



**WASTE MANAGEMENT PRACTICES IN THE
THEEWATERSKLOOF MUNICIPALITY, GRABOUW,
WESTERN CAPE**

By

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DECLARATION

I, Aseza Mpokopi, declare that the contents of this dissertation represent my independent work except as indicated in the references and acknowledgements. The dissertation is submitted in partial fulfillment of the requirements of Masters of Technologiae Degree at Cape Peninsula University of Technology, Cape Town Campus and has not previously been submitted for academic examination towards any qualification. It represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.



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25 January 2021

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ABSTRACT

Waste management practices in Grabouw, Theewaterskloof municipality (TwK) are experiencing challenges. Glimpses of waste management practices such as waste collection, transportation and disposal at Karwyderskraal landfill site are present within the study area. TwK appears to have one waste recycling facility, although the facility was not observed at the time of data collection and this provides a perception that most of the waste generated ends up at a landfill site. High dependency on landfill site disposal causes social, economic and environmental impacts. Social impacts are associated with health related risk emanating from air pollution, while, economic impacts are costs associated with construction of new landfill sites, environmental impacts are linked to the degradation of the environment (living space) due to reduced life span of the current landfill site. Based on the above, there is a need to assess waste management practices in Grabouw, Theewaterskloof municipality (TwK), to mitigate the possible socio-economic and environmental impacts caused by the over reliance on landfill sites.

The objective of the study was to evaluate waste management practices in the Theewaterskloof Municipality, Grabouw, Western Cape. A waste management practices survey was carried out in Grabouw for the duration of 8-months. Thus, four (4) residential areas were selected in Grabouw in order to fulfill the objectives of the study. The selected residential areas were Roodaka, Smarty Town, Zola and Marikana. These areas were selected based on the initial visit to Grabouw, where piles of waste on the streets and within the river systems were observed. The study used both qualitative and quantitative methods. Qualitative research method is a research method that is used to obtain existing data on publications, documents, and meeting minutes regarding a particular research topic, while, quantitative refers to a method used to quantify primary data obtainable from the research area. Certain organizations were randomly selected based on their involvement in waste management. The selected organizations were Community Development Workers (CDW), Community Workers Programme (CWP, Theewaterskloof Municipality (TwK), and the Community Members (CM) of the four (4) selected residential areas in Grabouw.

This study revealed that waste management practices in the study area are misunderstood, inefficient and fragmented. Additionally, the research showed that community members were not involved in waste management planning, waste receptacles allocated to households were too small and only two trucks were servicing the Theewaterskloof Municipality for waste

collection. Waste management practices applied within Grabouw were limited to collection, transportation and disposal. The major issues that affected waste management practices in Grabouw, Theewaterskloof included organizational structure, insufficient waste management investment (financial and human resources), lack of waste management planning, education and awareness that included uncoordinated political interference on the application of waste management practices. The study discussed and provided waste management practices applied globally, in Africa, and in other parts of South Africa, which are misunderstood within the study area. Such practices or solutions as detailed in section 5 of this research will assist to improve the current waste management situation in Grabouw, Theewaterskloof. However, the waste management practices are almost impossible to implement without proper training, high awareness within communities as well as a strong commitment and support of city authorities.

Keywords: Grabouw, Theewaterskloof, Waste, Waste Management, Waste Management Practices, Waste Management Services Planning, Waste Management Services Implementation, Sustainable Waste Management.

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LIST OF ACCRONYMS

CWP – Community Workers Programme

CDW – Community Development Workers

C&D – Construction and Demolition waste

DEA – Department of Environmental Affairs

DEAT – Department of Environmental Affairs and Tourism

IWMP – Integrated Waste Management Plan

ISWMM - Integrated Sustainable Waste Management Model

EIA – Environmental Impact Assessment

FBS - Free Basic Services

MCE - Multi-Criteria Evaluation

MCDA - Multi-Criteria Decision Analysis

MSWM – Municipal Solid Waste Management

NCWMCP – National Clinical Waste Management Code of Practice

NEMWA – National Environmental Management Waste Act

NWMS – National Waste Management Strategy

NGO – Non-Governmental Organizations

RIAM - Rapid Impact Assessment Matrix

SEA – Strategic Environmental Assessment

SSWM – Sustainable Solid Waste Management

TwK – Theewaterskloof Municipality

WHO – World Health Organization

WMP – Waste Management Plan

WMP – Waste Management Practices

GLOSSARY

Composting - *Controlled biological decomposition of organic waste to produce a valuable product, compost, which can be used as a soil supplement (Taiwo, 2011).*

Environmental Degradation – *Is the deterioration of the environment from its original state, in this case an unhealthy environment as a result of waste piling on streets. It is defined as any change or disturbance to the environment perceived to be deleterious or undesirable (Vij, 2012).*

Formal Settlement - *Is a spatial planned residential area which has amenities such as houses developed, roads, water, electricity and sanitation added to it (Theewaterskloof Spatial Development Framework, 2012).*

Informal Settlement - *Informal settlement is made up of economically depressed or migrant people living in a crowded settlement with or without legal rights to the land, they live upon. The settlements with no rights to the land, which they occupy, are generally called squatter camps. These communities are created for many reasons, including economic pressures and population gains (Theewaterskloof Spatial Development Framework, 2012).*

Material Recovery Facility - *A processing facility where recyclables and compostable's are removed out of the general waste stream and segregated according to type (CSIR, 2011).*

Municipal Solid Waste (MSW) – *Is a type of waste generated in house homes i.e residences and apartment buildings, commercial facilities and institutions. Generally classified as non-hazardous waste, household waste (e.g. waste paint or cleaning agents) may contain hazardous materials (Pongracz et al., 2004).*

Municipal Solid Waste Management Practices – *Are solid waste management practices applied by municipalities to manage its existing waste and they range from the point of collection through transport, storage and treatment to final disposal of waste at a designated landfill site (Permana et al., 2015).*

Landfilling – *Landfill refers to a dumping area and/ or ground tip, and historically as a midden. It is a site for the disposal of waste materials by burial and is the oldest form of waste treatment. Landfilling simply refers to dumping of waste on a specific designated site (Adeniran et al., 2017).*

Source Reduction - *Reducing the volume or toxicity of waste generated by changing design, operation; and manufacturing practices, and reusing materials to minimize the quantity of waste generated (Seadon, 2010).*

Source Separation - *Segregation of specific materials at the point of generation for separate collection (Seadon, 2010).*

Recyclables - *Materials (e.g. glass, plastics and paper) that, when sorted out of the waste stream can be reprocessed or remanufactured into new product (Adeniran et al, 2017).*

Recycling - *Diverting materials that still have useful physical or chemical properties out of the waste stream (Mamphitha, 2011).*

Reuse - *Use of a product in its original form, more than once and is a form of source reduction (Seadon, 2010).*

Waste – *Waste refers to any unwanted material, which may consist of materials left over from a community and household activities. The material may be discarded or accumulated, stored, or treated (physically, chemically, or biologically), prior to being discarded or recycled. It is also used to describe something we use inefficiently or inappropriately (Oelofse and Godfrey, 2008).*

Waste Management - *Waste management is the collection, transportation, disposal or recycling and monitoring of waste. This term is assigned to the material, waste material from anthropogenic origin. This material is managed to avoid its adverse effect over human health and environment (Farmer et al., 2015).*

Waste Management Practices – *Waste Management Practices are defined as any techniques, innovations and or methods used to reduce, handle and manage any streams of waste. These are often referred to as waste innovations used to turn waste materials into usable products (Lavagnolo, 2012).*

Waste Management Criteria – *is a concept that promotes waste avoidance ahead of recycling and disposal. The waste management criteria start with waste prevention and or minimization at source, waste re-use, recycling, energy recovery and lastly waste disposal. Reduce, reuse, and recycle is frequently used in community education campaigns, and has become a well-*

recognized slogan for waste reduction and resource recovery (Josimovic, Maric and Milijic, 2015).

CHAPTER 1: INTRODUCTION

CHAPTER 1

INTRODUCTION

1.0 Introduction

Waste is any unwanted material left over from a community, industrial and household activities. The material may be discarded or accumulated, stored, or treated (physically, chemically, or biologically), prior to disposal or recycling. It is also used to describe materials which are inefficiently or inappropriately used. Waste management is generally understood as the management of waste collection, transportation, recycling, disposal and or monitoring of waste. Waste materials are managed to avoid any adverse effect over human health and environment (Oelofse and Godfrey, 2008). Waste management practices are defined as any techniques, innovations and/or methods used to reduce, handle and manage any streams of waste. These are often referred to as waste innovations, used to turn waste materials into usable products or help make sound decisions on waste handling and disposal.

Waste management is perceived to be problematic in different parts of the world due to piling of waste on the street with poor to no proper waste management practices in place to manage it. As the result of increasing population and the environmental related pressures, reliable provision for waste control and waste disposal improvement is necessary. Globally, in the last decade of the 20th century, it became clear that waste management practices were seen as a technical problem, but more and more a management problem, which must be dealt with by all concerned stakeholders (Farmer et al., 2015). If steps are not taken to properly monitor and control the application of waste management practices across all sectors, and provide well-managed disposal and recycling facilities, the problem of waste will continue to pose an increasing threat to human and environmental health (Oelofse and Godfrey, 2008).

The South African context present no different view to this, however the National Environmental Management Act (Act 107 of 1998) requires that everyone who has caused or may have caused significant pollution or degradation of the environment to take reasonable measures to prevent and remediate that pollution (The National Environmental Management Act: No 58 of 1998).

Different factors influence municipal waste management practices and the frequently debated are: income type, education levels, type of house i.e. individual or rented property, availability of waste collection workers, household maids and the family member's knowledge of the harmful effects of improper municipal solid waste management practices. These factors do influence waste management practices in different cities (Lavagnolo, 2012). Within the Theewaterskloof Municipality-Grabouw, the problems facing waste management practices have been observed. The observations showed piles of waste in the streets and on open areas being used as dumping sites. No waste recovery initiatives were observed except for a metal scrap yard. Waste management practices were only focused on collection, transportation and disposal. This has consequently raised questions on the understanding of resident's role in waste management and what additional waste management practices could be applied in the research area. It is perceived that various communities in Grabouw, formal and informal settlements could be the highest contributor to waste management issues.

Additionally, an inspection of the study area revealed that some of the waste generated in Theewaterskloof Municipality, Grabouw is finding its way into the local rivers and streams resulting in changes of the watercourse characteristics. This could be attributed to poor waste management practices. Therefore, an evaluation of waste management practices is an essential element for an efficient and successful management of waste in the Theewaterskloof Municipality of Grabouw. Hence, a study was undertaken in Grabouw, Theewaterskloof Municipality, Western Cape to evaluate current waste management practices in the residential areas of Grabouw, Theewaterskloof Municipality.

1.1 Rationale of the Thesis

There is an increasing concern in the understanding of waste management concepts, practices and the application of waste management practices in Grabouw, Theewaterskloof. It is apparent that there is no political direction and understanding of a preferred method for waste treatment and different applications and strategies used in landfilling, incineration and recycling (Gutberlet, 2015). The benefits and impacts of investing in different approaches to be employed to achieve a reduction in landfilling are uncertain and this demonstrates high dependency on landfilling (Farmer *et al.*, 2015). The current global waste dilemma also provides evidence that industries have also failed to manage its waste, with manufacturers primarily determining the material composition of their products and packaging; therefore, making them part of the waste

problem. Waste is increasingly privatized and there is a lack of a coordinated state effort to regulate waste generation. Solid waste generation and management has become a prominent issue in local municipalities and one that often lacks clear political direction on how it should be managed (Gutberlet, 2015).

Waste management practices are also affected by rural to urban migration, where certain towns or municipalities find it difficult to deal with the rapidly increasing population. The increasing numbers from this migration which is officially known as Rural-Urban Migration has triggered difficulties to manage waste in urban areas, especially in informal areas. Also, urbanization contributes to waste generation, and the lack of proper/sound waste handling causes health hazards and urban environmental degradation (Vij, 2012). On the other hand, urbanization is a major driver for increasing municipal solid waste (MSW) generation rates within cities (Suthar and Sajwan, 2014).

Apart from urbanization, waste management practices may be viewed as one of the most neglected areas to be integrated to urban development. Piles of waste and wastes of all kinds littered everywhere have become common sight in urban life. Controversy still exists regarding the understanding and application of waste management practices to deal with the piling of waste in greater parts of the residential areas (Oelofse and Godfrey, 2008). For most of urban local authorities in South Africa, solid waste is a major concern that has reached alarming proportions requiring management initiatives and investments. Waste management practices should be one of the basic essential services provided by municipal authorities in South Africa and other countries, but the current scenario provides rather a clumsy picture in terms of service delivery due to the absence of adequate overall waste management strategies. Present levels of waste management services in many urban areas are so slow that there is a threat to the public health and environmental quality in general. Municipalities often lack capacity or no funds at all allocated to waste management services which then results in waste management practices not being fully applied in managing waste (Manaf *et al.*, 2009).

Waste management practices are believed to differ from/between one sector/area to another i.e. developed and developing nations, urban and rural populations, industrial and residential areas. However, Giusti (2009), indicated that waste management practices are based on environmentally sound criteria in order of preference and they consist of prevention/minimization at source, which is the most preferred waste management criteria followed by waste re-use, recycling, energy recovery and lastly disposal which is the least

preferred option. In simple terms, waste management practices are innovations or techniques used to handle waste. A daunting challenge facing cities in sub-Saharan Africa is the inefficient management of waste. African city authorities therefore need to urgently adopt appropriate and efficient practices to manage waste. The lack of well thought waste management plan/practices in most developing countries is a major drawback for efficient management of waste (Amoah and Kosoe, 2015).

Another prevailing challenge to efficiently and effectively manage waste is the issue of small zoned areas for the latest landfill sites development. Jin *et al.* (2006), noted that the latest landfill sites developed have a limited capacity of 3 to 4 years. Landfill development requirements and capacity are often neglected in many instances and that poses difficulties in managing waste (CSIR, 2011). A practical example of this challenge is the construction and demolition waste that is not taken into account during a developmental phase of a landfill site. Construction and demolition waste is increasing and the only solution at present is disposal to a landfill site and this should be accounted for in the developmental phase of a landfill site (Jin *et al.*, 2006).

Residents in poor urban communities usually have to cope with heaps of waste which are left lying uncollected. Despite the overabundance of studies on waste management, relatively little attention has been given to the evaluation of waste management practices. This could explain why residents adopt environmental unfriendly practices such as the dumping of waste onto the streets, public areas, lowlands and into rivers and streams which can have dire public health and environmental consequences (Amoah and Kosoe, 2015). Residents have a role to play in waste management and observations made in Grabouw of the Theewaterskloof Municipality do not present a different overview of residents and municipal involvement in dealing with waste management.

1.2. Research Area

The research area is Grabouw, Theewaterskloof Municipality, Western Cape Province, South Africa. Grabouw is classified as the second highest town in the Theewaterskloof Municipality and is predicted to experience continued growth within its central business, industrial and residential areas. Grabouw experienced very high levels of population growth over the last 5 – 10 years (Theewaterskloof Spatial Development Framework, 2012). Limited expansion opportunities exist regarding high-income and subsidized residential developments. Grabouw

is located along the N2 as the main point of entrance or exit to the Cape Metropolitan Region, the Overberg and the Southern Cape and as the point of convergence of routes serving the agricultural production areas (economic base of the sub-region) and of towns and rural centers, in the sub-region.

Grabouw is a mid-sized town located in the Western Cape Province of South Africa, 65 km southeast of Cape Town along the N2 highway. Grabouw is the commercial center of the Elgin Valley and the largest single export fruit producing area in Southern Africa. The town's population at the 2001 census was estimated at 21,593. However, during the 2011 census the recorded numbers had increased to 30,337. The census statistics presented simply indicates population growth in the area which would possibly be a challenge on how waste is managed in the selected residential areas.

Additionally, according to Overberg District Municipality and the Integrated Waste Management Plan of 2013, Theewaterskloof had the largest estimated population share of 106,273 in the Overberg District Municipality. This shows a gradual increase compared to census 2011 results.

Visual observations in the study area showed waste piling up on the streets and ending up in the tributaries of the Palmiet River. According to the constitution of the Republic of South Africa, municipalities have a stipulated duty to render waste management services to local communities, in which the Theewaterskloof Municipality seemed to be struggling to provide.

High level of seasonal migration into Grabouw is linked with fruit farming and other agri-industrial activities. This has resulted in high population growth rates, creating increasing demands for provision of basic services such as water, electricity, sanitation and housing. High level of poverty is also singled out as a factor with 78% of the population earning less than R3500 per month. The Palmiet River (and its tributaries), which runs through Grabouw, is an important ecological corridor. Additionally, there are wetlands and/or floodplain areas associated with the Palmiet River system (Theewaterskloof Spatial Development Framework, 2012).

Figure 1 below shows the location of the study area (Grabaouw, Theewaterskloof Municipality) and the residential areas selected for collection of data in order to complete the study, which are Roidakke, Smarty Town, Zola and Marikana.

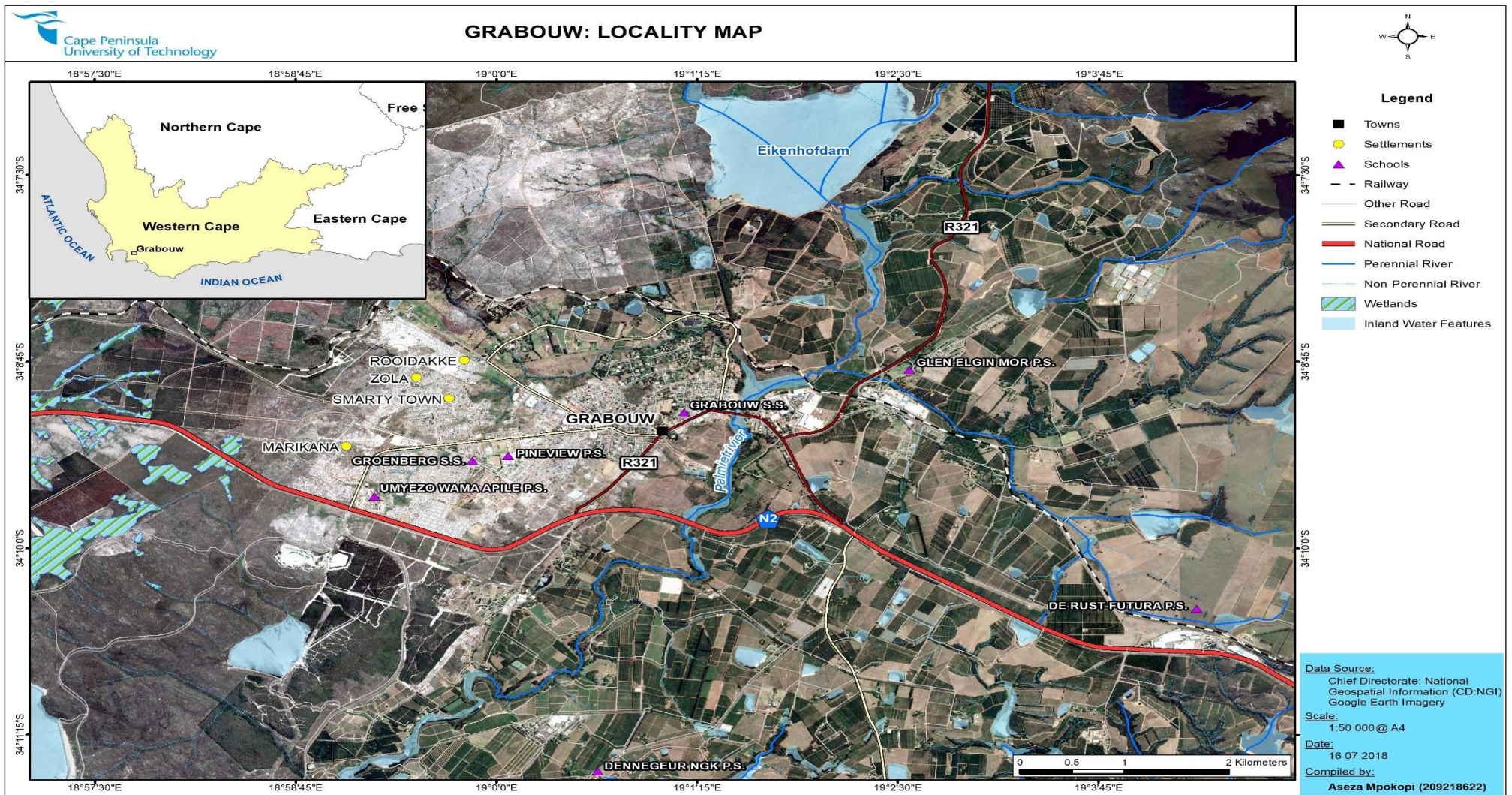


Figure 1: Map showing the research area and the selected residential area

1.3. Research Aims

The research aim is to evaluate current waste management practices in Grabouw residential areas, thus, to understand the participation (in waste management practices) of the municipality, community residents and community-based organizations. The main research questions asked to reach this aim are stated below.

1.4. Research Questions

To evaluate the waste management practices, the following questions were asked:

- i. What are the current waste management practices in Grabouw, and
- ii. How are the waste management practices employed in the Theewaterskloof Municipality, Grabouw?

1.5 Research Objectives

To provide answers to the above research questions, the research had to reach the following objectives:

- Identify and explain municipal waste management service delivery to the residential areas;
- Determine the current waste management practices linked to waste management/ service delivery in Grabouw residential areas;
- Identify strengths, potential shortcomings, weaknesses and failure of the present waste management practices; and
- Provide recommendations for future waste management planning and waste management practices.

1.6 Significance of the Research

The research aims to evaluate current waste management practices and their application in the selected residential areas in the Theewaterskloof Municipality, Grabouw. The findings of the

research could assist the community to understand their role and responsibility in waste management as well as the possible existent opportunities. The research would also assist the local government to provide effective waste management services. Provision of effective waste management services could improve the living conditions of the communities which were previously inadequately serviced. The research will reveal other waste management practices that the local government can incorporate in its waste management planning and contribute significantly to the marketability of Grabouw for tourism purposes and investment opportunities. This research could potentially assist the provincial government with or in future planning and development of residential areas and the integration of waste management practices in the planning process rather than an add on aspect of development. The research findings could also be used by other researchers who want to further explore the research problem for any specific purposes.

PREFACE

The structure of this thesis is articulated in the following manner; Chapter one provides a brief background of the research problem, where specific research area observations are discussed which provided a basis for undertaking this research. The waste, waste management and waste management practices terminologies which are essential to this research area explained. This chapter clearly portrays the thesis topic, research questions, objectives, and the significance of the research.

Chapter two focuses on the literature review. The following topics are covered as part of the literature review process: waste management service delivery, sustainable waste management and waste management practices. Literature obtained on waste management service delivery assisted the researcher to understand essential municipal waste management services, which are provided in the study area and the associated challenges. Sustainable waste management provided an analysis of initiatives and strategies which assist to manage waste in a sustainable manner. In addition, the waste management practices analysis also provides an indication of the waste management practices used worldwide, in Africa and South Africa.

Chapter three focuses on the research methodology used to achieve the research objectives and answer the research questions. In this section (research methodology), the research aspects covered include theoretical foundation, research approach, research design and research methods used to gather required data.

Chapter four interprets the research findings, present discussions based on findings and chapter five provides conclusion and recommendations.

CHAPTER 2: LITERATURE REVIEW

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

The literature review sets out what will be covered by the researcher within a particular study and is often presented differently from the introduction chapter (Winchester and Salji, 2016). The literature review sets the context for the study and discusses what will be covered and or accomplished in the research (Winchester and Salji, 2016). This chapter covers previous studies and critiques related to the researched topic. The critiques develop the reader's understanding of the context of the research problem and lead to the discovery of a theoretical framework. The literature review shows the unique approach of the study and how it adds to the body of knowledge and includes the theories that will inform the research study (Aaron, 2008). For this particular study, the literature review will cover the waste management service delivery, sustainable waste management and the waste management practices in the world, Africa and within South Africa. This is to compare, and contrast waste management practices from different parts of the world including at some parts of South African cities to those found in the research area. Sustainable waste management literature was selected to provide contexts on how waste can be sustainably managed i.e. providing successful alternatives and/or initiatives which are being practiced over the world.

The concepts contained in the research aims and objectives are waste management, waste management service delivery, waste management planning, waste management practices and sustainable waste management. The variables include the number of vehicles used for waste collection, waste collection times / intervals, temporary waste storage areas for segregated waste, availability of bins and their capacity per household, availability of waste skips on informal areas, the understanding and participation of municipality, community residents and community-based organizations in waste management practices. Thus, the theoretical framework for this research is based on the concepts of waste management, waste management service delivery, waste management planning, waste management practices and sustainable waste management. Although there are several concepts highlighted as part of the theoretical framework for this research, the researcher decided to focus on three concepts due to their relevance to the research problem. The selected concepts are discussed in this chapter.

2.1 Waste Management Service Delivery

Waste management is one of the basic essential services to be provided by municipal authorities in other countries and in South Africa. However, the present scenario provides a deferring view in terms of service delivery as evidenced by absence of adequate overall waste management practices/mechanisms. Present level of service delivery in urban areas worldwide, in Africa and South Africa is so slow that there is a threat to the public health and environmental quality in general. Municipalities often have less or lack funds allocated to waste management services which then results to waste management practices not fully implemented (Manaf, et al, 2009).

Waste management service delivery amongst others includes the collection, transportation, recovery and disposal of waste, the supervision of such operations and management of disposal sites. Waste management service delivery also, entails strategic planning, prescribing options, prevention of contamination of the environment and conservation of resources, minimizing the amount and toxicity of waste creation (Pongracz, Phillips, and Keiski, 2004). Waste management service delivery is generally understood by most citizens abroad and in South Africa, as a precise name for waste collection, transportation, recycling, disposal and or monitoring of waste (Oelofse and Godfrey, 2008). However, Farmer *et al.* (2015), interprets waste management practices as any techniques, innovations and or methods used to reduce, handle and manage any waste streams. These are often referred to as waste innovations used to turn waste materials into usable products or help make sound decisions on waste handling and disposal.

Cossey (2007), believes that waste management service delivery has improved at local government, but his perception is that local municipalities are still faced with many real challenges. Although, waste separation is commonly encouraged by many local municipalities, there are still short comings as many municipalities do not have the capacity to deliver on that. Waste separation at source is a vital part of waste management hierarchy, as it improves waste recycling and the use of appropriate transports for collection of waste. Local government have a critical role to play in waste management service delivery. The local authorities should consider establishing long-term goals and objectives, develop a plan which indicates how and when waste is collected as a method for delivering waste management services to respective communities. Through its role in waste management, municipalities should ensure that

communities are protected from the risk of injury, illness, and disease through appropriate application of waste management practices (Cossey, 2007).

On the other hand, the South African Constitution requires local government to provide communities with fair, affordable and sustained basic services, which include waste management. The majority of municipalities and cities in South Africa including the Theewaterskloof Municipality in Grabouw are faced with serious economic, social and environmental challenges related to solid waste management. The waste disposal methods, which the municipalities currently rely on such as landfills, are not environmentally sustainable and municipalities are facing difficulties in complying with regulations and other environmental laws. Additionally, the depletion of available landfill space, particularly in the large cities and metros increases the current challenges of municipalities' (Kalule and De Wet, 2009).

The National Waste Management Strategy (NWMS) published in 2020 requires spheres of government to take a different approach to waste management, which is stipulated in the promulgated National Environmental Management Waste Act, Act 58 of 2008 (RSA, 2008). The NWMS calls for an integrated approach to waste management that adopts the following waste hierarchical principles: avoid, reduce, recycle, re-use and (only as a last resort) dispose of waste (Department of Environment, Forestry and Fisheries, 2020)

However, municipalities generate revenue through user charges (tariffs), levies, rates and taxes. In most cases, the revenue sources are inadequate because they are mainly taxes, and are becoming unaffordable for communities, especially poor and impoverished households. Many South African municipalities and the Theewaterskloof Municipality, Grabouw in particular, contains of a large impoverished population who cannot afford to pay for basic services. Government's policy on Free Basic Services (FBS) provides these impoverished households with basic services that include refuse removal. Refuse removal is perceived as one free basic service that is expensive, and most municipalities do not have the resources to offer it. For municipalities with excessive number of impoverished households, generating revenue from refuse tariffs, rates and levies is not sustainable and or adequate to sustain waste management services (Kalule and De Wet, 2009).

2.2 Sustainable Waste Management

Taiwo (2011), in his study of Composting as a Sustainable Waste Management Technique in developing countries emphasized that attaining sustainability in waste management requires an option that employs environmental friendliness. Such techniques are believed to be effective, efficient and less costly than many available and applicable options. Solid waste management is a difficult task in most developing countries due to factors like poverty, education, population growth, urbanization and lack of proper funding by government which is also the current scenario in South Africa. Composting is one of the waste practices that is not costly to apply, when properly managed. It is sustainable with various advantages such as production of bio-fertilizer and generation of income, which should be highlighted.

On the other hand, Swelling (2010), in his study of Sustainability, Poverty and Municipal Services in Cape Town, points out that many publications of sustainable cities are largely concerned with environmental and resource use issues, with very little mention on the connection between sustainability planning, institutional governance and municipal finance. The study indicated that job creation can be stimulated by municipal interventions such as sustainable management of solid waste and turning waste products into usable resources. This can only be attained when the connection between sustainability planning, institutional governance and municipal finances are realized and uniform targets are developed and implemented. Masjasz-Lech (2014), placed an emphasis on waste generation being linked to the dwindling of natural resources, water consumption, negative environmental impact and creating additional costs of waste management. He perceived environmental awareness of entrepreneurs and communities being a tool that can be used to reduce the negative impacts of poor waste management on the natural environment. Moreover, the quantity of waste produced per capita during a year could serve as an index which can be used in the assessment of the level of sustainable development in terms of environmental governance.

The analysis of waste forms the basis for waste management concepts and design of recycling, treatment and disposal facilities. To compile a successful waste management analysis it depends on reliable data on current waste quantities, waste compositions, relevant physio-chemical properties, and the accurate prediction of solid waste generation for the relevant planning period. The composition and quantities of waste generated by households and commercial sources are subject to seasonal fluctuations. To take these factors into account,

waste analyses should be conducted in at least two seasons (winter and summer) (A Sustainable Waste Management Concept, 2010).

Recent debates on waste management governance show a complication within government structures with a potential for conflicting targets and frequent shortfall of practices compared to policy requirements. Although waste is regulated within spatial defined units, its composition and quantities are determined by economic processes operating at different scales to that of municipal waste governance. Local authorities consider the composition and quantity of the municipal waste stream as an independent variable (Pauline Deutz, Gareth Neighbour and Michael McGuire, 2010).

Permana et al. (2015), pointed out that waste reduction and waste separation are the two preferred practices in sustainable solid waste management (SSWM). These two practices are considered to be impossible to implement without community members awareness as well as a strong commitment and support from city authorities. Permana et al. (2015) also found that the participation of community members in waste reduction and waste separation was strongly connected to cleanliness in the community. This shows that if community members are involved in waste separation and reduction, there would be visible results in terms of the cleanliness of surrounding environments and in communities.

The increase in population; economic growth, wellbeing, and rapid urbanization are significant factors that contribute to waste generation. The author asserted that integrated and sustainable waste management should not only be a top priority but, must go beyond technical aspects to include several key elements of sustainability to ensure success of any solid waste project. Masjasz-Lech (2014), is in agreement with Permana et al. (2015), as he perceived waste/excessive waste generation being driven by quick increase of population in urban areas, which therefore possess a challenge for integrating waste management services into sustainable urban planning. Urbanization has become a major issue in the sustainable development debate, mainly because of the challenges associated with planning and development for unpredicted influx of people. Same to the case of urbanization, waste management services require careful planning and integration into spatial planning.

Permana et al. (2015), also, pointed out that sustainable solid waste management practices involve decision at strategic, tactical, and operational levels. However, the operational level is often ignored and in some cases overlooked. In the study of SSWM practices in low income areas in Makassar (Indonesia), sustainable waste management practices and cleanliness were

limited to waste separation, waste recycling and to some extent, waste reduction. Although practices were present in every district, the level of the practices varied in each district.

Seadon (2010), observed that transitioning to a sustainable waste management system requires an identification and application of leverage points which affect change. He stated that a sustainable waste management system has:

- A particular focus on the process and not the products, and
- Links the three pillars of sustainable development i.e. social, economic and environmental aspect, to ensure that none of the sustainable development pillars are negatively impacted.

The process to transition to a SWMS is achieved by using increased powerful leverage points to change the parameters of a WMS to become a more effective system. Thus, the best example of an effective WMS is the recycling of solid waste which has the potential to create direct, indirect and induced 'green' jobs. For example, direct jobs can be created at public and private waste recycling facilities, while indirect jobs can be created through businesses that purchase recyclable commodities such as processors (compost manufacturers and scrap metal dealers). This is evident at the Waste to Energy Facility (New Horizon Waste to Energy Facility) based in Athlone, Cape Town, which is the first of its kind in South Africa to generate gas from food waste. This waste to energy site has generated a number of job opportunities for locals and it can benefit small waste recycling business, as the waste (sorting glass, textile, and cans) is only separated in the process. Jobs created within the waste management sector are valuable and sustainable or demand less carbon emissions. The waste management sector provides an opportunity to employ poor and previously disadvantaged people in street cleaning, refuse collection, sorting and recycling initiatives (GreenCape, 2016).

Nichols (2017), reported that, the understanding and knowledge of waste management within the Neonatal Unit in United Kingdom indicated that staff were aware of the cost and environmental issues surrounding health care waste management and, were willing to consider and adopt changes in practice intended to generate financial savings and manage waste in a sustainable way. The willingness of staff members to adopt new practices could be a result of continued feedback to staff members regarding performance on sustainable waste management. However, the evidence as presented by the author suggest that a significant obstacle within the study area to achieve sustainable waste management practices was a lack of opportunity to segregate waste at the point of generation within the clinical setting.

Participants in this research felt that this was caused by a lack of space for setting up different types of waste receptacles to place waste in different waste streams (Nichols, 2017).

Furthermore, the importance of universities in promoting sustainable development has been highlighted in several significant declarations, including the Kyoto declaration (1993). Adeniran et al. (2017), undertook a solid waste generation and characterization in the University of Lagos for a sustainable waste management, in an attempt to show how waste characterization can influence the design and implementation of waste management policies to create an integrated solid waste management system (ISWM). Waste characterization was highlighted as a better option to assist in the understanding of waste generation patterns on the university campus and should stimulate the basis for a better decision on the sustainable strategies to manage waste on campus. More similar studies can be carried out for local municipalities to determine which immediate waste reduction practices can be employed as collection and disposal are the last resort.

A waste generating sector which has received less attention to date in terms of sustainable waste management is the construction industry. Construction and Demolition (C&D) waste is solid waste consisting of abandoned substance due to construction, renovation, or demolition of civil structures. C&D waste is not often managed effectively causing organizational, legal, operational, social and environmental problems in developing countries (Mahpour, 2018). In Malaysia, for years, construction has been known as the key economic sector that has provided an important catalyst for economic development. However, the main problem of the construction industry in Malaysia and in other developing countries such as South Africa is their dependence on methods that require intensive labour resulting in generation of waste (Giroto, 2017). To date, about 80% of construction waste ends up on landfills and the presence of chromium in C&D waste in landfill poses a risk to human health through leachate and other forms released into the environment (Dejkovski, 2016). Giroto (2017), pointed out that globally, about 26 000 tons of C&D waste were generated daily during year 2014, and this quantity/amount may have increased to date. This clearly provides an indication of C&D waste ending up on landfills on an annual basis, as landfills remain the predominant waste disposal method, despite its lowly term benefits such as reducing liabilities, promoting a positive public image, reducing waste production, and lowering waste treatment, disposal and production costs (Tseng et al., 2018). The effects of C&D waste include but are not limited to terrestrial and aquatic acidification, ozone layer depletion, global warming, respiratory impacts and aquatic eutrophication (Mahpour, 2018). C&D waste management is an environmental dimension of

sustainable construction which requires urgent attention if C&D waste ending up on landfills is to be minimized.

2.3 Waste Management Practices

Farmer et al. (2015), interpreted waste management practices as being any techniques, innovations and or methods used to reduce, handle and manage any streams of waste. These are often referred to as waste innovations used to turn waste materials into usable products or help make sound decisions on waste handling and disposal. Although controversy still exists regarding the understanding of waste management practices and its applications to deal with the piling of waste in our residential areas. Farmer et al (2015) argues that there is no political direction in terms of preferred method for waste treatment. Also, interactions between changes in landfilling, incineration and recycling are not well understood. Benefits and impacts of investing in different approaches to be employed to achieve reduction in landfilling are uncertain and this demonstrates high dependency on landfilling.

Gutberlet (2015), indicated that the problems of waste management are due to the increasing population and yet political institutions and administrations fail to manage massive amounts of waste resulting from new developments and packaging materials. Manaf et al. (2009), believes that increasing waste volumes beyond the current infrastructural and organizational, institutional and financial arrangements can trigger challenges for the application of waste management practices. Al-Khatib et al. (2015), on his research of community participation on waste management indicated that respondents with higher education found to be more likely to participate in waste management initiatives / activities compared to the illiterate. Research by the Center for Scientific Information and Research (2011), reveals that waste management is problematic in different parts of the world. However, there is no clear understanding of waste management practices and its applications to deal with the piling of waste in our residential areas.

Literature presents an increasing concern in the understanding of the waste management concepts, practices and the application of waste management practices in various countries including South Africa. Therefore, there was a need to determine current waste management practices at Grabouw residential areas and to identify potential shortcomings, weaknesses and failures of the present waste management practices. Recommendations on how waste

management practices are applied and how to improve the current scenario are provided in chapter five.

CHAPTER 3: RESEARCH METHODOLOGY

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

The waste substances are disposed of or intended to be disposed under the provisions of the national law (Tseng *et al.*, 2018). Some authors interpret waste as any substance, which comprises of scrap materials, effluent or other unwanted extra substances arising from the application of a process. It must be acknowledged that, when defining the concept of waste, there are several dimensions to consider. Waste is seen as a dynamic concept due to the fact that, anything can be a waste or non-waste for different persons in different places, and at different times. While some perceive waste as anything that is, in the given time and place, in its actual structure and state, not useful to its owner, or an output that has no owner, and no purpose (Pongracz, Phillips and Kieski, 2004). The term ‘discard’ appears to be a key ingredient in defining waste. The term has the connotation of rejection of something useless or undesirable (Pohjola and Pongracz, 2002).

To evaluate waste management practices in the research area, the study had to look at the current waste management practices in the Theewaterskloof Municipality in general and Grabouw in particular. To reach the research aims, answer the research questions and attain research objectives, qualitative and quantitative research-based methods were selected. A qualitative research method was selected because it would assist the researcher to collect published information on current waste management practices in the Theewaterskloof Municipality, Grabouw; identify potential shortcomings, weaknesses and failures of the present waste management practices; and provide recommendations for future waste management planning and waste management practices. While, a quantitative research method has helped to determine the sequence of waste management services, amount of waste generated and collected as well as the number of trucks used to collect waste.

3.1 Theoretical Foundation

Theory is a group of propositions that are used to explain phenomena or give a concise view of a subject, and the system of the propositions, in which there is a scheme of relations between the parts (Pohjola and Pongracz, 2002). In many instances, a scientific theory could be considered as a set of sentences expressed in terms of a specific language and/ or terminology. Theory will always be thought of as a particular phenomenon constructed from a linguistic framework of a clear specific structure, which determines the rules of deductive inference (Pohjola and Pongracz, 2002). There is clear difference between using the word ‘Theory’ in the scientific domain, as opposed to everyday life. In common usage, ‘theory’ is contrasted with ‘practice’. The word ‘theory’ is associated with a feeling of uncertainty. The word ‘theory’ originally means to observe, or to contemplate. Theory, in its origin is the state of contemplation as distinct from the state of action (Tseng et al., 2018).

In viewing the Waste Management Theory (WMT); Pongracz, Phillips and Kieski (2004), refers to WMT as an integrated body of knowledge about waste and waste management. However, the main aim of waste management theory is to provide a clear view of waste management. It provides an explanation and or definitions of all waste related concepts and offers a formal conceptual model of waste management. The WMT removes challenges emanating from restricted insights, vague concepts and lack of basic models, and leads to better control of any waste related activities in society through sustainable development (Pohjola and Pongracz, 2002).

Building the theory of waste management is an effort towards scientification of waste management (Tseng *et al.*, 2018). Pongracz, Phillips, and Kieski (2004), agreed with Tseng et al. (2018), that constructing a WMT is an effort towards conceptualizing waste management. WMT is formed on the basis that waste management should prevent waste causing harm to the environment and human health (Pongracz *et al.*, 2004). Waste management theory is a concept describing waste management, providing definitions to all other terminologies used in the waste sector, and suggesting a methodology of waste management system as it stands today. Waste management theory is based on the assumption that the way we describe a target shows an action upon it, which indicates that sustainable waste management depends mainly on how waste is interpreted. Every term used in a scientific theory or in given branch of science must be precisely defined. Definitions in a body of science are used to state or describe the accepted

meaning or meanings, of a term already in use (Pongracz, Phillips and Kieski, 2004). A proper definition of waste is of importance to construct a sustainable agenda of waste management. The waste management theory is important because it enables the defining of waste unambiguously (Pongracz, Phillips and Kieski, 2004). The theoretical framework for this research draws on the concepts of waste, waste management and waste management practices.

Waste management is generally understood by most citizens abroad and in South Africa as a precise name for waste collection, transportation, recycling, disposal and or monitoring of waste (Oelofse & Godfrey, 2008). Waste management is one of the basic essential services to be provided by municipal authorities in other countries around the world in general and in South Africa, in particular the Theewaterskloof Municipality, but the current situation provides a differing view in terms of service delivery as observed in the study area. Current levels of service delivery in many countries and in South Africa is so low that it is a threat to environmental quality in general and the public health in particular (Manaf, et al, 2009). Research by the CSIR (2011), reveals that waste management is problematic in different parts of the world. Cossey (2007), believes that waste management has improved at local government, but his perception is that local municipalities are still faced with many real challenges. Waste separation is commonly encouraged by many local municipalities; though there are still shortcomings, as many municipalities do not have the capacity to deliver on that. Waste separation at source, also regarded as a waste management practice is vital within the waste management hierarchy, as it improves waste recycling and transportation as well as using the relevant transports. Local government has a critical role to play in waste management. The local authorities need to describe objectives such as how, when, who will manage waste and what are other interventions or innovations which will be used to help manage waste. Through its role in waste management, the municipality must ensure that communities are protected from the risk of injury, illness, and disease through appropriate regimes of collection, processing and disposal of household waste (Cossey, 2007).

Farmer *et al.* (2015), interpret waste management practices as any techniques, innovations and or methods used to reduce, handle and manage any waste streams. These are often referred to as waste innovations used to turn waste materials into usable products or help make sound decisions on waste handling and disposal. Although controversy still exists regarding the understanding of waste management practices and its applications to deal with the piling up of waste in our residential areas. Manaf *et al.* (2009), believes that increasing waste volumes beyond the current infrastructural and organisational, institutional and financial arrangements

can trigger challenges for the application of waste management practices. Al-Khatib, *et al.* (2015), indicated that respondents with higher education were found to be more likely to participate in waste management initiatives / activities compared to the illiterate. Municipalities often lack funding allocated to waste management services which then results in waste management practices not fully applied (Manaf *et al.*, 2009).

3.2 Research Approach

For this research, qualitative and quantitative research-based tools were used (mixed method approach). This method involves collecting both qualitative and quantitative data, integrating the two forms of data and using distinct designs which incorporate philosophical assumptions and theoretical framework. The qualitative and quantitative approach aided the researcher to provide a complete understanding of the research problem. A qualitative research-based tool was best suited for this research because it helped the researcher identify current waste management practices in the Theewaterskloof Municipality, Grabouw. While a quantitative research-based tool assisted in determining the sequence of waste management services, amount of waste generated and collected as well as the number of trucks used to collect waste.

Grabouw possesses two different settlements, formal and informal settlements which were considered for this research based on observations which presented excessive waste piles on the streets of formal settlements, on open areas and within river streams. To provide precise comparison of waste management practices in the study area and those practiced globally, two informal settlements and two formal settlements were selected as shown in figure 1 above. A set of questionnaires were developed for identified community organizations involved in waste management, for community members in both selected formal and informal settlements and for municipal representatives. Questionnaires and personal interviews were used to gather required data over a eight-month period to completion this research.

The research has dealt with a range of forms of evidence such as available documents and publications, interviews, research questions completed and observations. The variety of evidence obtained in the research made it more feasible to provide meaningful answers to the research questions.

3.4 Research Design

A mixed method research approach was used for a collection of required data for the fulfillment of the research objectives. The mixed method involves a combination or integration of

qualitative and quantitative methods. Collection of qualitative data was designed in such a way that the answers were open ended without predetermined responses while, collection of quantitative data was designed in such a manner that the responses included closed ended responses. The questionnaires were designed to provide responses for both qualitative and quantitative data from the waste management organization employees i.e. CDW (**Appendix A**) and CWP (**Appendix B**), municipal representatives (**Appendix C**) and community members (**Appendix D**).

A total number of 100 households were targeted for data collection, due to unavailability of some household's members and unwillingness to participate, a total number of 30 community household was obtained. A number of households were randomly selected per residential area for completion of questionnaires. Ten community members per each formal residential area i.e. Smarty Town and Rooidaka were given a questionnaire to complete, except for a few household members who were unable to write and were assisted by the researcher. Five community members per each informal residential area i.e. Marikana and Zola were also provided with the questionnaires to complete. This made up a total of 30 households from which data was collected from, 20 from the formal residential area and 10 in the informal residential area. An interview was held with one (1) municipal representative using a set of questions specifically formulated for the municipality. A focus group of 16 community workers programme (CWP) was interviewed and four representatives of the Community Development Workers (CDW) involved on waste management in the study area. This amounted to a total of 51 participants consulted during data collection process.

Obtained quantitative data is presented in tables and on graphs in chapter 4 and interpreted to provide answers to the research questions. Same and or similar answers were recorded separately in order to examine the understanding of and application of waste management and waste management practices in Grabouw residential areas in comparison with the practices taking place in the rest of the world.

3.5 Research Methods

Research questions were designed in such a manner that they provided both qualitative and quantitative data. Quantitative choice of questionnaires was selected to ascertain the sequence

of waste management services i.e. how many times per week are waste receptacles collected? how many waste collection vehicles are used in Theewaterskloof Municipality? The amount of waste sent to the transfer stations and landfill sites?, amount of waste processed? Additionally, quantitative data was collected to assess the amount and rates of waste diversions and source separation. While qualitative data research questions were prepared to ascertain if there are any waste management plans or strategies in place to manage waste in the research area. Qualitative choice of questions aimed to collect data from existing publications, documents, meeting minutes, views of the community members and those of the waste management organization employees and views of the municipal representative on waste management and waste management practices. Also, to determine the involvement of community members in waste collection and recycling.

Representatives from different organizations were interviewed over a 8 month period. The organizations selected were community members, community workers programme, Theewaterskloof Municipality, and community development workers. These organizations were selected based on their involvement with waste management in Grabouw, Theewaterskloof.

3.5.1 Data Collection

Data was collected using the qualitative and quantitative research method to fulfil the research objectives as detailed in chapter one of this research study. Data collection was divided into two sections: primary data collection and secondary data collection.

In this study primary data collection is particularly derived from a set of questionnaires prepared to gather data which will subsequently answer the research questions. Primary data is collected by the investigator conducting the research. A questionnaire is a set of written questions in anticipation for gathering information obtainable through written responses of the subjects. The information obtained through use of a questionnaire is completely similar to that obtained by an interview; however, questions tend to have less depth (Creswell, 2009). Questionnaires were prepared and directed to a sample of community members from each selected residential area to complete. Closed-ended questions were included because they are easier to manage and analyze. They are also more efficient in the sense that a respondent can respond to more closed-ended questions than open-ended questions in a given period. The respondents were given an assurance that the answers provided could not be linked to them at the stage of data analysis, therefore ensuring anonymity.

Questionnaire design and development was guided by the following:

- Ensuring that there is a high response rate as the questionnaires were distributed to respondents to complete;
- Questionnaires were collected personally by the researcher;
- Questionnaires were designed in such a manner that they require less time and energy to manage;
- They offered anonymity because respondents' names were not required; and
- They ensured that there is less opportunity for bias as they were presented in a consistent manner.

Two sets of interviews were undertaken to fulfill the objectives of the research. Interviews with a sample of community members of each selected Grabouw residential areas and the local municipal representatives more particularly from the waste management department. The set of interviews with the community members assisted the researcher to determine the knowledge and views of community members with regard to localised waste management and waste management practices while, an interview with local municipality representative aided the researcher to determine the status quo of existing waste management practices, waste management plans and their implementation in the selected residential areas as well as future waste management plans. Interview questions were based on knowledge of waste management and waste management practices such as waste reduction, re-use, collection and recycling, treatment and/or treatment facilities and disposal as well as challenges experienced.

Secondary data refers to readily available data collected by other researchers and organizational structures (Creswell, 2009). Common sources of secondary data for scientific research include completed surveys in the similar discipline of study, information collected by government departments on waste management, organizational records (municipal records) and data that was originally collected for other research purposes.

Secondary data analysis normally saves time that would be spent collecting and analysing primary data, especially in the case of quantitative data, which takes time to analyse. Secondary data enables the researcher to gather large and high-quality database that would not be feasibly for an individual researcher to collect on his own. For this research; secondary data was collected by reviewing and analysing existing reports such as records of waste collection times and the Theewaterskloof Integrated Spatial Framework. Integrated Waste Management Strategies and Waste Management Plans would have been included under the secondary data

collection. A limitation to this study was that these were not available at the time of the secondary data collection.

3.5.2 Data Handling and Analysis

Primary data obtained through questionnaires was presented in tables and graphs developed to show trend patterns with regard to waste management practices on both formal and informal residential areas in Grabouw. Both discrete and continuous variables were used to present data obtained from the research to determine current waste management practices in Grabouw residential areas as well as the shortcomings in waste management.

Data obtained from interviews (primary data) has been analyzed using content analysis, which includes recording of themes. Each of the recorded interviews had been reviewed three times: firstly, to identify common themes; secondly, to highlight all parts of the text that matches identified themes; thirdly, to verify that no major theme categories have been missed and all parts of the text that matches identified themes are marked. The researcher was interested in any recurrent themes within the research, which could assist in the formulating of conclusive arguments and recommendations.

Secondary data analysis is the interpretation of data which was collected by someone else for other purposes. Unlike primary data analysis, where the researcher collected and interpreted his own data, secondary data analyses are typically broad in scope and include various publications linked to a particular research. For this research, secondary data was examined to determine relevance of the available data by looking at the data's original purpose, when it was collected, population, sampling/sample strategy, data collection protocols, questions asked, and the form of data. Through interpretation of available data, the researcher was able to identify common themes and data relevant to the research. Examining secondary data was intended to provide answers to the research questions other than the questions for which the data was initially collected for. Secondary data collection involved grouping of themes relevant to this research such as waste management service delivery, sustainable waste management and waste management practices which are the key themes in this research. This assisted to gather views of other researchers on these themes to form a basis for comparison with the current situation in the study area.

3.6 Description of Variables

A variable is an observed phenomenon which takes on diverse values. It is a logic grouping of attributes and attributes are characteristics that describe an object such as age and environmental beliefs (Flannelly, Flannelly & Jankowski, 2014). The variables were used to determine the method for environmental attributes to answer the research question and objectives.

The following variables were established for this research:

- Waste Management Practices Budget (WMPB) = **Independent Variable (X)**
- Availability of Waste Management Practices (AWMP) and Understanding of Waste Management Practices (UWMP) = **Dependent Variables (Y)**

The independent variable is a variable which the researcher manipulates to determine the possible effect or brings about a change in an observed occurrence which creates the relationship with the dependent variable (Kumar, 2011; Kumar, 2014). The researcher then examines how the independent variable affects other variables.

While a dependent variable is the variable which is assumed to depend on independent variable. It observes and measures the affected independent variable (Welman, Kruger & Mitchell 2005).

The relationship and dependability between two variables are essential. Where there is no relationship between two variables, the effect is rejected. The availability of waste management practices and the understanding of waste management practices by community member's is determined by the budget allocated to waste management practices which then clarifies the cleanliness and or dirtiness of the city.

3.7 Variable Correlation Test

A correlation analysis was determined by correlation coefficient test, where correlation coefficient of **+1** indicates a positive relationship, correlation coefficient of **0** indicates no relationship and correlation coefficient of **-1** indicates a negative relationship. WMPB (X) was assigned numerical values indicating the budget for waste management practices leading to the cleanliness of the town.

AWMP (Y) was assigned numerical values showing the impact caused by limited waste management practices budget. UWMP (Y) was assigned numerical values indicating resultant effect from unavailability of waste management practices.

Limited waste management practices budget, results in unavailability and or limited number of waste management practices and poor understanding of waste management practices by community members and those involved in the waste management sector. The numerical values assigned to both independent and dependent variables illustrate the correlation coefficient between variables. The correlation coefficient was calculated using Microsoft Excel. A correlation coefficient of 1 was observed which indicates positive correlation between variables.

As variable X increases, variable Y increases. As variable X decreases, variable Y decreases. A correlation coefficient of 0 indicates no correlation. Figure 2 illustrates the correlation analysis using R square value.

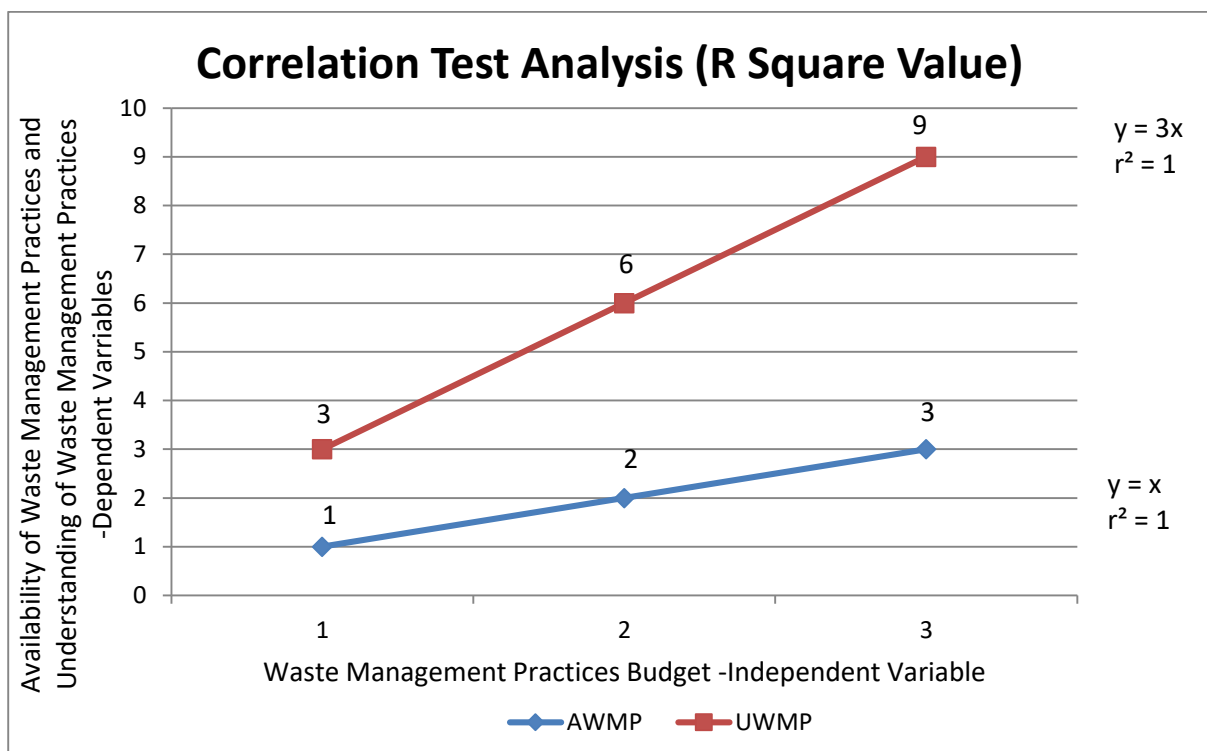


Figure 2: Variable (s) correlation analysis test graph

The correlation analysis figure 2 above shall be read in conjunction with table 1 below which indicates correlation coefficient between the independent and dependent variables for this

research. The correlation coefficient (CoE) is 1 which indicates a positive relationship between variables.

Table 1: Variable (s) correlation coefficient test

Variable (s)	Value (s)			Coefficient (CoE)
Waste Management Practices Budget (X)	1	2	3	1
Availability of Waste Management Practices (Y)	1	2	3	
Waste Management Practices Budget (X)	1	2	3	1
Understanding of Waste Management Practices (Y)	3	6	9	

3.8 Research Delineation

This research focused on current waste management practices at Grabouw residential areas. The town of Grabouw in the heart of the vast Elgin Valley is known as the commercial centre for what is the largest single export fruit producing area in Southern Africa (Theewaterskloof Spatial Development Framework, 2012). Two formal and informal residential areas adjacent to the Palmiet River were selected. These areas were selected based on previous observations which showed waste piles on the streets of formal residential areas, open spaces and within the river streams. Due to time constraints prescribed by the institution policies for completion of the research, the researcher perceived the two formal and informal residential areas to be sufficient for data collection and research completion. Data collection, analyses and report writing had to be done within the prescribed time frame. Again, considering the size of Grabouw, the researcher felt that limiting the research to the selected areas would ensure that data was collected within a 6 months' period even though the data collection period was extended for an additional 2 months. However, this was still within the timeframe for completion of the research.

Considering the previous year's statistics, the population of this town is expected to increase from time to time. Several authors believe that an increase in population growth results in waste

management issues and pressures for the local municipalities. As indicated above, two formal and informal residential areas were selected to fulfil the objectives of the research. A local municipality representative of the waste management department was included in this research. The selected residential areas are adjacent to the Palmiet River, which is the source of water supply for different communities. This helped the researcher to determine the possibility of waste ending up in Palmiet River streams. The selected residential areas of Grabouw played a pivotal role in the research by providing the required data on current waste management practices and the municipality provided the status quo of the existing waste management practices in the selected residential areas.

3.9 Contributions of the research

The findings of this research can be used by the Theewaterskloof Municipality, to create a benchmark of the current waste management practices, waste management service delivery and build on the understanding and participation of community members on waste management. Based on the current challenges and shortcomings, the recommendations made in this research will assist the municipality to develop an action plan to improve the waste management service delivery, incorporate global waste management practices and provide a mechanism for sustainable waste management.

The research findings will also assist provincial government to understand the status quo of the municipality regarding waste management service delivery and waste management practices. Furthermore, the research study can assist upcoming researchers and other researchers interested to replicate the study or undertake further studies in this particular area.

3.10 Ethical Considerations

The researcher requested the municipal management to interview employees involved in waste management within the Municipality (see **Appendix E**). Through this process the researcher was honest in all research data collection, data report, methods and procedures used to gather data and publication status. The researcher indicated to the interviewees that no names would be used during data interpretation and there would be complete anonymity. The researcher has not falsified or misrepresented data and all questionnaires which led to the completion of the research study are provided as appendices to this research study. The research design, data analysis and interpretation has been clearly presented above. This proves that the researcher had avoided being biased in experimental design, data analysis, and data interpretation.

Additionally, the researcher avoided or minimized self-deception and disclosed personal or financial interests that could affect the research process. The researcher has further avoided careless errors and negligence; carefully and critically examined his own work while considering the work and approach of peers.

The researcher kept good records of research activities, such as data collection, research design and correspondence with journals, shared data, results, ideas, tools and resources. He was open to criticism and new ideas and honored patents, copyrights, and other forms of intellectual property. The researcher has not used unpublished data, methods, or results without permission. He has provided proper acknowledgement or credit for all contributions to the research study. The researcher has strived to promote social good and prevent or mitigate social harms through research, public education, and advocacy. He has sought to avoid discrimination against colleagues or students on the basis of sex, race, ethnicity, or other factors not related to scientific competence and integrity. In closing, relevant laws, institutional and government policies were considered and adhered to.

CHAPTER 4: RESEARCH FINDINGS AND DISCUSSION

CHAPTER 4

RESEARCH FINDINGS AND DISCUSSION

In this chapter the researcher analyzed the work experience of the representatives of the selected organizations, identified and interpreted available waste management practices, waste management services planning and implementation of waste management services in Grabouw. Table 2 below shows the number of participants per selected organization on work experience, waste management practices, waste management services planning and implementation of waste management services.

Table 2: Showing number of interviewed representatives per selected organization

Community Development Workers (CDW)	Theewaterskloof Municipality (TwK)	Community Workers Programme (CWP)	Community Members (CM)
4	1	16	30

4.1. Work Experience

Work experience here refers to the number of years each representative from the selected organizations had been involved in waste management. Work experience has been included in this study to verify the number of years each representative has been involved in waste management (Table 3). This was selected to determine the knowledge of representatives on waste management practices, including their understanding and participation in waste management practices. It could be argued that the increased years of experience of representatives contribute to the understanding of waste management and the participation in waste management practice. Therefore, representatives with more experience would be more knowledgeable in waste management and participation in waste management than those with less years of experience.

Table 3 below shows representative's responses from the three selected organizations i.e. Community Development Workers, Theewaterskloof Municipality, and Community Workers Programme to work experience:

Table 3: *Work experience of the selected organizations*

#	Community Development Workers	Theewaterskloof Municipality	Community Workers Programme
<i>No of Years</i>	3 years	7 years	2 and 8 years
<i>Working arrangement</i>	Contract	Full Time	Contract

The CDW representatives were involved with the organization for three years. While the TwK representative had 7 years of involvement with the municipality. However, the years of involvement with the organization of the CWP ranged between 2 to 8 years. The role of waste collectors in SWM is often under-recognized (Dlamini, 2016). In most South African towns and suburbs, some residents are using trolleys for collection of paper, plastic, scrap metal and cardboard boxes, intended for recycling by selling it to recyclers and waste merchants. Currently, the role these residents play in the recycling industry has not been researched and analyzed. The relevant experience of waste collectors being incorporated in municipal waste programs is unknown (Mamphitha, 2011). The experience of waste collectors alone on waste

collection programs cannot be viewed as a complete tool to deal with current waste management issues in Grabouw. However, the number of years of experience presented by TwK and CWP presents reasonable grounds for the representatives to understand waste management and participate in waste management practices. While CDW had the least years of experience/involvement with the programme, the representatives presented an adequate understanding and participation in waste management. There appears to be little support provided to the waste collection programs from Theewaterskloof Municipality in terms of finances, guidance through education levels or capacity building. Financial and capacity building support in existing waste collection programs in Grabouw is seen as one of the tools which could assist to improve the municipal solid waste system.

Members of the CDW focus group indicated that the organization was established between 2011 and 2012, but since then, the organization has not shown growth in terms of human resources. This was mainly due to limited funds invested in the CDW waste management programme. Since the organization was established, only four members have been actively involved. This proves that too often; the waste management sector is neglected. Unavailability of funds invested in waste management programmes is one of the immediate challenges facing the waste management sector (Lavagnolo, 2012). Manaf *et al.* (2009), observed that increasing waste volumes beyond the current infrastructural, organizational, institutional and financial arrangements can trigger challenges for the application of waste management practices.

The research also found that the TwK representative was responsible for a number of sectors which included water, sewage and solid waste. The work experience of the TwK representative proved that he was experienced enough to handle the waste sector, however, the combination of different sectors and lack of supporting professionals within these sectors suggest a challenge in managing waste within TwK. Increasing waste volumes that exceed the capacity of existing organizational structures pose challenges in the management of waste (Manaf et al, 2009). Given the current waste management challenges in Grabouw, an added responsibility on the TwK official will pose more deficits on resources allocated for waste management. A well-structured waste sector has responsibilities allocated to each personnel for a purpose of achieving waste reduction and collection targets (British Columbia Ministry of Environment, 2016). The researcher's perception is that each of these sectors should have a responsible person if the waste management sector is to improve.

CWP representatives presented a different view when asked how long they were involved with the programme. Based on figure 3, the majority of respondents have been involved with CWP from year 2011. This shows that the programme is sustainable, even though some of the longest serving employees leave due to the working arrangements, such as contract and limited funds invested in the CPW programme. The monthly stipend of R1000.00 to R2000.00 provided to CWP members depending on the number of years serving the program shows limited funds invested in the programme, and this resulted in the longest serving members of the programme seeking new opportunities. Lavagnolo, (2012), agrees with the findings obtained in the study area that the unavailability of funds is one of the immediate challenges facing the waste management sector. Compared to the CWP stipend, the CDW stipend is even lower, estimated between R1000.00 and R1500.00 per month.

There are many factors that influence waste management practices and the more frequently debated are income types, education levels and type of household for example low-income households as in the case of Grabouw, Theewaterskloof (Lavagnolo, 2012). Al-Khatib et al. (2015), stated that respondents with higher education levels were more likely to participate in waste management activities compared to the illiterate. The municipal area presented a different scenario, where it was found that illiterate community members are more willing to participate in waste management; however, the waste management information was not shared with them. This is a matter of concern when trying to sort out waste related issues within the municipality because environmental awareness of communities is a tool that can be used to reduce the negative impacts of poor waste management on the environment (Masjasz-Lech, 2014).

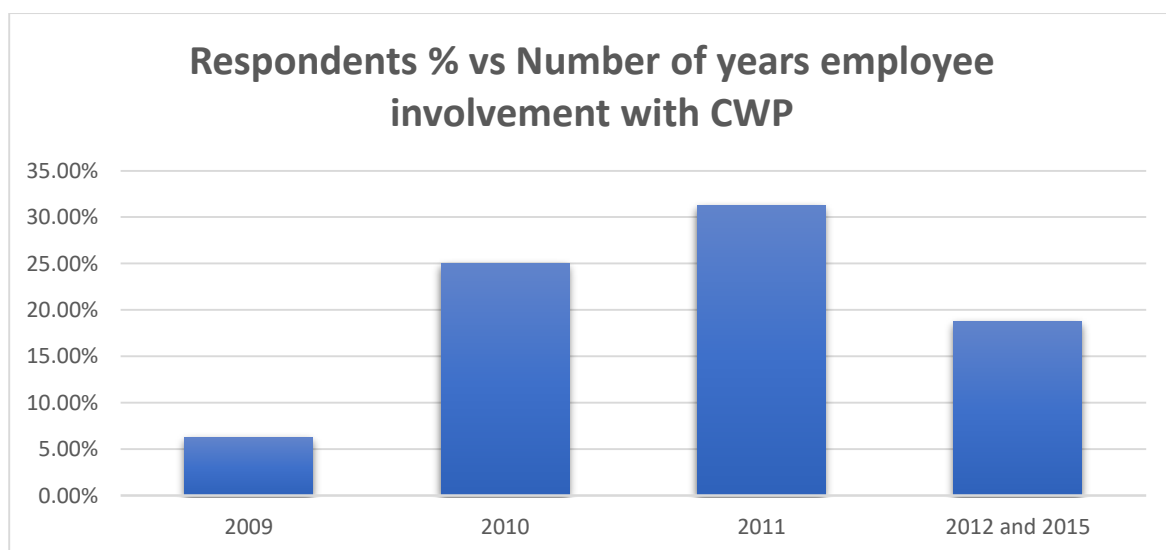


Figure 3: CWP respondents in waste involvement (Percentages vs. number of years)

4.2. Waste Management Practices

The National Waste Management Strategy (NWMS) published in 2011 and amended in 2020, requires government department’s i.e. national, provincial and local government to take a different approach to waste management, which is stipulated in the promulgated National Environmental Management Waste Act, Act 58 of 2008 (RSA, 2008). The NWMS calls for an integrated approach to waste management that adopts waste hierarchical principles: avoid, reduce, recycle, re-use and (only as a last resort) disposal of waste (Department of Environment, Forestry and Fisheries, 2020). As stipulated by legislation and being part of the waste hierarchy principles, appropriate application of waste management practices is of vital importance to deal with piles of solid waste which lands in the streets and in open areas. Table 4 below shows the organization’s responses on current waste management practices in Grabouw.

Table 4: Waste management practices in Grabouw

#	Community Development Workers (CDW)	Theewaterskloof Municipality (TWK)	Community Workers Programme (CWP)	Community Members (CM)
<i>Number of plastic bags collected per day</i>	30 plastic bags collected per day	± 2000 tons of waste collected per month	100 packed and collected per day	Only waste bins used
<i>Who collects waste and How often is waste collected</i>	TwK collects waste every day at working areas	TwK collects waste once a week in every community	TwK collects once a week at working areas	TwK collects once a week

Data obtained from CDW shows that there are 30 plastic bags collected per day. The waste collected by the programme is not quantified in terms of the number of tons of waste collected per day. According to Gawaikar and Deshpande (2006), the most important aspect of solid waste management is the quantity of waste to be collected, transported and managed. The quantity of waste determines the size and number of waste collection areas and equipment

required for managing waste. The waste quantities are measured based on weight and volume. The weight remains the same for a given set of rejected objects whereas volume is highly inconsistent. Therefore, no quantification of waste collected by CDW leads to poor or no available data for proper analysis, to determine which areas generate more waste and the type of waste generated.

CDW respondents pointed out that the two trucks which collect packaged waste; at specific times do not come to collect waste according to the schedule. This leads to wind-blown waste that ends up in the river system as shown in figure 7. Responses show that 100% of CDW employees have no idea of where the collected waste is taken to. CDW highlighted that there is no waste recycling facility in Grabouw. However, TwK pointed out that there is one waste recycling facility in TwK. This indicates that most waste generated by the TwK is disposed of at Karwyderskraal landfill site. Kalule and De Wet (2009), argued that the current waste disposal methods, such as landfills, are not environmentally sustainable, and municipalities have difficulty complying with regulations and other environmental laws. Waste generation, reduction, collection, re-use, recycling and disposal should be properly analyzed in order to make meaningful decisions. Analysis of waste provides a platform for development of waste management concepts, a proper recycling design, treatment and disposal facilities. A successful waste management plan relies on consistent data on current waste amounts and composition, including relevant physio-chemical properties, and accurate prediction of solid waste generation for the relevant planning period (A Sustainable Waste Management Concept, 2010). A good waste management plan must consider and ensure that there were adequate public review and consultation during development before approval. In addition, it must be able to promote the 3 R's of the waste management hierarchy for example reduce, reuse, and recycle for its sustainability purpose (British Columbia Ministry of Environment, 2016).

Sustainable solid waste management practices involve decision-making at strategic, tactical, and operational levels. However, the operational level is often ignored and or overlooked (Permana *et al.*, 2015). Permana *et al.* (2015), in their study of sustainable solid waste management practices and perceived cleanliness in low income areas, emphasized that sustainable waste management practices were limited to waste separation, waste recycling and to some extent, waste reduction. Although practices were present in every district, the level of the practices varied in each district. In Grabouw, waste management practices are only limited to collection, transportation and disposal. The other practices are either absent or inactive. However, recycling is perceived to be one of the practices that are taking place in the study

area but that was not observed at the time of data collection and there is no evidence to support its existence. There are only two trucks used to collect and transport waste to a landfill site in TwK Municipality. The number of trucks used for waste collection is not sufficient for handling the amount of waste being generated and ultimately ends up in open areas. The current waste management practices in Grabouw need to be reviewed and integrated in the spatial development framework and a separate integrated waste management plan should be developed. This will assist the municipality to save costs used to clean open spaces which are used as dump sites by communities.

About ± 2000 tons of waste are collected per month by the TwK, using two trucks (5 to 6 years old) which are believed to be in good working condition. For a municipality of this size, the trucks being used to collect waste are not sufficient. At least four to five trucks should be used to collect waste within TwK. The waste collected by the organizations (CDW and CWP) should be quantified to determine the impact of these programmes on the total number of tons of waste collected per day/month in Grabouw and TwK. Waste is only collected once a week in TwK which is a standard practice in South Africa (CSIR, 2011).

Data obtained from the CWP organization indicates that 100 plastic bags are packaged per day and temporarily stored along the road for collection by the municipal trucks. Similarly, as the waste collected by CDW, CWP’s collected waste is not quantified. The packaged waste by CWP is only collected once a week, which agrees with findings from the TwK (table 4). It is also evident that the two trucks which collect waste in the TwK sometimes do not come to collect packaged waste from CWP, due to mechanical breakdown and repairs which result in piling of uncollected waste on the streets.

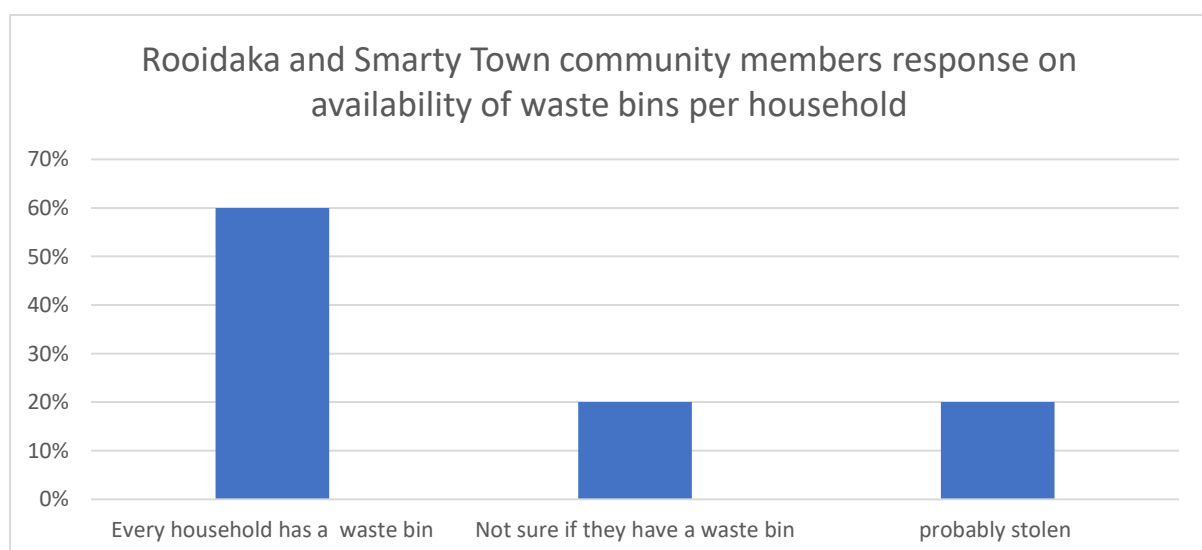


Figure 4: Rooidaka and Smarty Town community members' response on availability of waste bins per household

Based on figure 4 above, sixty (60%) percent of the community members from the two developed residential areas (Smarty Town and Rooidaka) believe that every household has a waste bin. Twenty (20%) percent of the respondents indicated that they were unsure and the other twenty (20%) percent pointed out that if a household did not have a waste bin, then it must have been stolen. Moreover, all the respondents casually mentioned that the waste bins issued to them are too small (they fill up quickly) referring to a 120-litre container as shown in figure 5. The prominent waste bin size issued to communities is 240-litre in size (CSIR, 2011). Therefore, based on the fact that TwK municipality only collects waste once a week, the researcher recommends that the municipality should issue each household with a 240-litre waste bin, to ensure that there is no waste being disposed of in the streets or overflowing waste in the household's yard.

Furthermore, Seadon (2010), transitioning to a sustainable waste management system requires identification and application of leverage points which effect change. He found that a sustainable waste management system has:

- A particular focus on the process and not the products, and
- Links and positions the mutual advantage of all parties involved for example looking at the three pillars of sustainable development.



Figure 5: Example of a 120-litre waste bin issued in Grabouw residential areas

Findings from the study area show that there is no coordinated system in place to manage waste and that the three pillars of sustainable development are not mutually prioritized. The social and environmental pillars are neglected as shown in figure 6. The understanding and knowledge of waste management practices amongst the community members is also limited (Nichols, 2017). However, it appeared that the municipality (TwK) is willing to adopt new practices such as waste composting and waste to energy strategies in areas such as Grabouw, which have high levels of waste generation. The challenge is that there is limited information available about alternative waste management practices which could be adopted in Grabouw. Also, it seems that there is no available budget to incorporate other waste management practices such as composting. A significant obstacle in the study area to achieve sustainable waste management practices was the lack of opportunity to segregate waste at the point of its generation such as at households, schools, public halls and in town. The other prevailing challenge to effectively and efficiently manage waste is the issue of small zoned areas for the latest landfill sites development. The latest landfill sites have a limited capacity of three to four years (Jin et al., 2006). Landfill development requirements are often neglected in many instances and this poses difficulties in managing waste (CSIR, 2011). Construction and demolition waste which cannot be recycled is increasing and the only solution at present is disposal to a landfill site and this further reduces the capacity of the landfill sites (Jin et al., 2006).

Based on figure 6 below, it is clear that 80% of CWP employees are not aware of the waste disposal facility when waste leaves the working areas. While 20% assumes that it's being disposed of at landfill site. On numerous occasions CWP noticed their packaged waste not collected by the municipality and the plastic bags which they use to package waste torn apart. Waste management practices in Grabouw are largely dependent on waste disposal. The benefits and impacts of investing and employing different approaches to achieve reduction in land filling are uncertain and this demonstrates the high dependency on land filling which is not a sustainable waste management practice (Farmer et al., 2015).

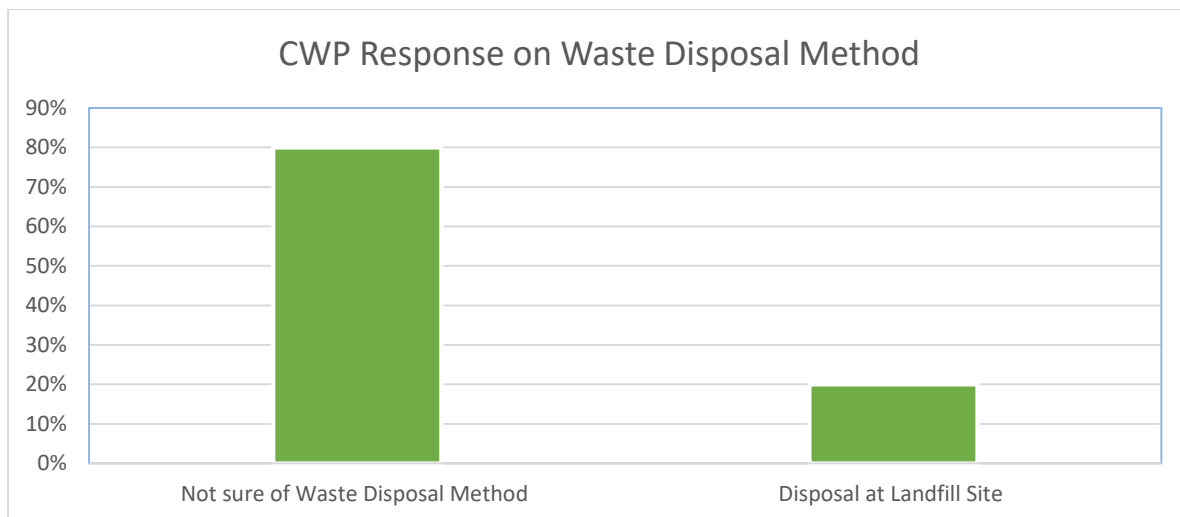


Figure 6: CWP response on Waste Disposal Method

Attaining sustainability in waste management requires an option that employs environmental friendliness. Such techniques must be effective, efficient and less costly than many options available for application (Taiwo, 2011). Composting is one of the environmentally friendly techniques which can be employed with in Grabouw and the composting being produced could be utilized by the farmers in the area. It is also, one of the waste practices that is not costly to apply when properly managed. Composting is sustainable with various advantages associated with it such as production of bio-fertilizer and generation of income. These factors are key for poverty alleviation and enhancing the community’s standard of living. Data obtained from quantifying waste collected in the residential areas would be useful to undertake decisions on whether a composting facility would be feasible in Grabouw and what other waste management practices could be applicable.

Waste characterization is a better option to assist municipalities to understand waste generation patterns, which should stimulate the basis for a better decision on the sustainable strategies to manage waste in Grabouw (Adeniran *et al.*, 2017). Additional similar studies can be carried out in the TwK, particularly at Grabouw to determine which immediate waste reduction practices can be employed to manage waste, as the current practices is not environmentally friendly. A prevailing challenge facing government structures is that waste management governance structures have a potential for conflicting targets and a frequent shortfall of practices compared to policy. Even though waste is regulated within spatially defined units, its composition and quantity are determined by economic processes operating at different scales to that of municipal waste governance (Pauline *et al*, 2010). Having conducted waste characterization, municipal waste governance should engage private sector entities that

determine the composition of products and challenge them to design and develop environmentally friendly products to ensure that municipalities do not encounter difficulties of having to deal with piles of waste which poses difficulties for recycling. Gutberlet (2015), supports the above argument by indicating that industries have also failed to manage its waste, with manufacturers primarily determining the material composition of their products and packaging; forcing them to manage the waste problem. Waste is increasingly privatized and there is a lack of a coordinated state effort to regulate waste generation. Solid waste generation and management has become a prominent issue in local municipalities including TwK and one that often lacks clear political direction on how it should be managed (Gutberlet, 2015).

The respondents from the two informal settlements, Zola and Marikana indicated that they do not have waste bins. This is a common practice in South Africa (CSIR, 2011). If the municipality is unable to provide waste bins for the informal dwellers in the two informal settlements, centralized waste skips should be provided. Four (4) waste skips for each informal settlement would be preferable and should be collected on a weekly basis. Samples of waste generated from each informal settlement can be taken from the full skips to perform a waste characterization study. This will enable determination of waste management practices which can be implemented (Adeniran *et al.*, 2017).

Additionally, visual observations also confirmed that there are no waste bins provided in the two informal settlements, as the dwellers were using plastic bags to dispose of their waste. When the plastic bags are full, they are taken closer to the road to be picked up by the municipal truck. Despite all the effort taken by some individuals, there are dwellers who still dispose of their waste in open spaces due to waste bins not being provided. For this reason, waste ends up in the river systems as shown in figure 7 below.



Figure 7: Waste lying in a river stream near the Zola informal residential area

4.3. Waste Management Services Planning

Waste management services’ planning is of importance to determine barriers to sustainable waste management and devise strategies to combat waste management issues (Permana et al., 2015). Table 5 highlights responses of the two organization (CDW and CWP), Theewaterskloof, and community members on availability of a waste management plan (WMP) which indicates how waste management services are planned as well as their participation in its development.

Table 5: Responses of Theewaterskloof Municipality and community members on the availability of a waste management plan and participation in the development of WMP

#	Community Development Workers (CDW)	Theewaterskloof Municipality (TwK)	Community Workers Programme (CWP)	Community Members (CM)
Availability of a WMP and representatives participation on its development	<ul style="list-style-type: none"> - No specific WMP in place - Therefore, no participation in its development 	<ul style="list-style-type: none"> - IWMP drawn up by consultants - IWMP was not available on municipal website - Community members were not involved in its development 	<ul style="list-style-type: none"> - No specific WMP in place - Organization manager selects working areas and informs the representatives 	<ul style="list-style-type: none"> - Community Members are not involved in the development process of a WMP

CWP representatives agree with findings obtained from CDW regarding the availability of a waste management plan which would define the working areas and the entire waste management process. In both these organizations, the responses indicated that there is no available waste management plan which the programme use to operate in Grabouw residential areas. This shows that the respondents did not participate in the development of the WMP. However, the CWP organization manager selects working areas on a weekly basis and informs the organization representatives on areas where work will be undertaken. CWP findings agree

with the CSIR (2011), on the basis that waste management is still problematic in different parts of the world with disagreement regarding the understanding of waste management practices and its applications to deal with the piling up of waste in residential areas, as evidenced by figure 9. This resulted because the CWP's is not aware of other waste management practices which can be employed to deal with piles of waste ending up on the streets, except by collection and transportation. This proves that there are no documented waste practices, waste management services planning, and no waste innovations introduced within TwK. Waste management requires proper planning and research (Seadon, 2010). The situation in Grabouw presents a clumsy picture of how waste is being planned and managed and this should be improved by developing a clear waste management plan indicating the problematic areas in Grabouw and Theewaterskloof. The waste management plan should include the following minimum requirements: waste collection points; collection times; quantification of waste collected per area; practices to be employed to reduce, recycle and recovering waste which are almost non-existent at this stage.

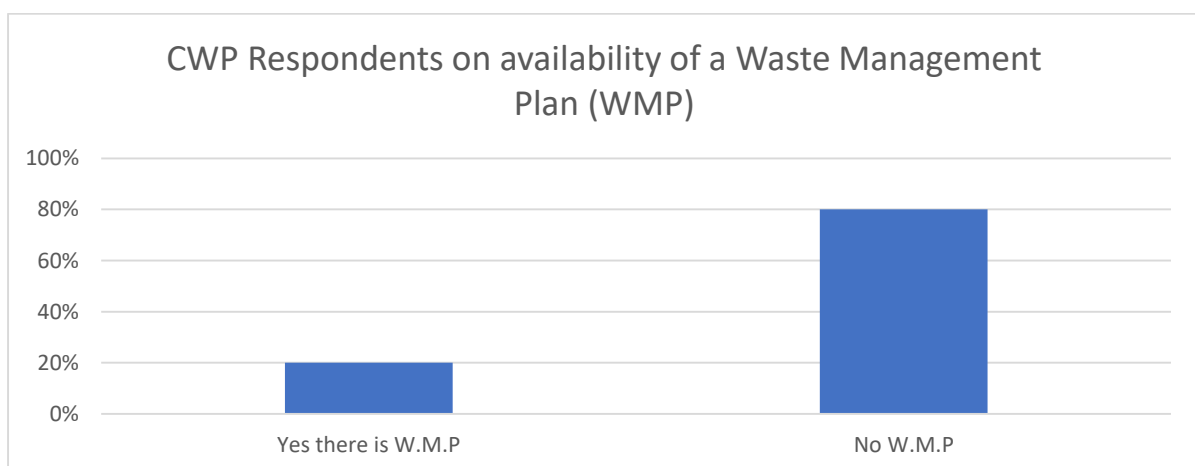


Figure 8: CWP response on availability of a Waste Management Plan (WMP)

Based on figure 8, 20% of CWP employees believe that a WMP is being kept by management. While 80% argued that there is no such thing as a WMP. This provides an indication that employees were not trained on waste management practices nor involved in the development of a WMP. Ejaz *et al.* (2010), highlighted the following as the consequences of not having a proper WMP:

- Improper solid waste management system may contribute to worsening environmental degradation of the community;
- Dispersed solid waste from the illegal open dumps often blocks drains and sewers;

- Flies breeding are directly linked with open solid waste dump sites;
- Uncollected solid wastes from a few locations within a city are degrading the urban environment and discouraging efforts to keep streets and open spaces clean;
- Different segregated solid waste materials, such as plastic bottles and medical supplies, are not being properly cleaned by local scavengers; and
- During rainy seasons, produced leachate from the open dumped sites could cause serious pollution to water bodies adjacent to open dumps as in the case of Grabouw;

The findings from the study area indicate that the manner in which waste is handled is not sustainable and TwK management needs to reconsider how waste can be managed in a sustainable manner. This can only be attained when the connection between sustainability planning, institutional governance and municipal finances are realized and uniform targets are developed and implemented (Permana *et al.*, 2015).

On the other hand, community members from the four selected residential areas noted that they were never involved in the waste management planning. This statement concurs with findings obtained from the TwK, suggesting that the IWMP was only developed by a consultant and no members of the community were involved in its development. No copy of the IWMP was found on the municipal website, while an adopted Integrated Development Plan of 28 March 2013 for the period 2012 to 2017 showed little commitment to waste management (Theewaterskloof Spatial Development Framework, 2017). Permana *et al.* (2015), states that community involvement in waste planning, waste reduction and waste separation is strongly related to a sense of cleanliness in the community. Therefore, communities should be involved in waste management planning. Moreover, an average of 30% of the interviewed community members in both developed residential areas indicated that if the municipal truck did not come to collect waste or certain households missed collection times, then that waste frequently ends up in the open spaces. Observations by the researcher proved that these open spaces are located close to flowing river streams. Such issues can be avoided if community members are involved in waste management planning. CDW and CWP should receive training related to waste management practices to provide them with more exposure on the opportunities that exist in waste management services. Knowledge shared with CDW and CWP could spread through the entire communities, as most of the members are from the selected communities for this study. This would potentially reduce incidents of waste disposal on open spaces as shown in figure 9.



Figure 9: Waste in an open space between Smarty Town formal residential area and Zola informal residential area

Waste management practices are more of a management problem than a technical problem and must be borne by all concerned and affected parties. Moreover, a waste management plan outlines how waste management services are planned i.e. collection points and trucks to be used, recovery process, recycling initiatives, and disposal of waste if it cannot be recovered (Farmer *et al.*, 2015). As shown in table 5, CDW representatives highlighted that there is no waste management plan used in the organization. However, the organization members, during weekly meetings, collectively decide which days to work, working areas and who will be working at which area. The organization manager informs the municipality of the working areas decided upon to ensure that packaged waste by the organization is collected. Even though CDW has a great strategy working for them, a proper waste management plan is still required and when developed it should be shared with the municipality, so that packaged waste is quantified, collected and managed.

Waste management practices are based on environmental sound criteria in order of preference and they consist of prevention/minimization at source, which is the first preference on waste management criteria followed by waste re-use, recycling, energy recovery and lastly disposal which is the least desired criteria option (Giusti, 2009). The situation at TwK presents a different view to the environmentally sound criteria. Waste management practices in the TwK are dominated by collection and disposal. A good practice though is that the waste collection points are recorded, and a route is determined based on recorded collection points. When new development patterns are found, they are incorporated into the recorded waste collection points.

The above findings prove that waste management practices at TwK show little effort in adopting the environmental sound criteria and no sound measures on how waste management services are planned. This can be attributed to insignificant waste management practices commitment in the TwK. Waste management practices appear to be the most neglected area to be incorporated to urban development (Farmer *et al.*, 2015).

A daunting challenge facing cities in sub-Saharan Africa is the inefficient management of waste (Amoah and Kosoe, 2015). Figure 9 proves that waste in the TwK is not efficiently managed. This is demonstrated by the lack of a well thought waste management plan/practices. Also, community members who are involved in waste collection, should be involved at the inception phase of the waste management system which would detail the waste practices to be employed in the study area. The TwK therefore needs to urgently adopt appropriate waste planning and efficient practices to manage waste. Farmer *et al.*, (2015) interpret waste management practices as any techniques, innovations and or methods used to reduce, handle and manage any streams of waste. These are often referred to as waste innovations used to turn waste materials into usable products or help make sound decisions on waste handling and disposal. Based on findings obtained from CWP, waste is only collected, transported and disposed of; no other innovations are being employed to reduce the generation of waste and prevent disposal at landfill.

In relation to the findings from the community members, the National Environmental Management Act (NEMA) (Act No. 107 of 1998) requires everyone who has caused or may have caused significant pollution or degradation of the environment to take reasonable measures to prevent and remediate that pollution (RSA, 1998). Unavailability of the WMP proves that employees of the organizations and community members were never involved in its development and as such the community members are not aware of such requirements as stipulated by NEMA. Certainly, the state cannot expect community members to take reasonable measures to prevent and or remediate any pollution which they may have caused if they are not aware of the national environmental management requirements.

4.4. Implementation of Waste Management Services

Waste management is a required basic service to be provided by municipal authorities in South Africa. However, the present scenario rather provides a deferring perception in terms of service delivery as shown by the absence of adequate overall waste management practices (Manaf *et*

al., 2009). The present level of services in the TwK is so low that there is a threat to environmental quality and possibly public health. Kalule and De Wet (2009), perceive refuse removal as one free basic service that is expensive and most municipalities do not have the resources to offer it.

CDW organization representatives noted that the organization has played a tremendous role in waste management services in the research area. They argue that the communities used to have lots of waste piling up on the streets which is now less compared to the time the organization was non-existent, but no evidence to support the assertion was obtained. However, they admitted that there is still waste which ends up on the rivers/streams as shown in figure 7, citing that this is caused by a lack of environmental education in the community. This can be viewed as a lack of a coordinated effort by TwK to manage waste. Solid waste generation and management has become a prominent issue in local municipalities and one that often lacks clear political direction on how it should be managed (Gutberlet, 2015).

One of the positive factors indicated by the organizations representatives is that the organizations can provide jobs to a few community members. This is despite that some community members do not stay long in the organization due to the fact that the stipend is too low to sustain some community members. The CDW organization representatives also believe that households place waste in the designated waste receptacles in the formal settlements. However, they intentionally dispose of waste in the river or open spaces when they have missed a collection truck, without knowing the impacts it may cause.

The TwK representative received waste management training and the candidate has seven years of experience in the field which makes the candidate competent enough to handle the waste management sector. However, the opportunities and benefits of implementing efficient waste management practices are not realized in the TwK. GreenCape (2016), asserted that solid waste recycling has the potential to create jobs. For example, some jobs can be created at private waste recycling facilities, which are non-existing in the research area, while other jobs can be created through businesses that buy recyclable materials such as processors (compost manufacturers and scrap metal dealers). The waste management sector has potential to create important and sustainable jobs, or jobs in sectors, which generate less carbon emissions. Poor and previously disadvantaged people are likely to be employed in the waste management sector for street cleaning, refuse collection, sorting and in recycling initiatives. However, the abundance of organic waste used in the waste to energy process is unknown, that poses risks

to failure of waste to energy investments, and the solution to this would be waste characterization studies. Job creation can be stimulated by municipal interventions such as sustainable management of solid waste and turning waste products into usable resources (Permana *et al.*, 2015). This can only be attained when the connection between sustainability planning, institutional governance and municipal finances are realized and identical targets are developed and implemented. Also, ensuring that the composition and quantity of the municipal waste stream are not seen as an independent variable (Pauline Deutz, Gareth Neighbour and Michael McGuire, 2010).

TwK's current situation suggests that the municipality has not invested enough in waste management practices and or services. This is evidenced by two trucks collecting waste in the TwK municipality, unavailability of waste recycling facilities and non-existence of waste management interventions such as composting. Also, the findings show that inclusion of community members can be achieved through the addition of financial and human resources, which are not currently committed to by the municipality to remove the barriers to successful implementation of waste management services. TwK highlighted the incorrect use of services issued for example waste receptacles and/waste bins, as one of the factors which hinders the implementation of waste management services. Local authorities including TwK need to table objectives indicating how, when, and who will manage waste and what other interventions and/or innovations will be added to help manage waste. Through its role in waste management, the municipality must ensure that communities are protected from the risk of injury, illness, and disease through appropriate regimes of collection, processing and disposal of household waste (Cossey, 2007).

The study area is characterized by high levels of seasonal migration linked to farming and other agri-industrial activities which resulted in high population growth rates, in turn creating increasing demands for provision of basic services such as water, electricity, sanitation and housing. High levels of poverty are also singled out with 78% of the population earning less than R3500 per month (Theewaterskloof Spatial Development Framework, 2012). Expansion of informal settlements could contribute to the difficulties to implement waste management services in Grabouw as noted by CDW. Since informal settlement dwellers at Zola and Marikana are not issued with waste bins, plastic bags and or waste skips; it proves to be an additional challenge on how waste services are implemented in Grabouw. Waste management practices are also affected by rural to urban migration, where certain towns or municipalities find it difficult to deal with the rapidly increasing population (Vij, 2012). The expansion of

informal settlement dwellers in Grabouw is caused by urbanization which triggers difficulties to manage waste in urban areas more especially in informal areas. Urbanization directly contributes to waste generation, and unscientific waste handling causes health hazards and urban environmental degradation (Vij, 2012). On the other hand, urbanization is a major driver for increasing municipal solid waste (MSW) generation rates within cities (Suthar and Sajwan, 2014).

Masjasz-Lech (2014) concurs with Vij (2012), that excessive waste generation is being driven by an increase in population growth in urban areas, which leads to a great concern for waste management services integration in sustainable urban planning. This can be linked to the situation in the Theewaterskloof Municipality where census results for the year 2011 proved that the population of the area has increased to 30,337. Urbanization has become a major issue in the sustainable development debate, mainly because of the problems associated with planning for expansion of residential areas. As with the case of urbanization, waste management services require careful planning and integration into spatial planning. Permana *et al.*, (2015), acknowledge that the increase in population, economic growth, wellbeing and quick movement of people from rural to urban areas are important factors that directly contribute to increased waste generation. He asserted that integrated sustainable waste management must not only receive top priority but must go beyond technical aspects to include several key elements of sustainability to ensure success of any solid waste project. Gutberlet (2015), emphasized that the problems of waste management are due to the increasing population and yet political institutions and administrations fail to manage massive amounts of waste resulting from new developments and packaging materials.

Waste management training is viewed as one of the aspects which enhances implementation of waste management services. Table 6 highlights organizations' response when asked about waste management training.

Table 6: Organizations responses regarding waste management training

#	Community Development Workers (CDW)	Theewaterskloof Municipality (TWK)	Community Workers Programme (CWP)	Community Members (CM)
<i>Do you feel that your organization</i>	No Waste Management Training	The respondent has received waste	Respondents believe that the programme has	No Waste Management

<i>has done enough to capacitate you about waste management?</i>	received by CDW	management training	not done enough to capacitate them on waste management practices	Training received by CM
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CDW organization noted that no waste management training was received by its employees. On the other hand, the CWP organization representatives believe that the organization has not done enough to capacitate its employees on waste management. Only one (1) CWP employee received waste management training and the training did not address the daily challenges of employees within the working areas, and was not facilitated in a language that they understand. Permana *et al.*, (2015), highlighted waste reduction and waste separation as the two preferred practices and/ methods in sustainable solid waste management (SSWM). These methods are perceived to be impractical to implement without the presence and awareness of community members as well as a strong commitment and support of city authorities. TwK must ensure that waste management training becomes a priority to the local community and any waste management organizations. There is no waste reduction and waste separation practices taking place in Grabouw and waste management training would ensure that there is immediate separation of waste and waste generation would be reduced. The presence of community involvement on waste reduction and waste separation is seen as a vital tool for keeping communities clean (Permana *et al.*, 2015). This shows that if communities are involved there would be clear results in terms of the cleanliness of communities.

Eighty percent (80%) of the community members interviewed noted that there are no incidents where waste is not collected, while twenty percent (20%) are of the view that on some days the municipality truck does not come to collect waste and people then decide to empty their waste receptacles on open spaces. This also happens when some of the community members missed the waste collection truck. These issues can be better addressed or prevented if community members receive waste management training and are involved in waste management services planning to ensure that waste management is tackled at its generation stage.

TwK admitted that community involvement is one of the factors which enhance implementation of waste management services. However, the current findings do not reflect community involvement in waste management except for a few individuals who are part of

CDW and CWP organizations. Even though these individuals have limited\ or no training in the waste management field. Masjasz-Lech (2014), observed that environmental awareness of entrepreneurs and communities is a tool that can be used to reduce the negative impacts of poor waste management on the environment.

Cossey (2007), believes that waste management has improved at local government level, but his perception is that local municipalities still faces many challenges, such as the lack of funds invested in waste management services and waste management programs, well thought waste management plans, waste management education and the unavailability of waste receptacles in some residential areas. These challenges have been noted as the main issues which hinder successful implementation of waste management services in the study area. Manaf et al., (2009), shows alignment to the findings of this study by stating that municipalities often lack funds allocated to waste management services which then results in waste management practices not fully implemented. This was also indicated by the TwK Municipal representative.

CHAPTER 5: CONCLUSION AND RECOMMENDATIONS

5.1 Conclusion

This study aimed to evaluate current waste management practices in Grabouw residential areas, in order to understand the participation in waste management practices of the municipality, community residents and community-based organizations. The findings show that the CDW representatives were involved with the organization for an average of three years, while the TwK representative had seven years of involvement with TwK's solid waste management department. However, the CWP had representatives with two years of involvement with the programme and some had been involved with the programme for eight years. The number of years of involvement for TwK and CWP representatives proved that they have adequate understanding of waste management and are active participants in waste management practices. While CDW had the least years of experience/involvement with the programme, the representatives presented a satisfactory understanding of waste management and participation in waste management practices. However, the Theewaterskloof Municipality appeared to have provided little support to the waste collection programs in terms of finances, guidance and through education or capacity building. This is demonstrated by the stipend amount the organizations representatives are receiving per month. If adequate support could be provided by the municipality, this would mean that the whole municipal solid waste management system would be improved. Over and above that, the municipal representative seemed to be responsible for a number of sectors, from which each sector should have one responsible person if, waste management is to be improved. The work experience of the TwK representative

proved that he is experienced enough to handle the waste sector. However, it appeared that there is no well-structured waste sector or waste management organizational structure.

Data obtained from CDW shows that the waste collected by the organization is not quantified in terms of the number of tons of waste collected per day. The quantity of waste collected determines the size and number of functional units and equipment required for managing the waste. This poses difficulties in managing current streams of waste in the study area. CDW indicated that there are two trucks collecting packaged waste. This is in agreement with the findings obtained from TwK and at times these trucks do not collect waste as per schedule, leading to wind-blown waste which ends up in the river. The number of trucks used for waste collection is not deemed sufficient to handle the quantity/amount of waste generated and ultimately ending up on open areas.

It appeared that the waste receptacles issued to the community members of the formal settlements are too small and they fill up quickly. As the TwK municipality only collects waste once a week, the researcher is of the view that the municipality should at least issue each household with a bigger waste receptacle to ensure that there is no littering taking place in these communities. The informal settlements should be provided with waste skips as they currently do not have a waste disposal mechanism provided to them except for the plastic bags system.

Waste management practices in the research area are only limited to collection, transportation and disposal. The other practices are absent, however recycling is perceived to be one of the practices that exists in the study area but, that was not observed at the time of data collection and there is no evidence to support its existence. Although the municipality is willing to adopt new practices such as composting and waste to energy amongst others. The challenge to this is insufficient information about alternative waste management practices, which could be applied in Grabouw. Additionally, the understanding and knowledge of waste management practices amongst community members perceived as a tool for waste reduction is limited and this result in waste piling up in the streets.

Composting is one of the environmental friendly techniques, which can be employed within Grabouw, and the farmers in the area could utilize the product (compost). Waste characterization can assist municipalities understand waste generation patterns which should

stimulate the basis for a better decision on the sustainable strategies to manage waste in Grabouw.

Waste management services planning is underpinned by a well thought planning process of how waste will be managed for example from temporary storage at house homes, collection times, collection vehicles, waste recovery facilities, recycling facilities / initiatives and disposal of waste streams which cannot be recycled further. In the study area both CWP and CDW indicated that there was no available waste management plan used in Grabouw. The CWP organization is not aware of other waste management practices, which can be employed to deal with piles of waste ending up on the streets, except collection and transportation. This further proves that there are no documented waste practices, waste management services planning, and no waste innovations introduced within TwK.

Waste management requires proper planning and research. The situation in Grabouw reflects poor planning of waste management services. While, the improvement of this situation could be by a development of a clear waste management plan which would indicate problematic areas in Grabouw and Theewaterskloof for example waste collection points, collection times, quantification of waste collected per area including practices to be employed to reduce, recycle and recover waste which are almost non-existing at this stage. The findings from the study area indicate that the way waste is handled does not represent a planned process for its management.

The community members from the four selected residential areas were never involved in the waste management planning. This is supported by findings obtained from the TwK, which suggest that the IWMP was only developed by a consultant and no members of the community were involved and or given an opportunity to participate in its development. A certain percentage of interviewed community members on average 30%, in both developed residential areas indicated that at times the municipal waste collection trucks do not collect waste, some households also miss collection times causing piles of waste on open spaces. Observations proved that these open spaces are near flowing rivers. Such issues can be avoided if community members were involved in waste management planning.

The present level of implemented waste management services in the study area is very low suggesting a potential for poor environmental quality and health related risks. The CDW organization appears to play a significant role in waste management services in the research

area, as the amount of excessive waste piles on the streets are now less than before the organization was established. There is still waste that ends up in the rivers and the CDW believes that this is caused by lack of environmental education within the community. The CDW organization also noted that households place waste in the designated waste receptacles in the formal residential areas, however, some residents intentionally dispose of the waste receptacles in the river or open spaces when they have missed a collection truck, without knowing the impacts it may cause.

The examination of TwK's current situation reveals that the municipality has not invested enough funds in waste management practices and/or services. This situation would need to be improved if the implementation of sustainable waste management services is to be achieved. The inclusion of community members and or community-based organizations involved in waste management can be achieved through the addition of financial resources, which are not currently made available by the municipality. TwK highlighted the incorrect use of services issued for example waste receptacles, which hinders implementation of waste management services.

Waste management training is viewed as one of the critical measures for effective and efficient implementation of waste management services. Waste reduction and waste separation at source are two preferred practices in sustainable solid waste management (SSWM).

5.2 Recommendations

The current waste management practices in Grabouw needs to be reviewed and integrated into the spatial development framework and a separate integrated waste management plan be developed if the government wants to save on costs used to clean open spaces currently being used as dumping sites. Proper planning and management should be considered by TwK management. This can only be attained when the connection between sustainability planning, institutional governance and municipal finances are realized and then uniform targets are developed and implemented. The provincial government should engage and support the municipality to improve the poor waste management practices in the study area, which could ultimately draw the attention of investors, increase tourism and provide job opportunities.

The collected waste by CDW and CWP is not quantified and should be quantified in order to determine the impact caused by these organizations on the total number of tons of waste

collected per day/month in Grabouw and TwK. Additionally, for the municipality of this size, at least four to five trucks should be used to collect waste in TwK.

Waste characterization is seen as a solution for waste to energy investments. Similar waste characterization studies can be carried out in the TwK, particularly at Grabouw to determine which waste reduction practices could be employed to dispose of waste. On completion of studies such as the waste characterization, an integrated waste management plan should be developed and published for a certain public commenting period so that communities are informed and able to provide their views.

Members of the CDW and CWP should be trained on waste management practices as they are involved in the management of waste in the study area. The knowledge shared with them could spread through the community, thus reducing the incidents of waste disposal on open spaces. Waste reduction and waste separation at source are viewed as the preferred practices and/ or methods in sustainable waste management. However, these practices are impractical to implement without proper training, awareness of community members as well as a strong commitment and support by city authorities. TwK must ensure that waste management training becomes a priority for a local community and to any organization involved in waste management.

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7. APPENDICES

APPENDIX A: Community Development Workers Questionnaires



CDW Research Questions

Good Day:

My name is Aseza Mpokopi, a Masters Student in the field of Environmental Management at Cape Peninsula University of Technology.

As part of the Master's Degree I have to do a research which focuses on Waste Management Practices.

I hereby request your permission to be interviewed based on your honest understanding of Waste Management Practices

The questions will focus on:

1. Waste Management Practices;
2. Waste Management Planning; and
3. Implementation of Waste Management.

There are no right or wrong answers to the questions. We only need your honest opinion.

All information will be kept in the structured component and no one will ever know who said what to me.

Would you kindly complete the interview questions below?

INSTRUCTIONS

All questions should be read thoughtfully and understood before responding. Please select the most appropriate answer where options are provided for you and respond to the best of your ability when required to provide your views.

CAPACITY

Questions:

1. For how long have you been employed by Community Development Workers (CDW)?

1 - 3 Years	
4 – 7 Years	
8 – 11 Years	
12 and above	

2. What type of working arrangement do you have with Community Development Workers Initiative?

Full Time	
Part Time	
Casual	

3. What does your job entail?

.....

.....

.....

.....

WASTE MANAGEMENT PRACTICES

Questions:

4. Would you give an indication of how much waste is collected per day by the Community Development Workers?

.....
.....

5. Who collects CDW packaged waste?

.....
.....

6. How often is the CDW packaged waste collected?

Once a week	
Twice week	
Three times a week	
Four times and above	

7. How is CDW packaged waste disposed of?

.....
.....
.....

8. Are there any waste recycling facilities that you know of? If *Yes*, how many do you know?

Yes	
No	

.....
.....

9. Have you ever noticed any packaged waste by CDW had not been collected?

Yes	
No	

WASTE MANAGEMENT SERVICES PLANING

Questions:

10. How is CDW waste collection planned?

.....
.....

.....
.....
11. Does CDW have any Waste Management Plan? If *Yes*, who and how was the Waste Management Plan Developed?

Yes	
No	

.....
.....
.....
12. Were you as CDW employees involved in the Waste Management Planning?

Yes	
No	

13. Have you attended any waste management training?

Yes	
No	

IMPLEMENTATION OF WASTE MANAGEMENT SERVICES

Questions:

14. What are the positive factors that that you can take away from the CDW?

.....
.....
.....

15. What are the challenges that you have encountered since joining CDW?

.....
.....
.....

16. Do you feel that CDW has done enough to capacitate you about waste management?
Please substantiate the choice of your answer.

Yes	
No	

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.....
.....

APPENDIX B: Community Workers Programme Questionnaires



CWP Research Questions

Good Day:

My name is Aseza Mpokopi, a Masters Student in the field of Environmental Management at Cape Peninsula University of Technology.

As part of the Master's Degree I have to do a research which focuses on Waste Management Practices.

I hereby request your permission to be interviewed based on your honest understanding of Waste Management Practices

The questions will focus on:

4. Waste Management Practices;
5. Waste Management Planning; and

6. Implementation of Waste Management.

There are no right or wrong answers to the questions. We only need your honest opinion.

All information will be kept in the structured component and no one will ever know who said what to me.

Would you kindly complete the interview questions below?

INSTRUCTIONS

All questions should be read thoughtfully and understood before responding. Please select the most appropriate answer where options are provided for you and respond to the best of your ability when required to provide your views.

CAPACITY

Questions:

17. For how long have you been employed by the Community Workers Programme (CWP)?

1 - 3 Years	
4 - 7 Years	
8 - 11 Years	
12 and above	

18. What type of working arrangement do you have with CWP?

Full Time	
Part Time	
Casual	

19. What does your job entail?

.....
.....
.....
.....

WASTE MANAGEMENT PRACTICES

Questions:

20. Would you give an indication of how much waste is collected per day by the CWP?

.....
.....

21. Who collects CWP packaged waste?

.....
.....

22. How often is the CWP packaged waste collected?

Once a week	
Twice week	
Three times a week	
Four times and above	

23. How is CWP packaged waste disposed of?

.....
.....
.....

24. Are there any waste recycling facilities that you know of? If *Yes*, how many do you know?

Yes	
No	

.....
.....

25. Have you ever noticed any packaged waste by CWP, had not been collected?

Yes	
No	

WASTE MANAGEMENT SERVICES PLANING

Questions:

26. How is CWP waste collection planned?

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.....
.....

27. Does CWP have any Waste Management Plan? If *Yes*, who and how was the Waste Management Plan Developed?

Yes	
No	

.....
.....
.....

28. Were you as CWP employees involved in the Waste Management Planning?

Yes	
No	

29. Have you attended any waste management training?

Yes	
No	

IMPLEMENTATION OF WASTE MANAGEMENT SERVICES

Questions:

30. What are the positive factors that that you can take away from the CWP?

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.....
.....
.....

31. What are the challenges that you have encountered since joining CWP?

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.....
.....

32. Do you feel that CWP has done enough to capacitate you about waste management?
Please substantiate the choice of your answer.

Yes	
No	

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APPENDIX C: Theewaterskloof Municipal Representative Questionnaires



Municipal Representative Research Questions

Good Day:

My name is Aseza Mpokopi, a Masters Student in the field of Environmental Management at Cape Peninsula University of Technology.

As part of the Master's Degree I have to do a research which focuses on Waste Management Practices.

I hereby request your permission to be interviewed based on your honest understanding of Waste Management Practices

The questions will focus on:

7. Waste Management Practices;
8. Waste Management Services Planning; and
9. Implementation of Waste Management Services.

There are no right or wrong answers to the questions. We only need your honest opinion.

All information will be kept in the structured component and no one will ever know who said what to me.

Would you kindly complete the interview questions below?

INSTRUCTIONS

All questions should be read thoughrally and understood before responding. Please select the most appropriate answer by placing an (x) where appropriate if options are provided for you and respond to the best of your ability when required to provide your views.

CAPACITY

Questions:

33. For how long have you been employed at Theewarterskloof Municipality (TWK)?

1 - 3 Years	
4 – 7 Years	
8 – 11 Years	
12 and above	

34. What is your designation?

.....
.....

35. What is your job description?

.....
.....
.....
.....

WASTE MANAGEMENT PRACTICES

Questions:

36. Would you give an indication of how much waste is collected per day at Theewarterskloof Municipality?

.....
.....

37. How is waste collected in the Theewarterskloof Municipality?.....

38. How is waste disposed of in the Theewaterskloof Municipality?.....

39. Are there any waste recycling facilities? If *Yes*, how many do you know of?

Yes	
No	

.....

40. How many waste removal trucks servicing Theewarterskloof?

41. How often do trucks collect waste in Theewarterskloof residential areas including Marikana, Roydaka; and Smarty Town which are located in Grabouw?

Once a week	
Twice week	
Three times a week	
Four times and above	

WASTE MANAGEMENT SERVICES PLANING

Questions:

42. How are the waste management services planned in Theewarterskloof Municipality?.....

43. Does the Municipality have any Integrated Waste Management Plan? If *Yes*, who and how was waste the Integrated Waste Management Plan Developed?

Yes	
No	

.....

.....

.....

44. Is the community involved in Waste Management Planning?

Yes	
No	

IMPLEMENTATION OF WASTE MANAGEMENT SERVICES

Questions:

45. What are the factors that enhances the implementation of Waste Management Services?

.....

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46. What are the factors which hinders the implementation of Waste Management Services?

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APPENDIX D: Community Members Questionnaires



Community Research Questions

Good Day:

My name is Aseza Mpokopi, a Masters Student in the field of Environmental Management at Cape Peninsula University of Technology.

As part of the Master's Degree I have to do a research which focuses on Waste Management Practices.

I hereby request your permission to be interviewed based on your honest understanding of Waste Management Practices

The questions will focus on:

10. Waste Management Practices;
11. Waste Management Planning; and
12. Implementation of Waste Management.

There are no right or wrong answers to the questions. We only need your honest opinion.

All information will be kept in the structured component and no one will ever know who said what to me.

Would you kindly complete the interview questions below?

INSTRUCTIONS

All questions should be read thoroughly and understood before responding. Please select the most appropriate answer where options are provided for you and respond to the best of your ability when required to provide your views.

CAPACITY

Questions:

47. Do you believe that every household has a waste bin/receptacle's?

Yes	
No	

48. Would you kindly indicate where do you dispose of your waste?

Waste bin	
Plastic bags	
Other	

49. How is your waste collected and how often does it get to be collected?

.....
.....
.....

50. Are there any incident where your waste does not get to be collected? If you have indicated *Yes in the table below*, please explain why?

Yes	
No	

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51. Evidence suggests that some waste has been discovered in the past within the river streams. Would you provide your views why is that so?

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APPENDIX E: Permission Letter for Data Collection



Theewaterskloof Municipality Head Office
6 Plein Street
P.O.Box 24
Caledon
7230

Telephone: +27 (28) 2143300
Fax: +27 (28) 2141289
Website: www.twk.org.za

Good day Mr Delcarne

08 February 2017

Permission letter:

As requested, herewith we grant permission to Mr Asez Mpokopi (a master student at CPUT) to interview the waste management personnel and EPWP workers at Grabouw for his research

Please ensure that visitors first report to the office of Mr. Shawn Galant at Waste Facility Grabouw.

The Municipality accepts no responsibility for any loss of property or injury.

Kind Regards

Hegans Marthinus

Act : Director Technical Services

Mr D.Damons

Villiersdorp Tel: (028) 840 1130 | Greyton Tel: (028) 254 9620 | Riviersonderend Tel: (028) 261 1360
Caledon, Botrivier, Tessaarsdal Tel: (028) 214 3365 | Genadendal Tel: (021) 251 8130 | Grabouw Tel: (021) 859 2507