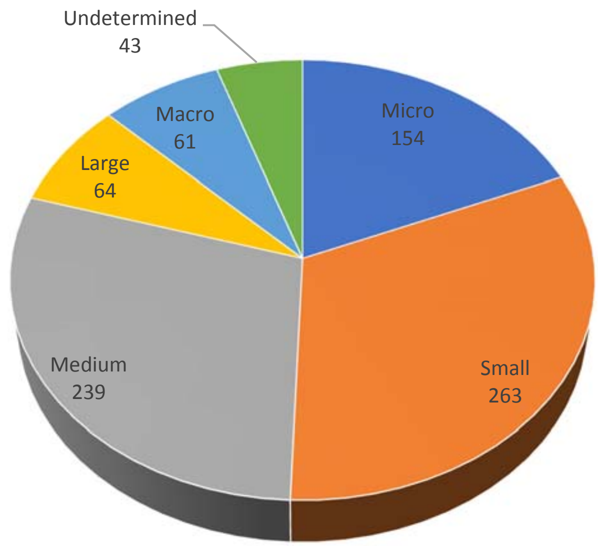


Figure 21: Breakdown of WWTWs in terms of hydraulic design capacity

Between 2009 and 2013, the DWA undertook a Green Water Services Audit and site inspection of all 824 WWTWs (DWA, 2013). These audits measure the performance of the WWTWs in terms of a number of key performance areas, including process control and maintenance skills, monitoring programme, submission of results, effluent quality compliance, risk management, local regulation, treatment capacity, and asset management.

Only 68 of the WWTWs audited (8.3%) were compliant in terms of effluent quality, with 348 WWTWs (42.2%) compliant in terms of local regulations.

HCRW Facilities

Health care risk waste (HCRW) is defined as "*waste which is produced in the diagnosis, treatment or immunization, of human beings or animals, or waste that has been in contact with blood, body fluids or tissues from humans or animals from veterinary practices.*" (DEA, 2014). It includes infectious materials, sharps, pharmaceutical wastes, pathological waste, laboratory waste, chemical waste and genotoxic waste.

HCRW is typically generated by households, and public and private health care facilities.

HCRW must be appropriately managed as it poses a risk to human health and environment due to its infectious and hazardous properties. This is one on of the main reasons that HCRW is required to be treated prior to final disposal at a landfill.

In 2017, there were 15 operational HCRW facilities (DEA, 2017). There are additional 17 licenced facilities that are not yet operational. These facilities are either under construction, installed but not operational, or construction has not yet started.

A total of 48,749 tonnes of HCRW was treated in 2017, 0.6% more than in 2015. The majority of the

HWRW was treated using non-burn technology (e.g. autoclave) (73%), and 27% using incineration.

Based on the design capacities provided by the treatment facilities, and the assumption that these facilities operate on average 24 days a month, the total design capacity is 85,169 t per annum. Given that 48,749 t of HCRW was generated in 2017, there was approximately 36,420 t or 43% spare capacity.

Biogas Installations

There are currently commercial-scale biogas installations in South Africa, the Bronkhorstspruit Biogas Plant and New Horizons Energy.

The Bronkhorstspruit Biogas Plant in Gauteng came into operation in 2015 (bio2watt, 2018). The plant uses approximately 120,000 t of manure a year as feedstock, to produce 4.6 MW of electricity and approximately 20,000 t of fertiliser.

Image source: bio2watt, 2017

New Horizons Energy Athlone in situated in the Western Cape. It is a MRF which accepts between 500 and 600 t of general waste per day (GreenCape, 2017). The waste is separated into various factions, including organics, recyclables, and non-recyclables, as shown in Figure 22. The organics are then fed into the anaerobic digester, which produces biomethane and liquefied food grade carbon dioxide.

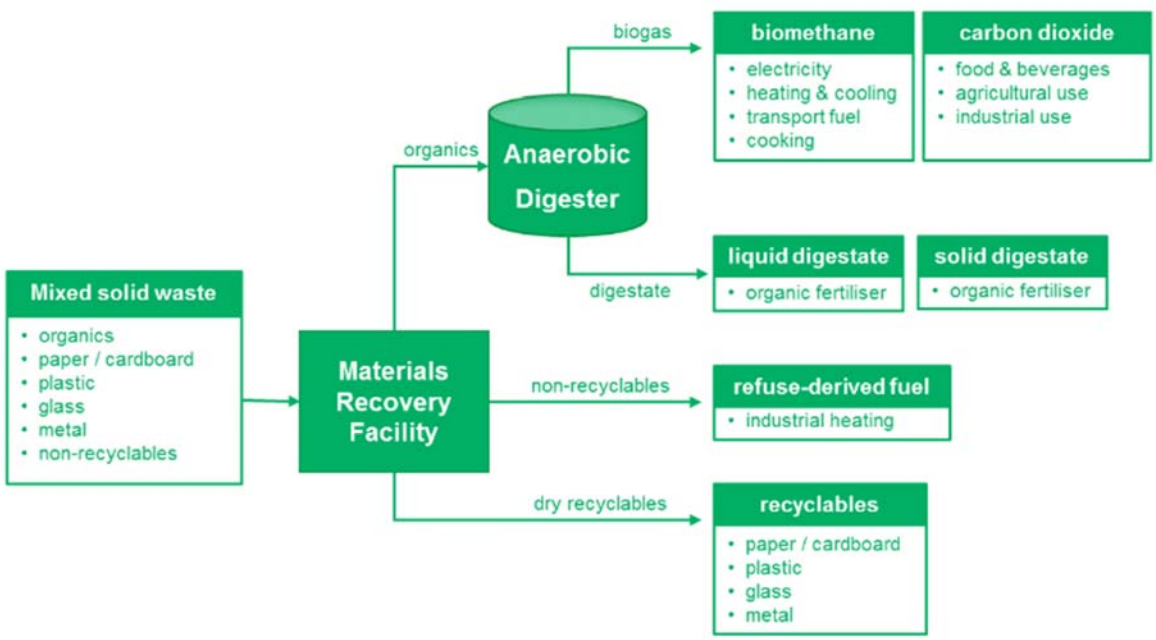


Figure 22: Process diagram of New Horizons Energy

Composting

There are generally four types of composting technologies used in South Africa and internationally (DEA, 2013). This includes:

- **Minimal technology:** static piles (no aeration);
- **Low technology:** compost bins or barrels, turned windrows, and vermicomposting;
- **Medium technology:** aerated static piles, turned windrows, anaerobic composters;
- **High technology:** turned or agitated bays or beds, anaerobic in vessel units; and
- **Low to high technology:** anaerobic Fermentative Composting.

3.6.3 Treatment and Disposal Facilities

According to the national list of licenced waste management activities (SAWIC, 2018b), there are 791 licenced treatment facilities in South Africa.

In contrast there are approximately, 611 facilities registered on the SAWIS, and 280 facilities reporting

Figure 23 presents the number of treatment facilities in each province based on the SAWIS database. Gauteng has the highest number of disposal facilities (142), followed by KwaZulu-Natal (113), Western Cape (106), and Northern Cape (105). It can be seen that, followed Gauteng (144) and Northern Cape (127).

The majority of these licenced facilities are dump sites or landfills that can be used by the public (473), followed by 269 onsite dump sites or landfills that are typically not accessible to the public, and 49 onsite storage facilities.

Note that this excludes facilities that are licenced depots or transfer stations that only temporarily store waste. It is estimated that there are 123 of such licenced facilities.

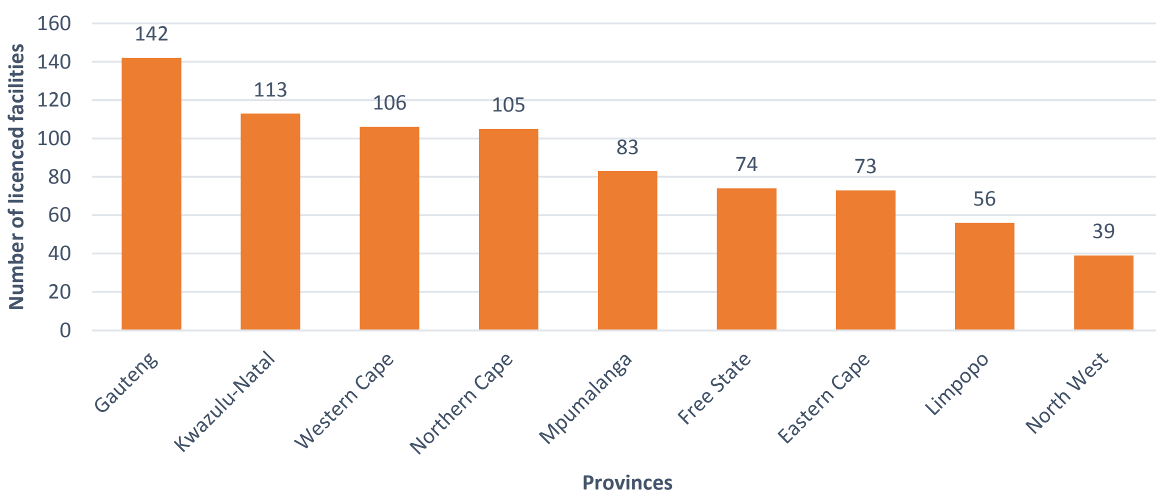


Figure 23: Number of waste treatment facilities per province

Landfills

In South Africa, the types of waste that can be disposed of at a landfill is dependent on the barrier requirements or liner of the landfill.

Table 6 presents the details of the waste acceptance criteria for landfill disposal to four classes of landfill according to GN R 636.

Table 6: Waste acceptance criteria for landfill disposal

<table>
<tr><th colspan="2">A. Waste Assessed in terms of GN R 635</th></tr>
<tr><td>Waste Type</td><td>Disposal Requirements</td></tr>
<tr><td>Type 0 Waste</td><td>Disposal not allowed – waste must be treated and re-assessed.</td></tr>
<tr><td>Type 1 Waste</td><td>Dispose only at a new Class A landfill, or existing Hh/HH landfill.</td></tr>
<tr><td>Type 2 Waste</td><td>Dispose only at a new Class B landfill, or existing GLB^{+} landfill.</td></tr>
<tr><td>Type 3 Waste</td><td>Dispose only at a new Class C landfill, or existing GLB^{+} landfill.</td></tr>
<tr><td>Type 4 Waste</td><td>Dispose only at a new Class D landfill, or existing GLB^{-} landfill.</td></tr>
<tr><th colspan="2">B. Pre-classified Wastes</th></tr>
<tr><td>General wastes</td><td>Disposal Requirements</td></tr>
<tr><td>Domestic waste; Business waste not containing hazardous waste/chemicals; Non-infectious animal carcasses; Garden waste.</td><td>Dispose only at a new Class B landfill, or existing GLB^{+} landfill.</td></tr>
<tr><td>Post-consumer/Waste packaging; Waste tyres.</td><td>Dispose only at a new Class C landfill, or existing GLB^{+} landfill.</td></tr>
<tr><td>Building and demolition waste and Excavated earth material not containing hazardous waste/chemicals.</td><td>Dispose only at a new Class D landfill, or existing GLB^{-} landfill.</td></tr>
<tr><td>Hazardous wastes</td><td>Disposal Requirements</td></tr>
<tr><td>Asbestos Waste; PCB Waste or PCB containing waste (>50 mg/kg or 50 ppm); Expired, spoilt or unusable hazardous products; General waste (excl. domestic), containing hazardous waste/chemicals; Mixed, hazardous chemical wastes from analytical laboratories, and laboratories from academic institutions in containers <100 litres.</td><td>Dispose only at a new Class A landfill, or existing Hh/HH landfill.</td></tr>
</table>

The majority of waste in South Africa is still landfilled. Given the reliance on landfilling as a management option for the foreseeable future, the remaining capacity (airspace) of the existing landfills is an important consideration.

Figure 24 presents the estimated remaining landfill airspace of some of South Africa's largest municipalities (SACN, 2014). It shows that the City of Cape Town and City of Johannesburg only have five and eight years of landfill airspace remaining respectively. There is therefore an urgent need in these municipalities to divert waste away from these landfills in order to prolong their lifespan. In looking at landfill airspace remaining, it is also important to consider the location of the landfills. For example, in eThekwini the Buffelsdraai (65 years remaining) and Lovu landfills (25 years remaining), which account for the majority of the remaining landfill airspace, are located well away from the densely populated urban areas, greatly increasing the distance and resulting costs of rendering regular waste collection service (eThekwini Municipality, 2016).

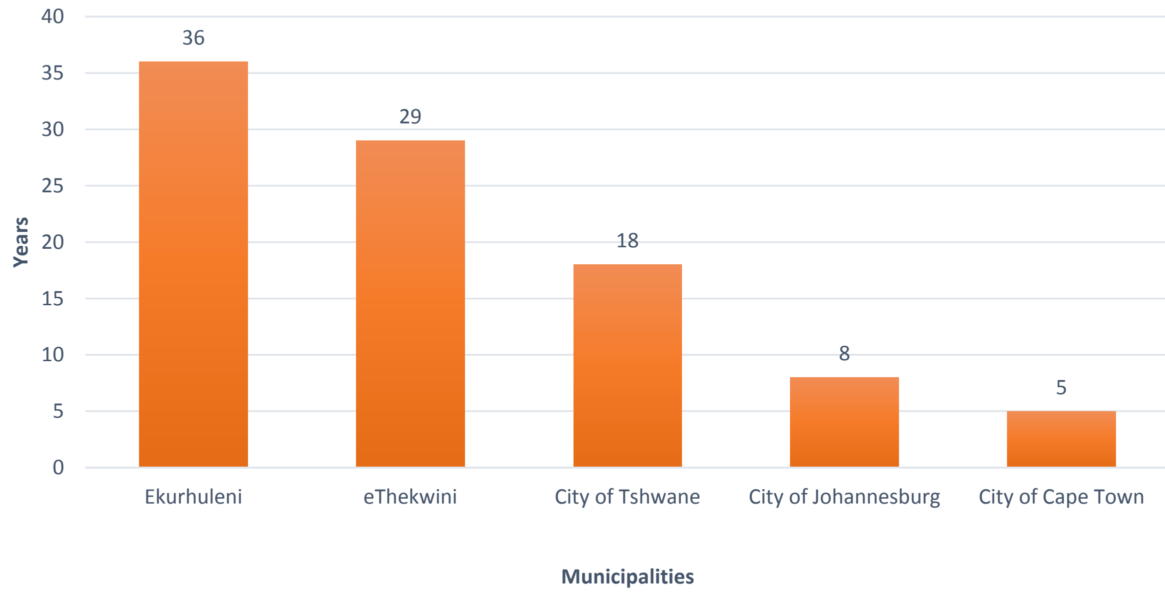


Figure 24: Estimated remaining landfill airspace of South Africa's largest municipalities

In terms of the *Waste Management Activities List* (RSA, 2013b), a WML is required for landfill sites disposing of any quantity of hazardous waste, in excess of 25 tonnes of inert waste to land, and/or general waste to land covering an area of more than 50m^2.

There has in recent years be a drive by the DEA to licence all existing landfills in South Africa. Table 7below presents a summary of the licencing status of storage, treatment and landfill facilities in South Africa (DEA, 2015).

Table 7: Licencing status of storage, treatment and landfill facilities in South Africa

Type of Facility	Total Number of Facilities	Number of Licenced Facilities	Number of Unlicensed Facilities	Percentage of Unlicensed Facilities
General waste landfill site	990	432	558	56.4
Hazardous waste landfill site	161	86	75	46.8
HCRW storage facility	25	0	25	100
Recycling facilities	198	44	154	77.8
Transfer stations	264	88	176	65.7
TOTAL	**1548**	**675**	**873**	**56.4**

3.7 STATUS OF LEGAL COMPLIANCE

While there is an urgent need to address the licensing status of waste management facilities in South Africa, there is also a need to ensure that the conditions of the WMLs are enforced.

3.7.1 Contraventions

According to DEA (2016), there are a number of waste management facilities with WMLs that are not complying with the conditions of those licences, resulting in poor levels of operation and negative impacts on human health and the environment.

Figure 25 Figure 25 presents the number of contraventions of the NEM:WA in 2016/2017 and the relevant authority (DEA, 2017b). In total, 186 contraventions were recorded, with DEA recording the highest number (89), followed by Gauteng GDARD (39), Limpopo DEDET (20), North West DEDECT (14) and KwaZulu-Natal DEDTEA (11).

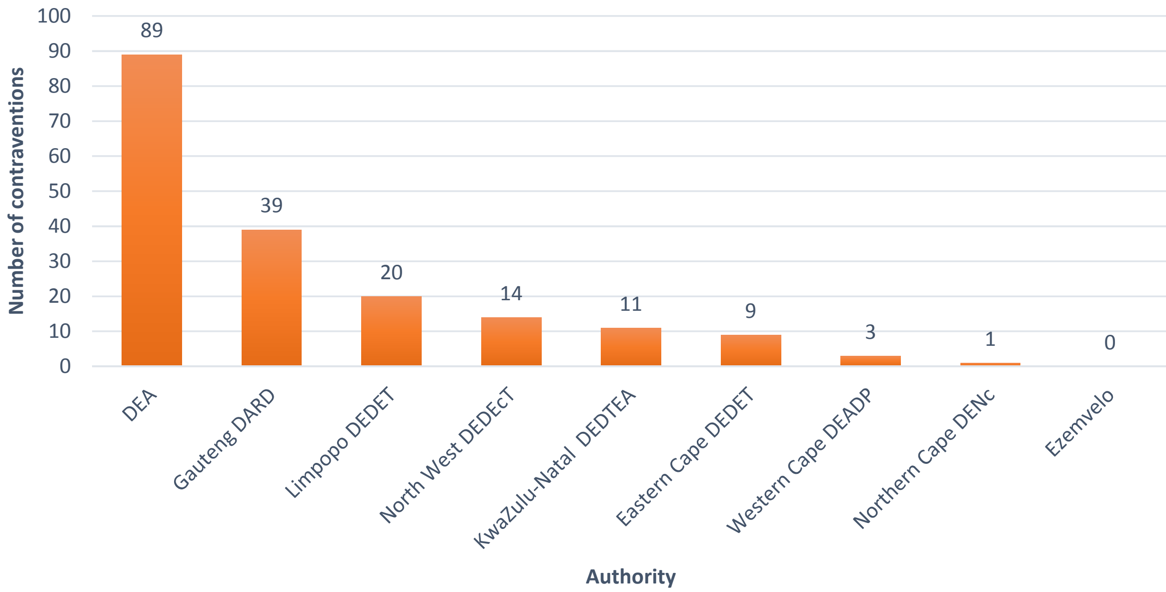


Figure 25: Number of NEM:WA contraventions in 2016/2017

3.7.2 Environmental Management Inspectors

The Environmental Management Inspectors (EMIs) are the officials appointed to carry out environmental compliance and enforcement functions in terms of the NEM:WA, and other relevant national and provincial legislation and local authority by-laws (DEA, 2017b).

These EMIs represent environmental compliance and enforcement capacity in South Africa. Figure 26 presents the number of national, provincial and local EMIs, as well designated EMIs, from 2015 to 2017 (DEA, 2017b). In total, the number of EMIs has increased from 2,294 in 2015 to 2,880 in 2017.

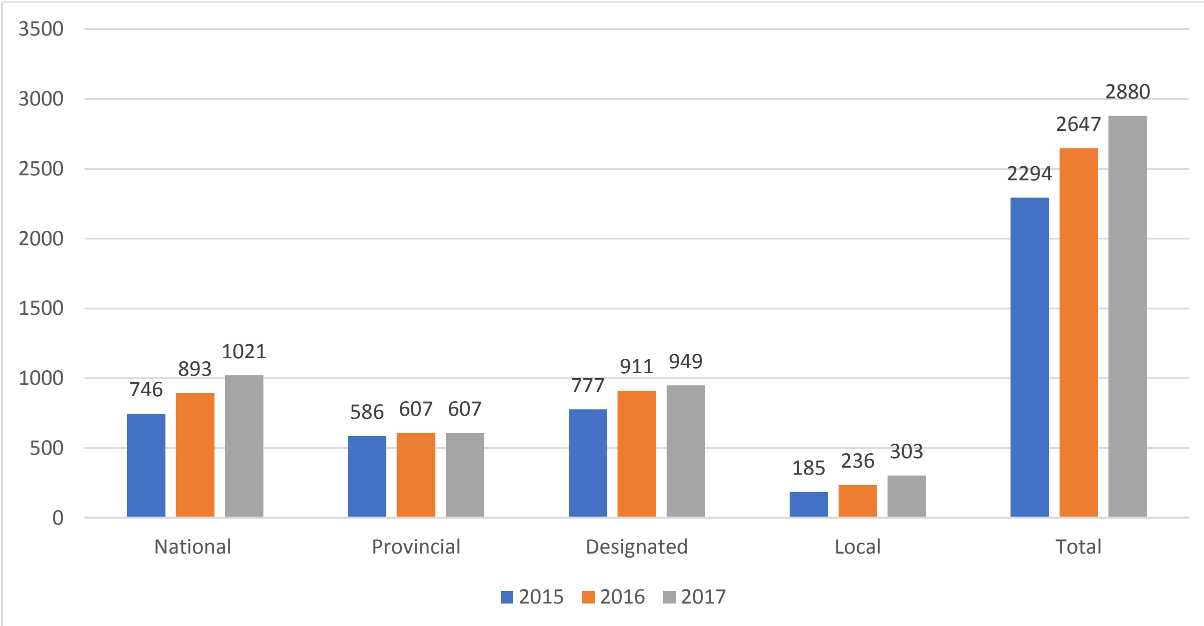


Figure 26: Total number of EMIs from 2015 to 2017

3.7.3 Inspections

Compliance monitoring inspections are undertaken by the EMIs to determine whether or not, facilities are compliant with the conditions of their licence. Figure 27 presents the total number of inspections undertaken in 2016/2017 by each authority / institution (DEA, 2017b). It should be noted that this includes inspections undertaken for the pollution and EIA sub-sectors, as well as waste.

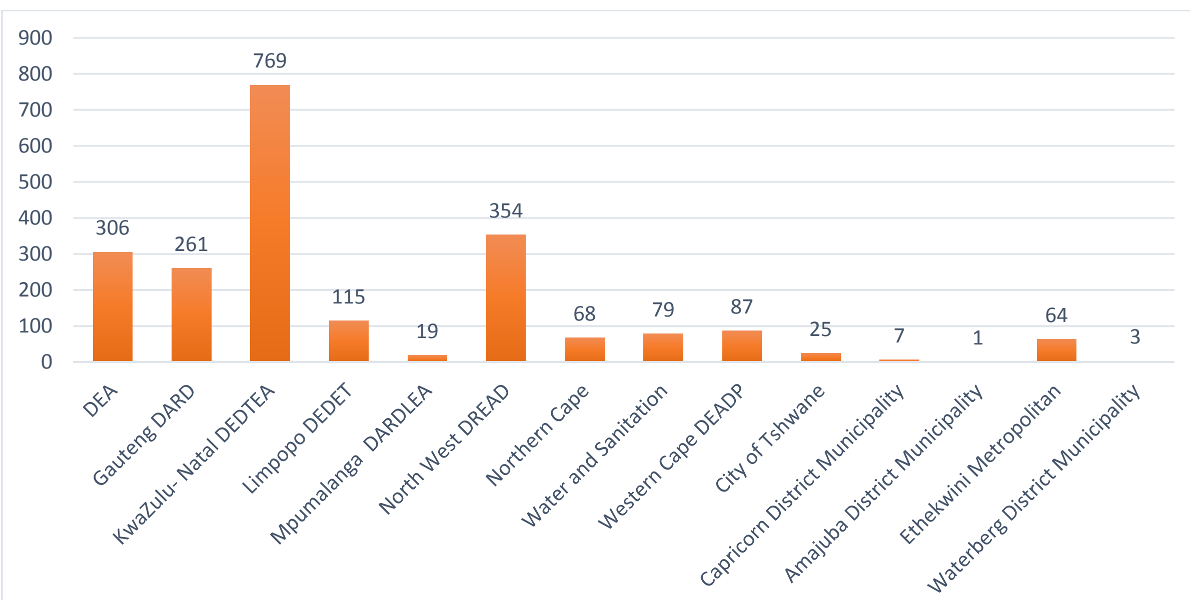


Figure 27: Number of compliance inspections in 2016/2017

3.7.4 Compliance Issues

A survey of relevant national and provincial authorities was undertaken to better understand the most common non-compliance issues encountered in the implementation of the provisions of the NEM:WA. This included:

- Lack of access control at landfill sites;
- Burning of waste;
- Inadequate daily compaction and cover at landfill sites;
- Littering and illegal dumping;
- Non-compliance with conditions of WMLs;
- Lack of dedicated staff at landfill sites; and
- Dumping of hazardous waste at general waste landfill sites.

3.7.5 SAWIS

The SAWIS was established between 2004 and 2006 with the aim of creating a single, national repository of accurate and reliable tonnages of general and hazardous waste recycled, recovered, treated and landfilled, as well as tonnages of waste exported.

With the promulgation of the *National Waste Information Regulations* in 2012, any person undertaking an activity listed in Annexure 1 must register on the SAWIS, and once registered, submit information on a quarterly basis. Note that generators of hazardous waste are currently only required to be registered on the SAWIS, but not to submit information.

Based on the most recent information downloaded from the SAWIS, there are 1,396 registered waste management sites. Note that this excludes the 10,419 registered generators of hazardous waste. Despite the requirement to submit information on a quarterly basis, by the 18 April 2018, only 535 sites had submitted the required information (38.3%) compliance rate.

4 Chapter 4

Impacts

Impacts resulting from the state of waste generation and management in South Africa

4.1 INTRODUCTION

The following section presents a brief summary of the key impacts resulting from the changes in the state of waste generation and management in South Africa (see Chapter 3), and as a result of the driving forces and pressures identified in Chapter 2. This includes:

- Air quality;
- Water quality;
- Land contamination;
- Land use; and
- Informal sector.

It is important to note that the focus will primarily be on impacts associated with landfills as this is still the most commonly applied waste management option in South Africa.

4.2 AIR QUALITY

In terms of air quality, there are main sources of air pollution that can potentially impact negatively human health, but also the environment.

4.2.1 Landfills

Landfill gas is primarily produced in a landfill site by the decomposition of organic waste under anaerobic conditions (in the absence of oxygen) (DME, 2004). These anaerobic conditions are created by the spreading, compaction and covering of the waste. The production of landfill gas is therefore not only a function of tonnage of waste, but also the organic content.

Landfill gas is a complex mixture of gases, comprising approximately 40-60% methane, 40-50% carbon dioxide, 2-5% nitrogen, and <1% volatile organic compounds (Pitchel 2005).

The continuous generation of landfill gas results in a build-up of landfill gas pressure, and the permeation of these gases towards the surface. Typically, the build of gases in a landfill is controlled by active gas extraction using a centrifugal blower and flaring (burning of the gas).

Landfill sites have been identified as one of the largest contributors to global Greenhouse Gas (GHG) emissions. In South Africa, it is estimated that landfills produce approximately 43 million m^3 of methane gas per year (DME, 2004) or 595 550 tonnes of carbon dioxide equivalent.

In addition to methane, carbon dioxide and nitrogen, landfill gases also toxic volatile organic compounds.

It is estimated that landfill gas can contain up to 200 compounds. Of these, the constituents of concern, due to potential impact in human health, include various carcinogens (e.g. benzene, carbon tetrachloride, methylene chloride, chloroform) and several non-carcinogenic toxins (e.g. phenols, chlorobenzene, tetrachloroethylene) (DEA, 2016).

Landfill sites also produce highly odorous compounds, which can result in a nuisance impact. The compounds that have been found to be highly odorous include hydrogen sulphide, carboxylic acids (including butyric acid and propionic acid), limonene, xylene, ethyl benzene, propyl benzenes and butyl benzenes (DEA, 2016).

4.2.2 Incineration

The emission rate of an incinerator is a function of the fuel usage, waste composition, incinerator design, and operating conditions (DEA, 2016).

Incinerators emissions are generally grouped into the following four categories:

1. Criteria gases (e.g. sulphur dioxide, oxides of nitrogen, carbon monoxide, lead and particulates);
2. Acid gases (e.g. hydrogen chloride, hydrogen bromide, hydrogen fluoride);
3. Metal gases (e.g. chromium, arsenic, cadmium, mercury, manganese and so on.); and
4. Dioxins and furans (e.g. polychlorinated dibenzo-p-dioxins and dibenzo furans).

Due to the rate of emissions and range of pollutants emitted from incinerator operations, it has been proposed that they are treated as 'toxic hotspots' for air quality management purposes.

4.2.3 Wastewater Treatment Works

As with landfills, WWTW are potential source of volatile organic compounds. Of the compounds measured at WWTWs in South Africa, the most odorous include hydrogen sulphide, mercaptans, ammonia, and the various fatty acids (butyric, propionic, valeric and acetic) (DEA, 2016).

While there is currently no conclusive evidence that human health is seriously affected by odour, odour impacts have been known to trigger secondary effects such as nausea, vomiting, loss of appetite, sleeplessness, and triggering of hypersensitivity reactions (DEA, 2016).

Further to this, odour impacts can potentially be source of community discontent, and negatively affect property values and development.

4.3 WATER QUALITY

Leachate arises from the water content of the waste disposed at the landfill site and the rain that percolates through the cover layers, accumulating in the waste (Blight, 2011). As a consequence, landfills in wetter climates or with large quantities of waste with a high-water content generate more leachate than those in dry climates. In very dry climates, landfills may generate no leachate.

The characteristics of the leachate are dependent on a number of factors, including the waste composition, age of the waste, degree of composition, and local climate (DWA, undated).

As the leachate carries dissolved and suspended contaminants from the waste, it can if not properly managed, contaminate surface and groundwater, posing significant risk to human health and the environment.

In order or prevent or prevent the impact of leachate on surface and groundwater water, new landfills now have to be designed in accordance to *National Norms and Standards for Disposal of Waste to Landfill* (2013).

4.4 LAND CONTAMINATION

In South Africa, contaminated land means "*the presence in or under any land, site, buildings or structures of a substance or micro-organism above the concentration that is normally present in or under that land, which substance or micro-organism directly or indirectly affects or may affect the quality of soil or the environment adversely*" (RSA, 2008).

Some of the main sources of land contamination include past and present industrial and commercial activities, and the treatment and disposal of waste

(EC, 2013). There are generally two types of soil contamination; local soil contamination and diffuse soil contamination covering large areas.

Local soil contamination occurs where intensive industrial activities, mining, inadequate waste disposal, and accidents have introduced excessive amounts of contaminants (EC, 2013). While soils are able to process some of these contaminants, once this ability is exceeded, the risk of issues, such as water pollution, human contact with polluted soil, and plants taking up contaminants increases.

Table 8 presents chemicals of public health concern that potentially relate to soil, and which could potentially result from inadequate waste storage, treatment and disposal activities (EC, 2013). For each chemical, the main sources or uses, human exposure pathway, and health effects are listed.

Table 8: Chemicals of major public health concern

Chemical of concern	Sources/uses	Human exposure	Health effects
Asbestos	Historically used for construction and product manufacture.	Exposure occurs when asbestos containing material (ACM) is crumbling or disturbed. The main route of entry is inhalation, but can also be ingested or lodged in the skin.	Inhalation can cause parenchymal asbestosis, asbestos-related pleural abnormalities, lung carcinoma, and pleural mesothelioma. Health effects may not emerge for decades, but lung cancer and pleural mesothelioma have high mortality rates.
Cadmium	Zinc smelting, mine tailings, or waste containing cadmium.	Cadmium can accumulate in plants and animals that enter the human food chain.	Liver and kidney damage, and low bone density.
Dioxin	Waste incineration, reprocessing metal industry, paper and pulp industry, and stored PCB-based industrial waste oils.	Human exposure to dioxin and dioxin-like substances occurs mainly through consumption of contaminated food.	Dioxins are highly toxic and can cause reproductive and developmental problems, damage the immune system, interfere with hormones and also cause cancer.
Lead	Batteries, mining, and leaded fuel		Neurological damage, lowers IQ and attention, hand-eye co-ordination impaired, encephalopathy, bone deterioration, hypertension and kidney disease.
Mercury	Fluorescent light bulbs, lamps, batteries, thermometers, mining (particularly artisanal/small scale gold mining), pesticides, medical waste etc.	Main exposure route for the population at large is via eating contaminated seafood.	Central nervous system (CNS) and gastric system damage, affects brain development, resulting in a lower IQ, affects co-ordination, eyesight and sense of touch, liver, heart and kidney damage, and teratogenic.

4.5 LAND USE

Due to the negative impacts associated with waste storage, treatment and in particular disposal sites, the surrounding land uses can be limited. This includes potential impacts such as traffic, noise, visual, dust and odour.

Air quality impact assessments for large hazardous and general landfill sites in South Africa have indicated that DEA, 2016):

- Significant health risks associated with the constituents of concern are generally restricted to within 500 m of the boundary if the site is well managed; and
- Odour impact distances can vary between 200 m and 5 km depending on the management of the landfill site.

This means that the use of land surrounding landfill sites is limited as it should ideally not be used for residential, commercial or institutional land uses.

Further to this, due to large amounts and longevity of the waste, the impacts associated landfills extend long after the site has been closed and rehabilitated (DEADP, 2017).

4.6 LITTERING AND ILLEGAL DUMPING

In South Africa, littering and illegal dumping is relatively common, particularly in the urban areas.

The illegal dumping of waste, in particular hazardous waste, poses significant risk to human health and the environment.

Litter is often carried by stormwater systems and streams into the rivers, and in the coastal areas, into the ocean, where it can impact negatively on freshwater and marine life.

Litter and illegal dumping is also unsightly, and can detract from the aesthetic value of the area.

Littering and illegal dumping are symptomatic of inadequate awareness or education, and waste collection service. It is also a major indicator of an area that is in decline or disorder (DEADP, 2017).

5 Chapter 5

Responses

Actions taken to mitigate or prevent the impacts resulting from the state of waste generation and management in South Africa

5.1 INTRODUCTION

This final chapter presents some of the main actions or responses currently being undertaken to mitigate or prevent the impacts identified in Chapter 4. In some cases, these responses also address the driving forces and pressures which affect the state of waste generation in South Africa.

The purpose of this section is to provide a broad overview of some of the key responses that is or likely to have a significant on the state of waste in South Africa. It is therefore not a comprehensive catalogue of all the current or future actions.

The actions or responses are grouped under the following headings:

- Legislative instruments;
- Compliance and enforcement;
- Economic instruments; and
- Priority wastes.

5.2 LEGISLATIVE INSTRUMENTS

This section of the report provides context to the changing face of South Africa's legislative landscape that has led to the current state of waste.

Figure 28 depicts the past two decades of pertinent legislation, policies and plans from a high-level perspective that has shaped the waste industry in South Africa over the past 30 years.

Figure 28: Legislative timeline leading to the SoWR

5.2.1 Acts regulating Environmental and Waste Management

South Africa's first legal framework document governing the disposal of waste in South Africa was the Environmental Conservation Act, 1989 (Act No. 73 of 1989) (ECA). The ECA required any type of waste facility, including transfer stations, storage facilities and recycling plants etc., to be regarded as a disposal site for which a Section 20(1) ECA permit was required.

For the next decade, no other legislation in South Africa controlled the permitting of waste facilities, despite waste managers becoming more resourceful in their search for cleaner technology solutions by establishing waste recycling and treatment plants, composting sites, storage areas, transfer stations, and incinerators etc. Even the Minimum Requirements (i.e. Minimum Requirements for the Waste Disposal by Land Second Edition, and the Minimum Requirements for Handling, Classification and Disposal of Hazardous Waste Second Edition), which were developed in 1998 and known to be the only guiding document regarding waste disposal for many years, only applied to landfill development in Southern Africa, and had limited applications to other waste technology solutions.

In the same year, the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) was developed to provide a progressive way to enforce, administer and govern environmental management legislation, as the ECA (NEMA's predecessor) was considered largely unsuccessful and inadequate as the environmental management legislation in South Africa. The fundamental guiding principles of NEMA include, amongst others, the concepts of "polluter pays", "cradle to grave", "precautionary principle" and "waste avoidance and minimisation." When the NEMA came into effect, a legal framework started to develop around non-landfill waste technologies.

The principles and provisions of the NEMA lead to the National Environmental Management: Waste Act 2008 (Act No. 59 of 2008) (NEM:WA), which is a waste specific environmental management act. When NEM:WA commenced on 1 July 2009, it was the first comprehensive act to regulate waste management in a proactive way in South Africa. The previous procedures for the permitting of waste sites in terms of Section 20 of the ECA were replaced by various provisions in the NEM:WA. In terms of the NEM:WA, all listed waste management activities must be licensed through an integrated environmental impact assessment (EIA) process. All provisions made in NEM:WA took effect in 2009, with the exception of: voluntary Industry Waste Management Plans (IndWMPs); the application process for waste management licences (WMLs); and the remediation of contaminated land. The NEM:WA promotes the principles of the waste hierarchy, which is an international and best practice waste management approach that has been adopted in South Africa.

Since waste management was first regulated in terms of NEM:WA, certain aspects required attention, and additional needs arose as some concepts of the NEM:WA were seen to be ambiguous and inadequate. The National Environmental Management: Waste Amendment Act (No. 26 of 2014) (NEM:WAA) came into effect on 2 June 2014 in order to rectify the shortcomings of the NEM:WA. Amongst other things, the NEM:WAA included a comprehensive definition of "waste." It also included a definite "end of waste status" by opening up more opportunities for the recycling market, and amends the terms "reuse" and "recovery".

5.2.2 Regulations Environmental and Waste Management

Since NEM:WA first took effect, there have been rapid amendments and improvements in waste management governance as the legal framework started to develop around non landfill technologies. The subsections below, highlight in chronological order, some pertinent regulations regarding waste management in recent years.

National Waste Information Regulations

The National Waste Information Regulations, 2012 (GN R. 635) (NWIR) was implemented on 1 January 2013. The purpose of the NWIR was to regulate the collection of data and information on waste management in South Africa in order to fulfil the objectives of the national waste information system as set out in NEMWA.

As a result of NWIR, the South African Waste Information System (SAWIS) was developed to provide a reporting framework for generators, recyclers, exporters and disposers of waste. It has proved to be a useful tool to inform waste management decisions by requiring the registration of new waste activities and submission of quarterly information on the website. However, as mentioned previously in Section 3.7.5, SAWIS is yet to be used comprehensively and diligently by waste managers as challenges remain in the implementation and enforcement of the NWIR

Waste Classification and Management Regulations

Historically, waste streams were classified according to the Minimum Requirements (see Section 5.2.1). The Minimum Requirements provided a national framework for waste management in South Africa. The Waste Classification and Management Regulations (GNR. 634 of 2013) (WCMR) were promulgated on 23 August 2013 and replaced the Minimum Requirements. The WCMR was promulgated in terms of the NEM:WA with the following associated norms and standards, which again were largely focused around disposal of waste to landfill:

- National Norms and Standards for the assessment of waste for landfill disposal (GNR.635 of 2013); and
- National Norms and Standards for disposal of waste to landfill (GNR. 636 of 2013) including detail on the barrier design based on the classification of the material.

List of Waste Management Activities, Norms and Standards

Around the same time in 2013, as the norms and standard were developed to better regulate waste disposal to landfill, regulations developed around non-landfill waste management solutions.

On 29 November 2013, GN R. 921 was published, replacing GN R. 718 of 2009. GN R. 718 provided the original list of waste management activities requirement a WML to operate when it was promulgated on 3 July 2009. It included the storage of waste in the list of waste activities requiring a WML in terms of Category A (activities requiring a Basic Assessment), and Category B (activities requiring a full scoping and EIA process).

However, in terms of the GN R.921, waste activities requiring a WML are divided into Category A, Category B, and Category C; where Category C activities need to be registered with the Department and comply with specific requirements, such as the Norms and Standards for Storage of Waste (GN 926 of 29 November 2013).

The National Norms and Standards for the Storage of Waste applies to general waste storage facilities and hazardous waste storage facilities that have the capacity to store, continuously, more than 100 m^3 of general waste or 80 m^3 of hazardous waste, respectively. It is only applicable to new facilities that have not yet been constructed.

Since 2013, when the norms and standards were promulgated for the storage of waste (and removed from the list of activities requiring a WML), further norms and standards have been drafted and introduced demonstrating the rapid change in South African legal framework promoting alternative uses and technologies in waste management.

On 11 October 2017, the National Norms and Standards for the Sorting, Shredding, Grinding, Crushing, Screening and Bailing of General Waste (GN R 1093) was promulgated with the concurrent removal of this activity from the list of waste management activities requiring a WML i.e. Category A3(2) of GN R 921.

Last year, GN 528 was issued on 2 June 2017 for comment in terms of the NEM:WA. The purpose of GN R 528 is to make regulations to exclude waste streams from the definition of waste namely, waste slag from ferrochrome metallurgy; waste ash from combustion plants; and waste gypsum from pulp, paper and cardboard production and processing. The regulations state that where a waste stream has been excluded from the definition of waste, that waste may be recovered or treated prior to use without a WML; and the negative impacts must be mitigated according to certain duty of care principles, and norms and standards.

5.2.3 Plans and Strategies in Waste Management

Long-term plans and strategies have developed in recent years, in order to address key issues, needs and problems experienced with waste management in South Africa.

Integrated Waste Management Plan

The development of an Integrated Waste Management Plan (IWMP) is a requirement for all spheres of government responsible for the waste management in terms of the NEM:WA. The IWMP is a tool for government to properly plan and manage waste within its jurisdiction. The minimum requirements for an IWMP are set out in Section 11(4) of the NEM:WA.

Local and district municipalities are required to submit their IWMPs to the relevant provincial department for approval, and to ensure that the IWMPs are included in their Integrated Development Plans (IDPs). IWMPs are five-year plans, which are generally reviewed annually. Table 9 presents the current status of IWMPs in South Africa per type of municipality (DEA, 2013).

Table 9: Number of IWMPs in South Africa (adapted from DEA, 2013:300)

Province	District Municipalities	Local Municipalities	Metropolitan Municipalities	Total
Limpopo	6	17	-	23
Gauteng	2	6	1	9
Western Cape	3	26	1	30
Mpumalanga	3	5	-	8
North West	4	2	-	6
Northern Cape	4	12	-	16
Eastern Cape	6	29	1	36
Free State	5	7	-	12
KwaZulu-Natal	8	41	1	50
			TOTAL	**190**

National Waste Management Strategy

The NWMS was first published in 1999, and was approved by cabinet in November 2011. Currently the DEA is preparing the third NWMS, which is due to be published at the end of 2018. The purpose of the NWMS is to achieve the objects of the NEM:WA. The NWMS has eight goals, which organs of state and affected persons are obliged to give effect to and achieve.

This SoWR aims to align with the third NWMS and thereby provide accurate and credible information regarding the existing waste management practices for realistic and achievable goals to be set in the NWMS.

5.2.4 Fiscal Drivers

Creating financial incentives and disincentives in respect of waste management behaviour by applying waste management charges, is understood worldwide, to be the most effective way of reducing waste and improving levels of re-use, recycling and recovery.

The drive towards recycling comes at a cost, and is ultimately borne by the consumers of the product, as taxes are proposed for the disposal of waste going to landfill, and levies are imposed by government or industry to the cost of production.

Pricing Strategy

The National Pricing Strategy for Waste Management (NPSWM) is a legal requirement of the NEM:WAA and gives effect to the NWMS through economic instruments and an extended producer responsibility. It was published on 11 August 2016 and due to be promulgated imminently.

It is aimed at reducing waste generation and increasing the diversion of waste away from landfill towards reuse, recycling and recovery to support the growth of the South African secondary resources economy from waste.

The NPSWM looks at both upstream and downstream economic instruments. The downstream economic instruments look at volumetric tariffs ("pay-as-you-throw" approach) and includes landfill taxes for waste disposal to landfill. The upstream economic instruments focus on the extended producer responsibility and international best practice in waste management.

Implementation of the pricing strategy is dealt with in more detail in Section 5.4.

Plastic Bag

South Africa introduced a plastic bag levy in 2004 in an attempt to reduce plastic bag consumption. Following the initial short-term drop in plastic bag consumption in 2004, South African got accustomed to paying for plastic bags and the demand began to increase again. The plastic bag levy did not appear to change consumer behaviour or plastic waste production. As a result, in 1 April 2018, the Plastic bag levy increased by staggering 50% to 12 cents per bag in a further effort to change conscious consumerism of plastic bags.

Tyre Levy

The tyre levy was effective since 1 February 2017 and remains the same at a rate of R 2.30/kg per tyre. It is payable by manufacturers and the rate is set irrespective of the tyre's previous use and irrespective of whether the tyre was imported or manufactured locally. The levy is earmarked for recycling and is payable in addition to any existing customs and excise duty payable on the import/export of such tyres.

Proposed Landfill Tax

The DEA is currently undertaking a study into the role of regulatory policy instruments on recycling targets and banning of the disposal of certain types of waste to landfill. The study includes a review of the existing general waste management fees and landfill tariffs by assessing the full costs of waste management and charges to discourage landfilling of waste; as well as, the feasibility of a disincentive landfill disposal tax to complement the existing landfill fees and discourage the disposal of waste to landfill.

5.3 COMPLIANCE AND ENFORCEMENT

In order to realise the desired outcomes of the legal instruments described in the preceding section, the enforcement of the provisions contained therein is required.

This aligns with Goal 8 of the NWMS, which seeks to establish effective compliance with and enforcement of the NEM:WA through an increase in the number of appointed EMIs, and successful enforcement actions against non-compliant activities.

Compliance and enforcement in South Africa is guided by the National Environmental Compliance and Enforcement Strategy (NECES), which provides the short to medium term roadmap to improved compliance and enforcement.

In terms of the NECES, the priorities for going forward include the development of the national integrated compliance and enforcement information management system, a feasibility study for an EMI Training Academy, and continuation of work on the administrative penalties project.

Targeted compliance and enforcement operations for WWTWs, Class B Landfill sites, and strategic identified industrial sectors will also be a key priority in the next financial year.

5.4 ECONOMIC INSTRUMENTS

In South Africa, the selection and use of economic instruments is largely based on the 'polluter pays principle' of the National Environment Management Act (No. 107 of 1998), where the generators of waste (i.e. businesses and households) are responsible for the costs of managing the waste generated (RSA, 2016)

The use of economic instruments also aligns with Goal 6 of the National Waste Management Strategy, which is for municipalities to have implemented cost reflective tariffs (DEA, 2011).

The *National Pricing Strategy for Waste Management (NPSWM)* is a legislative requirement of Section 13(A) of the *Waste Amendment Act (2014)* (RSA, 2016). The purpose of the NPSWM is to provide the basis for and guiding methodology or methodologies for setting of waste management charges in South Africa.

One of the main objectives of the NPSWM is to address the pervasive under-pricing of waste services in South Africa. Under-pricing creates the wrong set of incentives, undermines waste minimisation efforts, and ultimately undermines the polluter pays principle. This is one the reasons that disposal to landfill is still perceived to be the least costly and therefore more attractive option for waste management in South Africa.

Economic instruments are tools that are used to change behaviour by setting the level of the tax (or subsidy) at or near to the level of the external cost (or benefit), and in doing so internalise the externalities. These instruments provide incentives for manufacturers, consumers, recyclers and other actors along the product-waste value chain to reduce waste generation and to seek alternatives to final disposal to landfill, such as reuse, recycling or recovery.

Figure 29 presents a broad range of economic instruments that can potentially be implemented at various points along the product-waste value chain (upstream and downstream), as and when deemed appropriate, to correct for market failures, such as under-pricing (RSA, 2016).

Figure 29: Examples of economic instruments along the product-waste value chain

South Africa has to date focussed on Extended Producer Responsibility (EPR). With EPR, the producers of the good have a responsibility to safely manage those products after the end of useful life.

There are currently mandatory EPR fees in place for plastic bags, waste tyres, electric filament lamps (incandescent lightbulbs), and electricity generated using non-renewable resources (e.g. coal, gas and nuclear). These charges are intended to shift some of the responsibility from government to industry, obliging producers and importers to internalise waste management costs in their product prices, ensuring the safe handling of their products post end-of-life.

Voluntary EPR fees have also been levied on numerous waste streams, including paper and packaging (plastic, metal, and glass), waste oil, and waste batteries. These voluntary charges are generally collected and managed by product responsibility organisations (PROs). These PROs are typically overseen by the local producers and government.

Going forward, the intention is for government to institute an EPR fee, in the form of a tax, for all Industry Waste Management Plans (IndWMPs) that the Minister calls for in terms of Section 28 of NEM:WA. Currently, there are three IndWMPs be prepared for the followings sectors:

- Tyres;
- Paper and Packaging; and
- Electrical and Electronic Equipment and Lighting Industries.

5.5 AVOIDANCE, RECYCLING & RECOVERY

Countrywide, a number of municipalities and private businesses have or are planning to implement various initiatives to avoid, recycle or recover waste destined for disposal at landfill.

These initiatives are grouped into the following broad categories:

- Capacity building and awareness raising campaigns;
- Source separation;
- Informal waste sector; and
- Alternative waste treatment options.

5.5.1 Capacity Building and Awareness Raising Campaigns

A number of municipalities have or are planning to implement capacity building and awareness raising campaigns. These campaigns are typically aimed at educating the general public about the different types of waste, waste minimisation, recycling and recovery, and the impact of waste on human health and the environment.

These initiatives align with Goal 4 of the NWMS, which is to ensure that people are aware of the impact of waste on their health, well-being and environment.

At a national level, the DEA developed the Waste Awareness Strategic Framework in 2016.to assist provincial and local authorities to implement awareness raising campaigns. The DEA also recently embarked on a national environmental outreach and awareness campaign, which included various communities and schools across the country (DEA, 2018).

Table 10 presents examples of awareness raising initiatives in each of the provinces. These initiatives were largely taken from either the provincial IWMP or SOER.

Table 10: Examples of provincial awareness raising initiatives

Province	Initiatives
Eastern Cape	• Proposal to develop and implement an annual recycling awareness programme.
Free State	• Workshops for municipalities on basic environmental management; • Establishment of four environmental education centres; • Establishment of environmental clubs at the schools (currently 50 clubs); and • Supports the implementation of the international Eco Schools programme (currently 121 schools).
Gauteng	• Waste awareness and clean-up campaigns aimed promote waste separation and, reduce littering and illegal dumping by raising awareness amongst communities, schools and construction industries.
KwaZulu-Natal	• N/A
Limpopo	• N/A
Mpumalanga	• N/A
Northern Cape	• N/A
North West	• Waste minimisation awareness programmes undertaken in schools, higher leaning institutions and communities.
Western Cape	• Youth Jobs in Waste workers; • Newsletters; • Advertising boards; and • Clean-up campaigns.

5.5.2 Source Separation

There are a number of municipalities that have implemented source separation programmes, and there are others that have implemented pilot projects.

These initiatives align with Goal 1 of the IWMS, which is to promote waste minimisation, re-use, recycling and recovery of waste.

Table 11: Source separation implementation in each province

Province	Initiatives
Eastern Cape	• Currently no source separation programmes.
Free State	• Fichardt Park Pilot Project in Manguang Municipality.
Gauteng	• Pikitup Separation@Source programme in the CoJ; • “Boa Gape – recycling for a better tomorrow” in the CoT.
KwaZulu-Natal	• “Orange bag” programme in the eThekwini Municipality.
Limpopo	•
Mpumalanga	•
Northern Cape	•
North West	• Currently no source separation programmes.
Western Cape	• “Yellow bag” pilot programme in the Marina De Gama area of the CoCT; • Distribute 5,000 compost containers per annum in the CoCT; and • “Think Twice” programme in the Atlantic Management Area of the CoCT. • Two-bag system in Bitou, George, Hessequa, Kannaland, Knysna, Mossel Bay, and Outshoorn Municipalities.

5.5.3 Informal Waste Sector

The informal waste sector is a key component of the overall waste sector. While the informal sector is often disregarded in waste management planning, it is deeply embedded in the existing systems, and contributes significantly to existing levels of landfill diversion and recycling (DEA, 2016b).

Many well-meaning waste management projects have failed as the planning did not take into consideration the informal waste sector, which is very active, dynamic, and driven by basic survival needs.

There are therefore advantages to involving the informal waste sector in waste management projects. The challenge is to build on the existing recycling system in a way that incentivises the type of change desired.

In 2014, it was estimated that there were 62,147 waste pickers in South Africa, with 36,680 collecting waste from landfills, and 25,467 operating as trolley pushers (DEA, 2014b). In this context, waste pickers are broadly defined as people who "*collect, sort and sell reusable and recyclable materials*".

The majority of recyclables are recovered from landfill sites, dump sites, kerbside (household and communal bins), and businesses. Cherry picking of most valuable wastes generally occurs. The waste pickers then sell the collected recyclables to brokers (e.g. buy-back centres) or private recycling companies for a daily income (DEA, 2016b).

For most waste pickers, waste picking is the only income generating opportunity, while for others it is a first-choice due to the low entry barriers, low skill requirements, and relative freedom of the sector.

Due to the challenges associated with integrating the informal waste sector into the formal sector, integration initiatives need to be carefully tailored to suit the local context. Initiatives should seek win-win solutions that benefit not only the municipalities, formal recycling sector, and the local community, but also the waste pickers.

There are a number of examples from South Africa, where informal sector has been integrated into the formal sector. These are presented below.

Food for Waste and Separation at Source Projects

The Food for Waste and Separation at Source Projects were implemented by Pikitup in the City of Johannesburg (DEA, 2016b).

The aim of the Food for Waste Project is to clear illegal dump sites in informal settlements, while creating work opportunities to reduce poverty. Beneficiaries of the project collect recyclables and exchange them for a daily food parcel.

The Separation at Source Projects aims to divert recyclable waste away from landfills/dumpsites to save airspace, reduce transportation cost of waste, reduce littering and illegal dumping, and contribute to poverty alleviation efforts.

Pikitup provides assistance to informal waste reclaimers through the establishment of cooperatives/non-profit organisations, which collect recyclables from the Separation at Source areas. Pikitup also assists in the construction of satellite sorting/buy-back facilities, which are managed by these cooperatives/non-profit organisations, as well as provision of caged waste collection vehicles and PPE.

Vukuzenzele and Nkoza Drop-Off and Sorting Cooperative Pilot Project

The Vukuzenzele and Nkoza Drop-Off and Sorting Cooperative Pilot Project was implemented by the Ekurhuleni Municipality, in collaboration with Netsafrica (DEA, 2016b).

The project aimed to develop community-based recycling in Wadeville and Actonville, in order to foster job opportunities for disadvantaged groups.

Key components of the project included:

- Develop an operative plan to integrate recycling as a service assigned cooperatives at no cost to the Ekurhuleni Municipality;
- Selection and training of community-based cooperatives;

- Building a drop-off centre for waste recycling, which is manged by a cooperative; and
- Awareness raising in target communities.

Nearby households are provided with reusable recycling bags, which are collected once a week by members of the cooperatives and transported to the drop off centre using specially adapted bicycles.

Waterval Sanitary Landfill Site

This project was implemented by the Rustenburg Municipality. It involved the replacement of the existing Townhill Landfill site and several communal/dumpsite with the new Waterval Sanitary Landfill Site, which included a MRF (DEA, 2016b).

The problem was that the closure of the Townhill Landfill would negatively impact on the approximately 1,200 reclaimers who currently work at the landfill, 15% of which also live site.

Figure 30 below presents some of the opportunities being investigated for integrating the affected reclaimers into the formal waste sector centred around the new landfill site (DEA, 2016b).

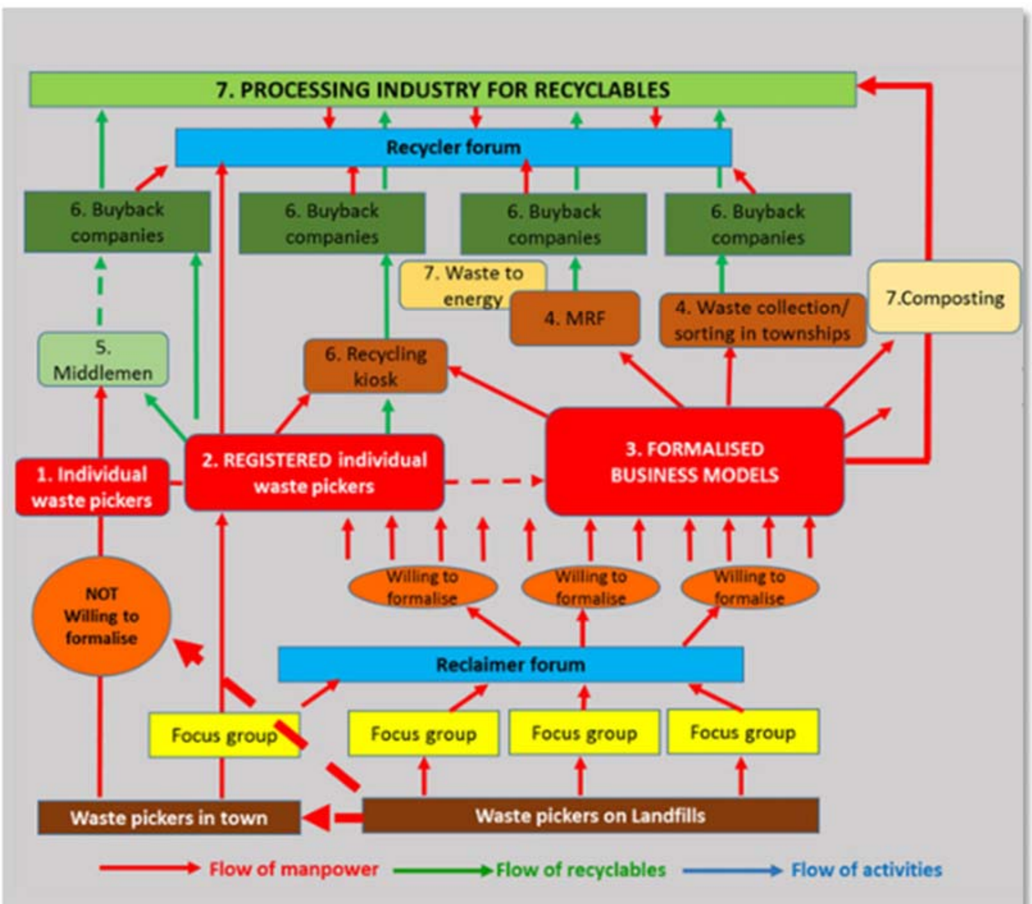


Figure 30: Opportunities for integrating the reclaimers into the formal recycling sector

5.6 OPERATION PHAKISA

Operation Phakisa is a national initiative designed to fast track the implementation of solutions on critical development issues highlighted in the National Development Plan (NDP) (DEA, 2018b). “Phakisa” which means “hurry up” in Sesotho signifies Government’s intention to implement priority programmes better, faster and more effectively.

Operation Phakisa is a results-driven approach, involving setting clear plans and targets, on-going monitoring of progress and making these results public.

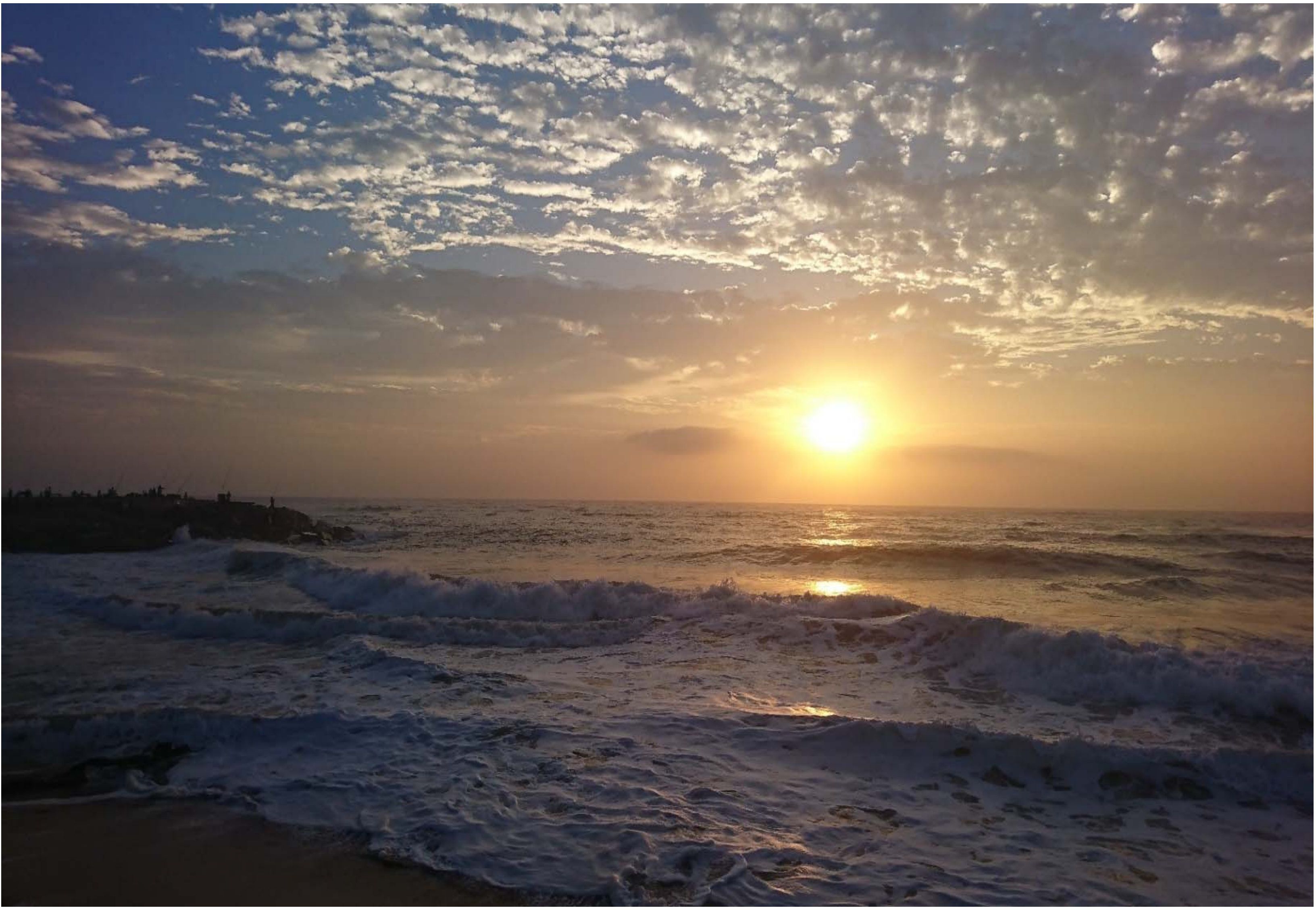
The Chemical and Waste Economy is one Operation Phakisa’s seven labs. The overall goal of this lab is “*how can the contribution of the chemicals and waste economy be increased to reach the MTSF and NDP targets on GDP and job creation, while reducing the negative environmental and health impact of chemicals and waste.”*

Based on the 24 waste areas originally identified in the Waste RDI Roadmap (2011), and in consultation with private sector, the following waste areas have been identified for prioritisation:

- Organic waste (food and abattoir waste);
- Municipal waste;
- Tyres;
- Mineral waste;
- Plastic;
- Construction and demolition waste;
- Ash;
- Sewage sludge;
- WEEE;
- Glass (within packaging);
- Slag (beneficiation opportunity); and
- Paper (within packaging).

6 Chapter 6

Conclusion



In conclusion, the state of waste in South Africa is being driven by a number of driving forces and pressures. This includes population growth, economic growth, level of income, increased urbanisation, and the globalisation of recycling market. These forces contribute to the increase in the quantity and complexity of waste generated, and the pressure on existing infrastructure top manage these wastes.

Based on the modelling, it is estimated that South Africa generated approximately 42 million tonnes of general waste in 2017, and approximately 4.9 million tonnes (11%) of general waste was recycled.

In the same period, South Africa generated approximately 38 million tonnes of hazardous waste. Only 7% of hazardous waste generated in 2017 was re-used or recycled, with the remainder treated and/or landfilled.

South Africa also generated an estimated 27.8 million tonnes of 'unclassified' wastes in 2017 consisting of slag (52%) mainly from mills and foundries, brine (42%) and mineral waste (3%) excluding tailings and waste rock dump.

In addition to the waste generated, South Africa imported and estimated 137,490 tonnes of general waste, mainly paper, plastic, glass and metals, was imported in 2017, while an estimated 258,557 tonnes of general waste, mainly paper, plastics and metals was exported.

While there are a number of recycling and recovery facilities in South Africa, there is still a dependence on landfilling as a waste management option.

In response, the South African government, as well as the private sector, have implemented a number of actions or initiatives to mitigate or address the impacts associated with improper waste management. This includes for example the introduction of legislative and fiscal instruments, greater compliance and enforcement, identification of priority wastes, and specific activities to avoid, recycle and recover waste.

In preparing for the 2nd SoWR, concerted effort is required to improve on the reporting of accurate waste data, in particular the uptake of the SAWIS and regular updating of provincial and municipal IWMPs. The classification of all waste streams is also a priority, so that those wastes currently presented as 'unclassified' can be spilt into the general and hazardous waste streams. Further to this, the current process of excluding certain waste streams from the definition of waste needs to be finalised in order to unlock the utilisation potential of these waste streams.

Despite the challenges in preparing this 1st SoWR, there a fair degree of confidence that the waste generation estimates are in the correct order of magnitude to inform high level policy decisions.

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Appendix A

Data Sources, Methodology and Limitations

The methodology of the SoWR was based on that of the *National Waste Information Baseline Report* (DEA, 2012). This was to allow for benchmarking of the results, and to draw high-level conclusions based on trends over the last six years (2011 – 2017). Note that the results are not directly comparable as the data sources and calculations used in the SoWR may differ from those used in the preceding *National Waste Information Baseline Report*.

Approach

As with the *National Waste Information Baseline Report*, a multiple-pronged approach was adopted in estimating general and hazardous waste generation. This included the following:

Empirical Data

Collect, collate and interpret existing empirical data. This information was collected from available reports and through interviews and/or surveys of provincial and local government, PROs, selected waste management companies, and other key stakeholders. The list of key stakeholders is attached as Appendix B.

Calculations

Using the collected empirical data, to scale up from a municipal or provincial scale to national scale or from the year data was captured to the baseline year. The official population statistics (mid-year estimates) and GDP published by Statistics SA were used in these calculations, as per the calculation below:

$$\frac{\textit{Waste amount}}{\textit{Population (or GDP) in waste generation year}} \times \textit{Population (or GDP) in 2017}$$

This approach is deemed to be acceptable as long as the data used is credible and representative of the waste stream.

Estimates

Collect, collate and interpret exiting estimates of general and hazardous waste generation from available reports. This was typically estimates reported on global scale, such as World Bank.

SAWIS

Extract tonnages of selected general and hazardous waste streams and/or for selected waste activities within a particular municipality or province.

Data Verification

In selecting the data to be used in the estimations of waste generation, the accuracy of the data was an important consideration. Preference was therefore given to data considered to be of higher accuracy.

In this regard, data obtained from the metropolitan municipalities, PROs and waste management companies was considered to be of high accuracy, while the calculations based on the information provided was considered to be of medium accuracy. Estimated data and data extracted from the SAWIS was considered to be of low accuracy.

Limitations

In calculating the tonnages of general and hazardous waste generated in the baseline year, a number of limitations were noted. This includes the following:

- In some cases, the tonnages of general and hazardous waste reported as 'waste generated', is based on quantities of waste recycled, recovered, treated, and/or disposed. This is unavoidable as there is a lack of comprehensive data for all the waste types.
- No primary data collection was done. As a result, secondary data collected from a wide range of sources, for which the accuracy could not always be verified, had to be used;
- Calculations are based on waste in the official waste streams. In some instances, there are waste types, such as mineral wastes, that are typically managed onsite, which may have not been accounted for. As a consequence, there is likely to be an underestimate of the total general and hazardous waste generated in South Africa in the baseline year,
- While waste generators were required to classify the waste that generate in accordance with SANS 10234 within 180 days of generation (excluding those wastes listed in Annexure 1 of the Waste Classification and Management Regulations (2013)), these classifications were not always made available by the waste generators. As a consequence, there is still some uncertainty regarding the waste types listed as both general waste and hazardous waste;
- There is no clear definition provided for the waste types listed in Annexures 3 and 4 of the National Waste Information Regulations (2012), and an apparent disconnect between these waste types, and those defined in the Waste Amendment Act (2014). This introduced a level of uncertainty, particularly with respect to brine and mineral wastes;
- Given the variation in the data accuracy of the different waste types, it is not possible to assign an overall level of accuracy to the calculated tonnages of general and hazardous waste generated. However, by cross-referencing the calculations with estimates from other sources, there is a high degree of confidence that the results are in the correct order of magnitude;
- While a number of waste characterisation studies have been undertaken, these studies have used different methods and categories. As a consequence, the results of these studies are not directly comparable;
- As the municipalities only collect the data going to landfill, the waste diverted before landfill (e.g. recycling depots) are not accounted for. As a consequence, there is likely to be an underestimate of the total general and waste generated in South Africa in the baseline year; and
- Historically, surveys of hazardous waste generators and management facilities yielded poor response rates. As a result, the waste generation estimates provided in provincial Hazardous Waste Management Plans were not suitable for use in waste generation extrapolations; and
- There is a general reluctance by many large industries to release information on the hazardous wastes generated, particularly if these wastes are disposed onsite; As a consequence, there is likely to be an underestimate of certain hazardous waste types generated in South Africa in the baseline year.
- The number of waste management facilities in South Africa is based on the national list of waste management activities (SAWIC, 2018a). It is assumed that this was the most comprehensive and up-to-date list of waste management activities in South Africa at the time. As the SoWR was reporting on the number of waste management facilities and not activities, the said list was amended to exclude multiple entries for a single facility (i.e. where a facility held more than one licence).
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Table A-1 and A-2 below, present the calculation methods applied to the general and hazardous waste types respectively.

Table A-1: Calculation methods applied to the general waste types

Waste Type		Approach / Methodology	Source
GW01	Municipal waste	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017a
GW10	Commercial and industrial waste	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017a
GW13	Brine		
GW14	Fly ash and dust		
GW15	Bottom ash		
GW16	Slag		
GW 17	Mineral waste		
GW 18	WEEE		
GW 20	Organic waste	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017
GW 21	Sewage sludge		
GW30	Construction and demolition waste	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017
GW50	Paper	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017 • PRASA (2017) Paper Recycling in South Africa
GW51	Plastic	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 201 • Stats SA, Mid-Year Estimates. 2017 • Plastics SA (2017) National Plastics Recycling Survey 2016

GW52	Glass	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017 • The Glass Recycling Company (2017)
GW53	Metals	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Waste data from various sources, including IWMPs, feasibility studies, SOERs etc. • Stats SA, Community Survey, 2016 • Stats SA, Mid-Year Estimates. 2017 • TUTWA (2017) SA Metal Industry in Focus • SARS (2017) Import and Export Excise Tax
GW54	Tyres	(Accumulated tonnage of waste / sample population in 2017) x South African population in 2017	• Engineering News (2018) • REDISA (2017) Presentation at Gauteng Provincial Waste Forum Meeting
GW99	Other	Amount in 2004.	• DME (2004) Assessment of Commercially Exploitable Biomass Resources

Table A-2: Calculation methods applied to the hazardous waste types

Waste Type		Approach / Methodology	Source
HW 01	Gaseous waste	Amount in 2017	• SAWIS (2017)
HW 02	Mercury containing waste	Amount in 2017	• SAWIS (2017)
HW 03	Batteries	(Amount in 2011/ GDP in 2011) x GDP in 2017	• DEA (2012) National Waste Baseline Survey; • Stats SA (2017), GDP; • First National Battery (2017).
HW 04	POP Waste	Amount in 2017	• SAWIS (2017)
HW 05	Inorganic waste	Amount in 2017	• SAWIS (2017)
HW 06	Asbestos containing waste	Amount in 2017	• SAWIS (2017)
HW 07	Waste Oils	(Amount in 2011/ GDP in 2011) x GDP in 2017	• Rose Foundation (2014) Use Oil Management
HW 08	Organic halogenated and /or sulphur containing solvents	Amount in 2017	• SAWIS (2017)
HW 09	Organic halogenated and/or sulphur containing waste	Amount in 2017	• SAWIS (2017)
HW 10	Organic solvents without halogens and sulphur	Amount in 2017	• SAWIS (2017)

HW 11	Other organic waste without halogen or sulphur	Amount in 2017	• SAWIS (2017)
HW 12	Tarry and Bituminous waste	Amount in 2017	• SAWIS (2017)
HW 13	Brine	(Accumulated tonnage of waste / sample production in 2017) x South African production in 2017	• Various sources, including Eskom facts & figures, company sustainability reports etc.
HW 14	Fly ash and dust from miscellaneous filter sources	(Total coal usage / production coefficient) x split between fly ash & bottom ash	• Eskom's revised Coal Ash Strategy and Implementation Progress
HW 15	Bottom ash	(Total coal usage / production coefficient) x split between fly ash & bottom ash	• Eskom's revised Coal Ash Strategy and Implementation Progress
HW 16	Slag	(Accumulated tonnage of waste / sample production in 2017) x South African production in 2017	• Various sources, including company sustainability reports etc.
HW 17	Mineral waste	(Accumulated tonnage of waste / sample production in 2017) x South African production in 2017	• Various sources, including company sustainability reports, and previous project experience etc.
HW 18	Waste of Electric and Electronic Equipment (WEEE)	(Average SA WEEE generation rate x South African population in 2017	• ISWA (2017) Global-E-waste Monitor
HW 19	Health Care Risk Waste (HCRW)	Amount in 2017	• DEA (2017) HCRW Treatment Figures
HW 20	Sewage sludge	((Total flow in 2013 / Population in 2013) x Population in 2017) x avg. dry sludge / ML	• DWA (2013) Green Drop Report • CoT (2016) Screening calculations for all WWTW
HW 99	Miscellaneous	Amount in 2017	• SAWIS (2017)

Appendix B

List of Key Stakeholders

Appendix C

Preliminary Priority Waste Analysis

Waste Type	Health & safety risk	Reduction in waste stream to landfill	Reduction in pollution & resource conservation	Litter abatement	Job creation	Energy & cost reduction in manufacturing	Market value	Existing market potential	Abundance in waste stream	Separability from waste stream	Bulking factor for landfills	Recycling options	Access to regular & reliable data	Existing recycling initiatives, programme etc.	**TOTAL**
General wastes															
Municipal waste															
Commercial and industrial waste															
Brine															
Fly ash and dust															
Bottom ash															
Slag															
WEEE															
Organic waste															
Sewage sludge															
Construction and demolition waste															
Paper															
Plastic															
Glass															
Metals															
Tyres															
Other															
Hazardous wastes															
Gaseous waste															
Mercury containing waste															
Batteries															

Waste Type	Health & safety risk	Reduction in waste stream to landfill	Reduction in pollution & resource conservation	Litter abatement	Job creation	Energy & cost reduction in manufacturing	Market value	Existing market potential	Abundance in waste stream	Separability from waste stream	Bulking factor for landfills	Recycling options	Access to regular & reliable data	Existing recycling initiatives, programme etc.	**TOTAL**
POP Waste															
Inorganic waste															
Asbestos containing waste															
Waste Oils															
Organic halogenated and /or sulphur containing solvents															
Organic halogenated and/or sulphur containing waste															
Organic solvents without halogens and sulphur															
Other organic waste without halogen or sulphur															
Tarry and Bituminous waste															
Brine															
Fly ash and dust															
Bottom ash															
Slag															
WEEE															
HCRW															
Sewage sludge															
Miscellaneous															