# MOGALE CITY LOCAL MUNICIPALITY

## INTEGRATED WASTE MANAGEMENT PLAN

## DRAFT STATUS QUO REPORT

**15 March 2012**


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**TITLE:** Mogale City Local Municipality Integrated Waste Management Plan

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# AMENDMENTS PAGE

| Date | Nature of Amendment | Amendment No. | Signature |
|---|---|---|---|
| 15 March 2012 | First Draft for Discussion of the Status Quo | 0 | |
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## LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| CBD | - | Central Business District |
| DEA | - | Department of Environmental Affairs |
| DEAT | - | Department of Environmental Affairs and Tourism |
| DM | - | District Municipality |
| DWAF | - | Department of Water Affairs and Forestry |
| EIA | - | Environmental Impact Assessment |
| ECA | - | Environmental Conservation Act (Act 73 of 1989) |
| GDACEL | - | Gauteng Department of Agriculture, Conservation, Environment and Land Affairs |
| GDP | - | Gross Domestic Product |
| GP | - | Gauteng Province |
| GVA | - | Gross Value Added |
| GPS | - | Global Positioning System |
| IDP | - | Integrated Development Plan |
| IWMP | - | Integrated Waste Management Plan |
| IWMSA | - | Institute of Waste Management Southern Africa |
| kg | - | kilogram |
| kg/cap/day | - | Kilogram per capita per day |
| Landfill Classification System | - | G - General waste |
| | - | C - Communal landfill (< 1 ton per day) |
| | - | S - Small landfill (between 1 and 25 tons per day) |
| | - | M - Medium landfill (between 25 and 500 tons per day) |
| | - | L - Large landfill (greater than 500 tons per day) |
| | - | B+ - Significant leachate produced |
| | - | B- - No significant leachate produced |
| | - | H:H - High hazard with hazard ratings 1 to 4 |
| | - | H:h - Low hazard with hazard ratings 3 and 4 |
| LM | - | Local Municipality |
| MCLM | - | Mogale City Local Municipality |
| MEC | - | Member of the Executive Council |
| MFMA | - | Local Government: Municipal Finance Management Act (Act 56 of 2003 |
| MIG | - | Municipal Infrastructure Grant |
| NEMA | - | National Environmental Management Act (Act 107 of 1998) |
| NEMWA | - | National Environmental Management: Waste Act (Act 59 of 2008) |
| NWA | - | National Water Act (Act 36 of 1998) |
| NWMS | - | National Waste Management Strategy |

| | | |
|---|---|---|
| PTO | - | Power Take-Off |
| REL | - | Rear End Loading (Waste Compactor) |
| SAWIS | - | South African Waste Information System |
| SLA | - | Service Level Agreement |
| t/a | - | Tons per annum |
| WRDM | - | West Rand District Municipality |

## GLOSSARY OF TERMS

| | | |
|---|---|---|
| Compost | - | The aerobically decomposed remnants of organic matter. Serves as a growing medium for plants. |
| Formal Settlement | - | A residential area which has completed the formal township application process. It is characterised by geometrically laid out roads and the provision of household water, sewer and electrical services. |
| Informal Settlement | - | A residential area which has not completed the formal township application process. It is characterised by un-evenly laid out roads, often with insufficient width. The settlement may or may not have water at house level, nor sewer and electrical services. |
| Organic Waste | - | A type of waste, typically originating from plant or animal sources, which may be broken down by other living organisms |
| Promulgated | - | The act of formally proclaiming or declaring new statutory or administrative or administrative law when it receives final approval |
| Recycle | - | To separate and process material from waste for further use as new products or resources |
| Rural Area | - | Any area that is not classified urban. Rural areas are subdivided into tribal areas and commercial farms (Source Statistics SA) |
| Urban Area | - | A classification based on dominant settlement type and land use. Cities, towns, townships, suburbs, etc. are typical urban settlements. Areas comprising informal settlements, hostels, institutions, industrial and recreational areas, and smallholdings within or adjacent to any formal urban settlement are classified as urban (Source Statistics SA) |
| Waste | - | Includes any substance, whether solid, liquid or gaseous, which is: discharged, emitted or deposited in the environment in such volume, constituency or manner as to cause an alteration to the environment, a surplus substance, or which is discarded, rejected, unwanted or abandoned, -reused, recycled, reprocessed, recovered or purified by a separate operation from that which produced the substance or which may be or is intended to be re-used, recycled, reprocessed, recovered or purified, or identified as waste by prescribed by regulation |
| Waste Facility | - | Any site or premises used for the accumulation, handling or processing of waste with the purpose of either re-using, treating or disposing of that waste at that site or on another premises |
| Waste General | - | Waste that does not pose an immediate threat or hazard to people or to the environment and includes business waste, domestic waste, garden waste and building waste |
| Waste, Hazardous | - | Waste that may, by circumstances of use, quantity, concentration or inherent physical, chemical or toxicological characteristics, have a significant adverse affect on health and the environment |
| Waste, Industrial | - | Waste, other than hazardous waste, that is generated by an industry |
| Waste Treatment | - | Any method, technique or process that is designed to change the physical, biological or chemical character or composition of a waste, or to remove, separate, concentrate or recover a hazardous or toxic component of a waste or to destroy or reduce the toxicity of the waste in order to minimize the impact of the waste on the environment. |
| Illegal dumping | | Small scale intentional disposal of waste, littering, abandonment of waste by an individual/individuals |
| Illegal disposal | | Large-scale, unpermitted disposal of waste products. |

| | |
|---|---|
| Business waste | Means waste that emanates from premises that are used wholly or mainly for commercial, retail, wholesale, entertainment or government administration purposes |
| By-product | Means a substance that is produced as part of a process that is primarily intended to produce another substance or product and that has the characteristics of an equivalent virgin product or material |

# 1 INTRODUCTION

Nemai Consulting has been appointed by Mogale City Local Municipality (MCLM) to revise the existing Integrated Waste Management Plan (IWMP) for the municipality.

MCLM developed an IWMP in 2004 to establish a more integrated approach to waste management in the municipality. According to the goals set in this document, the IWMP should be reviewed at five-year intervals. The purpose of this document therefore is to determine the status of existing waste management practice, investigate the possibility of waste disposal regionalisation and revise goals and objectives to suit current waste management demands.

Since completion of the IWMP for MCLM in 2004, significant changes occurred in the waste management dynamics of South Africa. Legislation came into practice that has been developed for waste management in South Africa and is known as the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA). This set certain requirements for every sphere of government and organisation or individual involved in waste generation or management.

Along with the Act, Gauteng Province developed an Integrated Waste Management Plan. This plan was developed to establish a provincial perspective on waste management in the province and was developed to be in line with the NEMWA. District and local municipalities will need to align their waste management objectives with that of the province in order to ensure achievement of goals.

This document reflects the current waste management situation in the MCLM as at October 2011 to January 2012.

## 1.1 Study Aims

The study aims, as laid out in the terms of reference for the project, are to:

- Develop a comprehensive Integrated Waste Management Plan for the Mogale City Local Municipality; and
- Identify gaps in the information and the needs of waste management planning in the municipality.

The project deliverables, as stated in the call for proposals are as follows:

- The Status Quo Report;
- Gaps and Needs Analysis;
- Strategy Formulation Phase;
- Action Plan Development Stage; and
- An Implementation Plan

These sections have been provided in this IWMP.

## 1.2 Structure of the Document

The structure of the report is illustrated in the graphic below.


**Figure 1 IWMP Document Structure**



Sections 2, 3 and 4 of this document cover the Status Quo analysis of the MCLM waste management service. This includes a legal review of waste management as it affects the local municipality.

The next section is an estimation of the waste generation volumes for the local municipality, included as Sections 5 of the report. The waste generation analysis presents the expected volumes of waste that should be planned for in the next five years. This is a theoretical calculation which takes into account domestic, commercial and industrial waste generators.

The report then covers strategic waste planning, in Section 6. This section discusses the waste challenges faced by the local municipality, why they are important to address and a framework for addressing the challenges. This section addresses the goals and targets for waste management over the next five years.

Action planning, Section 7, uses the outputs from the strategic waste planning section and presents projects that should be implemented in order to achieve the goals of the IWMP.

The final section is the implementation plan, Section 8, which establishes the timeframes that need to be adhered to ensure that the IWMP is implemented.

## 1.3 Compliance with the Requirements of the Waste Act

The National Environmental Management: Waste Act specifies the contents of a waste management plan. This is contained in Section 12. It is required to demonstrate how this IWMP complies with the requirements of the act.

The table below has been prepared to present the requirements for an IMWP and describes the sections of the document where each requirement is addressed.

| NEMWA Section | Description | Applicable section of this document |
|---|---|---|
| 12 (1) (a) | An IWMP should contain a situation assessment that contains at least: | |
| 12 (1) (a) (i) | A description of the population and development profiles of the area to which the plan relates | Section 2 |
| 12 (1) (a) (ii) | An assessment of the quantities and types of waste that are generated in the area | Section 4.4 |
| 12 (1) (a) (iii) | A description of the services that are provided for the collection, minimisation, re-use, recycling and recovery, treatment and disposal of waste | Section 4.2 to 4.9 |
| 12 (1) (a) (iv) | The number of persons in the area not receiving waste collection services | Section 4.1 |
| 12 (1) (b) | Within the area of the IWMP, show how the municipality intends to: | |
| 12 (1) (b) (i) | give effect to Chapter Three of the NEMWA | Section 6 |
| 12 (1) (b) (ii) | give effect to the objects of the NEMWA | Section 6 |
| 12 (1) (b) (iii) | To identify the negative impact of poor waste management practises on health and the environment | Section 6.1 |
| 12 (1) (b) (iv) | To provide for the implementation of waste minimisation, re-use, recycling and recovery targets and initiatives | Section 6 and Section 7 |
| 12 (1) (b) (v) | To address the delivery of waste management services to residential premises | Section 6 and Section 7 |
| 12 (1) (b) (vi) | To implement any relevant international agreements | Not Applicable |
| 12 (1) (b) (vii) | To best environmental practise with regards waste management | Section 6 and Section 7 |
| 12 (1) (c) | Not applicable at municipal level | Not Applicable |
| 12 (1) (d) | Set out the priorities and objectives of the municipality in respect of waste management | Section 6 |

| NEMWA Section | Description | Applicable section of this document |
|---|---|---|
| 12 (1) (e) | Establish targets for the collection, minimisation, re-use and recycling of waste | Section 7 |
| 12 (1) (f) | Set out the approach to the planning of new facilities for disposal and decommissioning of existing waste disposal facilities | Section 7 |
| 12 (1) (g) | Indicate the financial resources required to give effect to the plan | Section 7.9 |
| 12 (1) (h) | Describe how the municipality intends to give effect to the IWMP | Section 8 |
| 12 (1) (i) | Comply with the requirements prescribed by the minister | No additional requirements |

The table demonstrates, by reference to table column entitled "Applicable section of this document", that this IWMP complies with the requirements of the NEMWA.

# 2 MOGALE CITY LOCAL MUNICIPALITY OVERVIEW

## 2.1 Location

The Mogale City Local Municipality (MCLM) was established in terms of the Municipal Structures Amendment Act (Act 33 of 2000) as a Category B municipality. It forms part of the West Rand District Municipality. The MCLM is located on the western border of Gauteng, adjoining the City of Johannesburg and the North West Province. The area of jurisdiction is approximately 1 103 $km^2$.

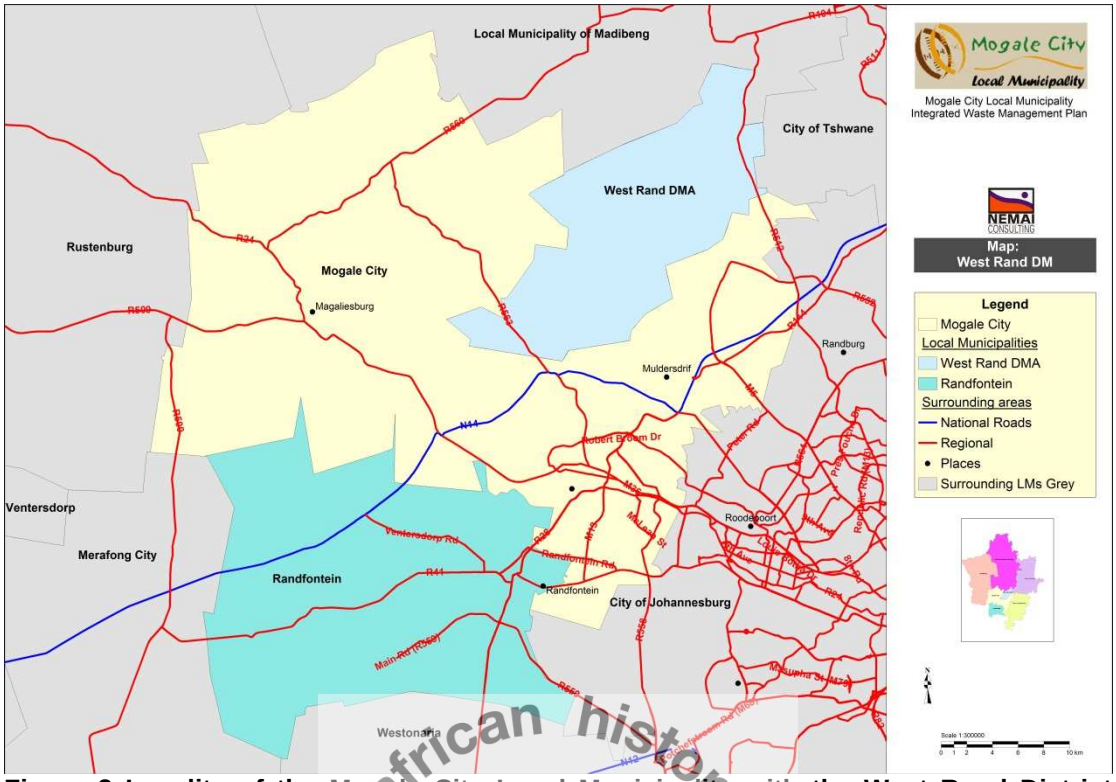


**Figure 2 Locality of the Mogale City Local Municipality with the West Rand District Municipality**



Mogale City is made up of eight main places

- Kagiso;
- Krugersdorp;
- Magaliesburg;
- Mogale City Rural
- Muldersdrift;
- Munsieville;
- Orient Hills; and
- Rietvallei.

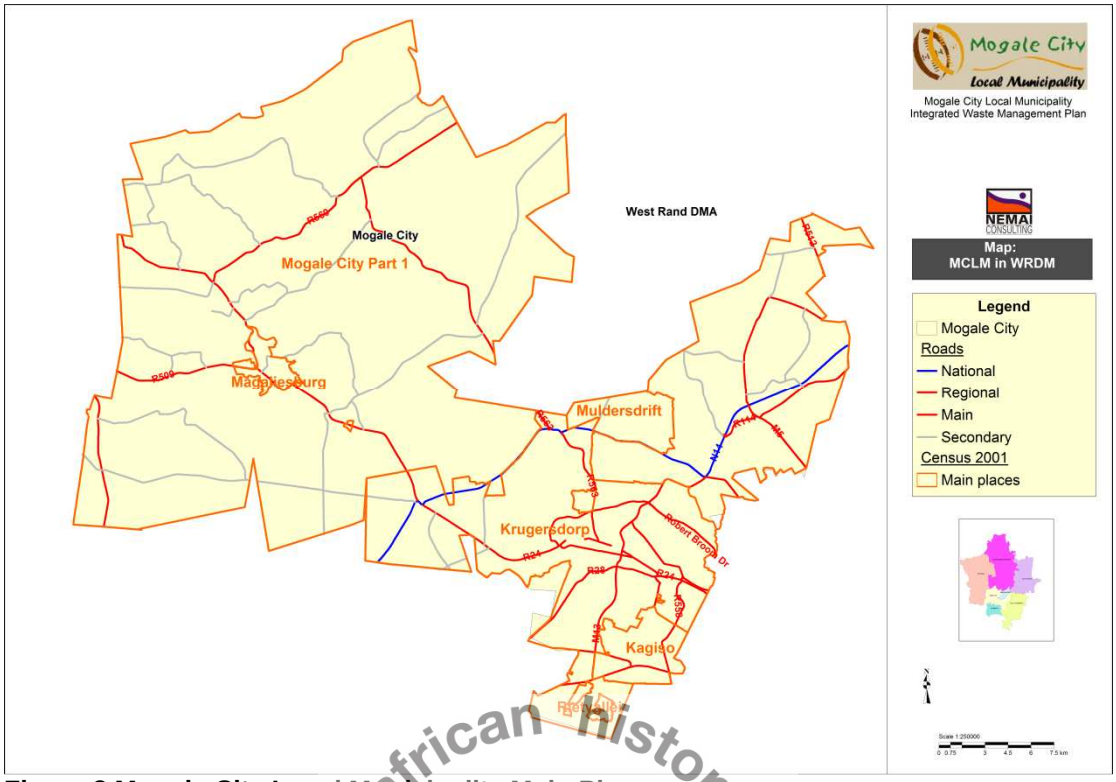


**Figure 3 Mogale City Local Municipality Main Places**

The figure above shows the location of each of these main places.

## 2.2 Approach

The discussion of the demographics and the development profile of the municipality will be carried out using Census 2001 data

Additional demographic and service delivery information was taken from the Community Survey 2007.

The Census 2001 data is the most comprehensive dataset available for the area, and despite it representing data that is eleven years old, it is currently the best data at hand. The analysis will be conducted using the Census 2001 subplace as the smallest geographic unit of measure. The subplaces have been extracted using the project GIS, and the data for the affected subplaces will be presented in the table and figures below.

Where the data has been broken up into rural and urban subplaces, this has been done using the Census 2001 "1996 Definition" which uses a land-use density definition rather than the alternative, population density, definition. This breakdown has been included so that the rural and urban populations can be separated.

The Community Survey 2007 was conducted by Statistics South Africa and was intended as an update on selected Census 2001 data. This survey methodology relied upon a sample taken of the population in each subplace,

and was not an enumeration such as Census 2001. Thus, this survey is more updated, but less comprehensive, than the figures derived from Census 2001.

## 2.3 Population

A demographic profile of the MCLM is essential in understanding the waste generation of the area under consideration and to gain insight into the development status of the study area.

The table below shows the population for 2001 and 2007, along with the household numbers, in the West Rand District Municipality.

**Table 1 Census Data (Community Survey, 2007)**

| Municipality | Persons | | % of WRDM Total | |
|---|---|---|---|---|
| | 2001 | 2007 | 2001 | 2007 |
| Mogale City Local Municipality | 289 835 | 319 641 | 54% | 59% |
| Randfontein Local Municipality | 128 731 | 117 261 | 24% | 22% |
| Westonaria Local Municipality | 109 328 | 99 218 | 20% | 18% |
| West Rand DMA | 5 781 | 2 918 | 1% | 1% |
| **West Rand DM** | **533 675** | **539 038** | **100%** | **100%** |

Mogale City LM has the largest population in the WRDM of 54 percent in 2001 to 59 percent in 2007. Possible reasons for the population disparity are that Mogale City LM is the most urbanised municipality in the West Rand and has the most diversified market for job seekers compared to the other local municipalities.

An implication of the high population is that Mogale City LM is the largest generator of waste in the West Rand DM, thus requiring a sound municipal waste management programme.

## 2.4 Household demographics

### 2.4.1 Household population

The table below provides a breakdown of the number of households in MCLM by main places. Kagiso and Krugersdorp have the highest household population of MCLM of 34 percent and 29 percent respectively.

**Table 2 Household Population in Mogale City (Census 2001)**

| Main Place | Number of households | % of total |
|---|---|---|
| Kagiso | 27 987 | 33.51% |
| Krugersdorp | 24 534 | 29.37% |

| | | |
|---|---|---|
| Magaliesburg | 604 | 0.72% |
| Mogale City Rural | 14 068 | 16.84% |
| Muldersdrift | 100 | 0.12% |
| Munsieville | 6 069 | 7.27% |
| Orient Hills | 313 | 0.37% |
| Rietvallei | 9 852 | 11.79% |
| **Mogale City** | **83 527** | **100.00%** |

### 2.4.2 Household type

The type of waste generated by households is found to be dependent on income and house. The table above reveals that 66 percent of housing in Mogale City is formal housing.

Formal housing is classified

- House or brick structure on a separate stand or yard
- Flat in block of flats
- Town/cluster/semi-detached house (simplex; duplex; triplex)
- House/flat/room in back yard

Informal Housing is classified as:

- Traditional dwelling/hut/structure made of traditional materials
- Informal dwelling/shack in back yard
- Informal dwelling/shack NOT in back yard
- Room/flatlet not in back yard but on shared property
- Caravan or tent
- Private ship/boat



**Table 3 Type of Housing (Census 2001)**

| Main Place | Informal | Formal | Total | % of Informal | % of Formal | % Total |
|---|---|---|---|---|---|---|
| Kagiso | 9 443 | 18 526 | 27 969 | 34% | 66% | 100% |
| Krugersdorp | 2 084 | 22 421 | 24 505 | 9% | 91% | 100% |
| Magaliesburg | 172 | 431 | 603 | 29% | 71% | 100% |
| Mogale City | 3 565 | 10 498 | 14 063 | 25% | 75% | 100% |
| Muldersdrift | 3 | 98 | 101 | 3% | 97% | 100% |
| Munsieville | 3 501 | 2 572 | 6 073 | 58% | 42% | 100% |
| Orient Hills | 300 | 15 | 315 | 95% | 5% | 100% |
| Rietvallei | 8 611 | 1 243 | 9 854 | 87% | 13% | 100% |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Total** | **27 679** | **55 804** | **83 483** | **33%** | **67%** | **100%** |
| | | | | **27%** | **68%** | |

Sixty eight percent of the households in MCLM are formal housing, while twenty seven percent of households are informal dwelling types and five percent other housing typologies.

Table 4 below demonstrates that, in 2001, the overwhelming majority of the population resided in urban areas. The urban/rural split for MCLM is eighty three percent urban to seventeen percent rural. Kagiso and Krugersdorp combined have seventy six percent of the urban population. Ninety one percent of the rural population in the Mogale City Local Municipality is made of the Mogale City Rural main place.

**Table 4 MCLM Rural-Urban Split (Census 2001)**

| Main Place | Number of people | % of People | Number of people | % of People |
|---|---|---|---|---|
| | **Urban** | **83%** | **Rural** | **17%** |
| Kagiso | 100 929 | 42% | 16 | 0% |
| Krugersdorp | 83 391 | 35% | 3 227 | 6% |
| Magaliesburg | 2 222 | 1% | 294 | 1% |
| Mogale City | 1 411 | 1% | 45 456 | 91% |
| Muldersdrift | 600 | 0% | 0 | 0% |
| Munsieville | 19 836 | 8% | 0 | 0% |
| Orient Hills | 0 | 0% | 1 088 | 2% |
| Rietvallei | 31256 | 13% | 0 | 0% |
| Totals | 239 645 | 100% | 50 081 | 100% |
| **Total Population** | **289 726** | **100%** | | |



## 2.5 Income

### 2.5.1 Household income

The figures in Table 5 below showing household income were produced in the study area in Census 2001. The table demonstrates that fifty four percent of households in MCLM are low income earners. This will have an effect on both the waste generation per capita as well as the affordability of the waste management service offered by the municipality.

**Table 5 Household Income Bands, (Census 2001)**

| Main Place | Kagiso | Krugersdorp | Magaliesburg | Mogale City | Muldersdrift | Munsieville | Orient Hills | Rietvallei | Mogale City |
|---|---|---|---|---|---|---|---|---|---|
| No Income | | | | | | | | | |
| Number of Households | 6 692 | 1216 | 46 | 1 206 | 4 | 1 440 | 100 | 3 498 | 14 202 |
| % of no income | 47.1% | 8.6% | 0.3% | 8.5% | 0.0% | 10.1% | 0.7% | 24.6% | 17% |
| Low (R1 – R38 400) | | | | | | | | | |
| Number of Households | 14 921 | 9337 | 430 | 10 289 | 66 | 4 019 | 199 | 5 872 | 45 133 |
| % of low income | 33.1% | 20.7% | 1.0% | 22.8% | 0.1% | 8.9% | 0.4% | 13.0% | 54% |
| Medium (R38 401 – R307 200) | | | | | | | | | |
| Number of Households | 6 279 | 12279 | 124 | 2 189 | 27 | 605 | 15 | 435 | 2 1953 |
| % of medium income | 28.6% | 55.9% | 0.6% | 10.0% | 0.1% | 2.8% | 0.1% | 2.0% | 26% |
| High (R307 201 and above) | | | | | | | | | |
| Number of Households | 97 | 1687 | 11 | 388 | 0 | 12 | 0 | 50 | 2 245 |
| % of high income | 4.3% | 75.1% | 0.5% | 17.3% | 0.0% | 0.5% | 0.0% | 2.2% | 3% |
| Totals | 27 989 | 24 519 | 611 | 14 072 | 97 | 6 076 | 314 | 9855 | 83 533 |



The table below depicts the Income of WRDM industries per LM. Mogale City earns 45.9 percent of income, with the difference shared equally between Randfontwin and Westonaria. Thus the Mogale City LM is a major contributor to the industrial economy of the WRDM.

**Table 6 6Income of WRDM industries per LM 2005-2006, (WRDM GDS 2007)**

| Municipality | Total Income | % of income |
|---|---|---|
| Mogale City | 83 926 | 45.9% |
| Randfontein | 49 549 | 27.1% |
| Westonaria | 49 532 | 27.1% |
| **WRDM Total** | **183 007** | **100.00%** |

## 2.6 Employment

### 2.6.1 Employment status of Mogale City

Figure 4 below shows the employment status of MCLM for 2001 and 2007 and Gauteng for 2007. The percentage of people employed in Mogale City has risen by 3.73 percent. This is confirmed with a 3.24 percent decline in unemployment. People who are not economically active include children under the age of 15 and those who are retired. The population of "not economically active" has also declined by 4.31 percent.

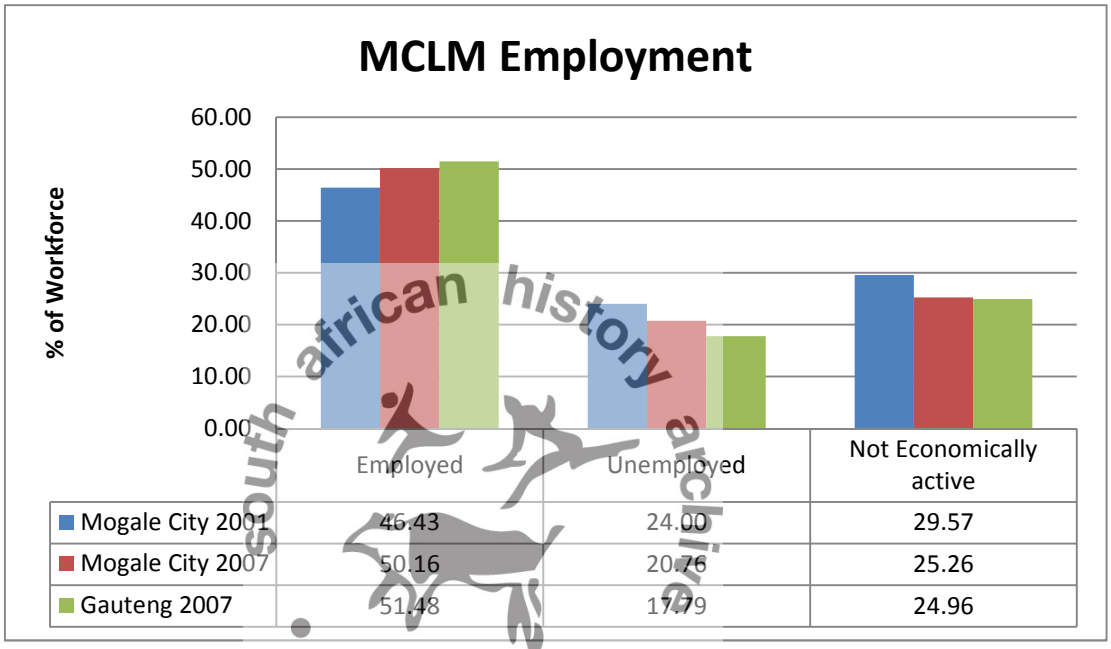


**Figure 4 Employment Status, (Census 2001) (Community Survey 2007)**



The figure shows that unemployment in the MCLM is in the 20% range, using the strict definition. The strict definition for unemployment excludes people who should be members of the workforce, but who have been discouraged from seeking work. Thus they are not counted in the workforce and the percent unemployed decreases.

### 2.6.2 Industry Employment

Measuring employment by industry is critical for labour absorption but gives no indication as to the value or waste generation of each worker. However they do provide hints to the size of each industry which determines the amount of waste produced by the industry.

**Table 7 Employment per sector (Census 2001)**

| Sector | Number of persons employed | % of employment per sector |
|---|---|---|
| Agriculture, hunting, forestry and fishing | 9 305 | 12% |
| Mining and Quarrying | 1 289 | 2% |

| Sector | Number of persons employed | % of employment per sector |
|---|---|---|
| Manufacturing | 13 310 | 17% |
| Electricity, gas and water supply | 481 | 1% |
| Construction | 6 304 | 8% |
| Wholesale and retail trade | 15 392 | 20% |
| Transport, storage and communication | 4 664 | 6% |
| Financial, insurance, real estate and business | 10 042 | 13% |
| Community, social and personal service | 17 317 | 22% |
| **Total** | **78 104** | **101%** |

The figure shows that the Mogale City economy is dominated by the following four categories:

1. Community Services – at 22 percent, is the largest employment industry. Community industry includes government services, personal and social services other services such as education, justice, policing and health provision;
2. Wholesale and retail trade – 20 percent of employment, the trading industry is the second largest employment industry in MCLM;
3. Manufacturing – 17 percent of employment share;
4. Business Services – 13 percent This sector includes activities such as banking, real estate, insurance and all financial services; and

On the other hand agriculture, construction, transport, electricity, gas and water supply contribute the remaining twenty nine percent of employment in the local municipality.



## 2.7 Sector

Table 8 below provides the contribution to Gross Geographic Product per sector for the West Rand District Municipality. Gross geographic product (GGP) is the total income or payment received by production factors within a particular area.

According to the MCLM IDP 2009/2010 indicates that the WRDM GGP showed a 1.1 percent economic growth rate.

No data set was available on MCLM per sector contributions to GGP. However comparative data and discussion below on the impact of MCLM to WRDM, will provide insight to the economy of MCLM to infer the type of waste characterisation of the municipality

**Table 8 Percentage contribution per sector to GGP 2010, (WRDM)**

| Sector | Contribution to GGP |
|---|---|
| Agriculture | 17.70% |

| Sector | Contribution to GGP |
|---|---|
| Mining | 11.20% |
| Manufacturing | 1.50% |
| Electricity | -1.70% |
| Construction | 14.30% |
| Trade | -0.40% |
| Transport | 2.90% |
| Finance | 5.90% |
| Community Services | 3.70% |
| Households | 3.20% |

The table demonstrates that the most important economic sector is Agriculture at 17.70 percent of GGP; this is followed by the construction sector at 14.30 percent of GGP, and then mining, at 11.2 percent. Electricity and trade for WRDM declined by 1.7 percent and 0.4 percent respectively.

Below is a table that depicts the average growth rate of WRDM industries. The data set from IHS Global Insight records the period 1996-2005. It is evident that Mogale City is the fastest growing area within WRDM. The sectors with the highest growth are transport at 6.3 percent, trade at 3.6 percent, finance 3.3 percent and construction at 2.9 percent.

Randfontein and Westonaria have experienced similar growth sectors to those of Mogale City. All three LMs mining have experienced a decline of around 5.4 percent in mining and a decline in the electricity sector.



**Table 9 Average growth of WRDM industries per LM 1996-2005, (IHS Global Insight Regional Explorer)**

| Economic Sector | 1996-2005, Average growth in GGP | | |
|---|---|---|---|
| | Mogale City | Randfontein | Westonaria |
| Agriculture | 1.2% | 1.3% | 1.4% |
| Mining | -5.4% | -5.3% | -5.4% |
| Manufacturing | 2.3% | 1.0% | 2.7% |
| Electricity | -0.7% | -2.4% | -4.6% |
| Construction | 2.9% | 2.3% | 3.4% |
| Trade | 3.6% | 2.9% | 4.1% |
| Transport | 6.3% | 5.5% | 6.0% |
| Finance | 3.3% | 3.2% | 2.7% |
| Community Services | 1.2% | 1.0% | 0.9% |

| | | | |
|---|---|---|---|
| **Total GGP** | **2.7%** | **1.1%** | **-1.9%** |

## 2.8 Infrastructure

### 2.8.1 Health

There are seventeen provincial clinics and hospitals in the MCLM of which nine clinics operated directly by the MCLM. The table below provides a list of clinics and hospitals in Mogale City, as provided by the Mogale City website. All three provincial hospitals are in Krugersdorp as well as four of the five private institutions.

Hospitals are a generator of health care risk waste, hence given the number of institutions in MCLM, waste management for health care is vital, particularly in Krugersdorp which houses almost all large health care institutions.

**Table 10 List of Clinics and Hospitals in Mogale City, (Mogale City)**

| Mogale City Clinics | Provincial Hospitals | Private Institutions |
|---|---|---|
| Central Clinic | Dr Yusuf Dadoo Hospital | Krugersdorp Private Hospital |
| Jan Maree Clinic | Sterkfontein Hospital | Bell Street Day Hospital |
| Noordheuwel Clinic | Leratong Hospital | Medi Cross Clinic |
| Lewisham Clinic | | Hospice in the West |
| Munsieville Clinic A | | Jack van Belkum Kindershuis |
| Munsieville Clinic B | | |
| Kagiso Clinic B | | |
| Azaadville Clinic | | |
| Lusaka Clinic | | |



### 2.8.2 Roads

According to the 2011 – 2016 IDP of Mogale City, the Mogale City total road network is 1 000km. This is made up of 860km of paved roads and 140km of gravel roads in rural areas. The road network can be broken down further into 100km of main arterial roads and 900km of tertiary roads.

**Table 11 Road condition in MCLM (WRDM 2009)**

| Road Network | Condition of the Surfacing | | | | | Condition of the structure | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Very Good | Good | Fair | Poor | Very Poor | Very Good | Good | Fair | Poor | Very Poor |
| Class 3 Minor Arterials | 39% | 23% | 25% | 11% | 2% | 75% | 19% | 5% | 5% | 3% |

| Road Network | Condition of the Surfacing | | | | | Condition of the structure | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | Very Good | Good | Fair | Poor | Very Poor | Very Good | Good | Fair | Poor | Very Poor |
| Class 4a: Connector Roads (CBD areas) | 31% | 28% | 18% | 14% | 9% | 73% | 14% | 7% | 2% | 4% |
| Class 4b: Connector Roads (Residual areas) | 36% | 28% | 20% | 10% | 5% | 82% | 12% | 3% | 0% | 3% |
| Class 5: Access Roads | 19% | 43% | 25% | 12% | 2% | 78% | 20% | 2% | 0% | 0% |
| **Total Road Network** | **26%** | **35%** | **23%** | **12%** | **3%** | **77%** | **17%** | **3%** | **2%** | **2%** |

The condition of roads is a good indicator to transporting of waste efficiently. The table above indicates the condition of Mogale City roads. Seventy seven percent of the structures of the roads are in very good condition and sixty one percent of the surfacing is either in very good or good condition. This indicates waste removal will not be hampered by bad road condition.

### 2.8.3 Refuse removal

The table above indicates that 84% of refuse is collected weekly by authorities, followed by 7 percent personal removal of waste. This accounts for 92 percent of household waste being removed formally.

**Table 12 Household Refuse Removal, IHS Global Insight Regional Explorer 2009**

| Level of Service | 2006 [No. of HH] | 2009 [No. of HH] |
|---|---|---|
| Removed weekly by authority | 89 591 | 99 082 |
| Removed less often than weekly by authority | 1 822 | 4 304 |
| Removed by community members | 3 298 | 2 003 |
| Personal Removal (own dump) | 10 116 | 8 358 |
| No refuse removal | 5 396 | 3 575 |

The current rates charged for collection include:

**Table 13 Refuse Removal Rates, (Mogale City, 2012)**

| Refuse removal | 2010/2011 | 2011/2012 | INCREASE |
|---|---|---|---|
| **Mobile refuse containers 240l bins** | **R** | **R** | **%** |
| Domestic Refuse: One removal per week per 240l container per month or part thereof | 85.35 | 96.44 | 13% |
| Domestic Refuse: Daily Removal per 240L | 506.11 | 571.9 | 13% |

| | | | |
|---|---|---|---|
| container per month or part thereof | | | |
| Business Refuse: One removal per week per 240l container per month or part threof | 196.83 | 222.42 | 13% |
| Business Refuse: Daily removal per 240l container per month or part thereof | 787.28 | 889.63 | 13% |
| Handling /Delivery Fees per container to be delivered | 56.20 | 63.50 | 13% |
| Replacement of lost/Pondaged container (payable in advance if fault of user) | 506.17 | 571.97 | 13% |

The 2011/2012 financial year saw a thirteen percent increase in rates for all refuse removal. Given that 54 percent of households are low income earners and 17 percent of households earn no income at all according to Census 2001 data, a price hike would likely negatively affect the income groups who pay for refuse removal services.

MCLM had their solid waste by-laws gazetted in 2007.

### 2.8.4 Electricity usage

Electricity usage is a gauge of resident's standard of living. In 2009, three percent of MCLM households use electricity for lighting purposes only, the usage has declined by 50 percent between 2006 and 2009. On the other hand, seventy percent of households use electricity for lighting and other purposes has increased slightly by three percent.

From 2008 there have been substantial increases in the price of electricity which could possibly explain the fifty percent decline in usage for lighting purposes only. However, the increase in prices did not deter households who use electricity for more that lighting only. Between 2006 and 2009 there has been a three percent increase in the number of households who use electricity for this purpose.

This data is an indication that low income households are economically stressed and would be difficult to shoulder additional burdens placed on them by higher waste management charges.

**Table 14 Number of Household electricity usage, (IHS Global Insights Regional Explorer 2009)**

| Usage | 2006 | % of Total | 2009 | % of Total | Change |
|---|---|---|---|---|---|
| Lighting only | 6 142 | 6% | 3 063 | 3% | -50% |
| Lighting and other purposes | 82 129 | 75% | 84402 | 72% | 3% |
| No electricity usage | 21 952 | 20% | 29 856 | 25% | 36% |
| Total | 110 223 | 100% | 117 321 | 100% | 6% |

### 2.8.5 Water Supply

The table below indicates that the number of households with piped water inside the dwelling has increased by 20 percent between 2006 and 2009. The municipality has the remaining 3 580 households that still need access to piped water, this accounts for 17% of households.

**Table 15 Access to water (IHS Global Insights Regional Explorer 2009)**

| | 2006 | 2009 | Change |
|---|---|---|---|
| Piped water inside dwelling | 51 334 | 61 512 | 20% |
| Piped water in yard | 46 129 | 44 059 | -4% |
| Communal piped water: less than 200m from dwelling (At RDP-level) | 4 627 | 3 020 | -35% |
| Communal piped water: more than 200m from dwelling (below RDP-level) | 5 077 | 5 151 | 1% |
| No formal piped water | 3 055 | 3 580 | 17% |

## 2.9 Review of 2004 Integrated Waste Management Plan

As of the time of writing, a copy of the 2004 IWMP has not been received.

# 3 LEGISLATIVE OVERVIEW

Waste management planning must be contextualised within the framework of national government, provincial government, district municipality and local municipality legal, regulatory and policy. Below is a brief summary of this framework together with the implications thereof on waste management and waste management planning.

Waste management in South Africa is covered by NEMWA at national, provincial or at local levels. Other legislation mentioned below should be read in conjunction with the NEMWA to get a clear understanding of waste requirements in the South African context.

The summary included in this section is not exhaustive but merely seeks to highlight the more important aspects in respect of waste management.

## 3.1 The National Waste Management Strategy

### 3.1.1 Integrated Waste Management

The White Paper on Integrated Waste Management and Pollution Control identified a number of issues relating to waste management including:

- The lack of priority afforded to waste management

Historically, waste management was not afforded the priority it warranted as an essential function in respect of the prevention of pollution and protection of the environment and public health. Consequently, insufficient funds and human resources were allocated to this function. In many instances this has resulted in a lack of long-term planning, information, appropriate legislation and capacity to manage the waste stream generated in South Africa.

- Fragmented legislation and ineffectual enforcement

Until the recently passed NEMWA, legislation has been fragmented and the concomitant lack of government capacity has meant that the enforcement of existing legislation was frequently unfocused, especially with regard to waste disposal.

- Unacceptable safety, health and environmental practices for pollution and waste management

Environmentally and socially unacceptable practices characterise many aspects of waste management such as:

- substandard, ineffectual or non-existent waste collection and street-cleaning systems:
- illegal dumping and littering and
- poorly sited waste disposal sites.

- The absence of integrated waste management options

To date, the focus on waste in South Africa has been on waste disposal and impact control. This has resulted in concerns such as:

- a lack of focus on issues such as waste avoidance, minimisation and cleaner production technology initiatives, as well as the regulatory initiatives to manage waste minimisation; inadequate resource recovery and a general lack of commitment to recycle; and
- a lack of a variety of appropriate waste treatment methods.

Integrated waste management is a process whereby the focus of waste management is upon a hierarchical approach. This can be compared to the previous waste management approach which had a strong focus on collection, transport and disposal. The application of the waste hierarchy dictates that disposal of waste to landfill is seen as a last resort, with increasing focus being placed on the minimisation of waste through cleaner production, recycling and treatment.

The waste hierarchy, as discussed above, can be divided into four main categories: cleaner production, recycling, treatment and disposal. Cleaner production results in the prevention, as well as minimisation, of waste. Recycling through composting and the recovery of materials as well as the reuse of materials, play an important role in the waste hierarchy. Treatment of materials through the physical treatment, chemical treatment, as well as destruction of materials is the third step in the waste hierarchy. The disposal of waste is the final step in the waste hierarchy and if the three previous steps are followed, the minimum amount of waste goes to landfill.

### 3.1.2 Integrated Waste Management Plans

The NWMS is government's long-term plan (up to the year 2010) for addressing key issues, needs and problems experienced with waste management in South Africa. The strategy aims to reduce both the generation and the environmental impact of waste. It presents a plan for ensuring that the socio-economic development of South Africa, the health of its people and the quality of its environmental resources are no longer adversely affected by uncontrolled and uncoordinated waste management. It establishes a waste management system that concentrates on avoiding, preventing and minimising waste and makes provision for waste management services for all. It extends an acceptable standard of waste collection, as well as transportation, treatment and disposal services to all communities.

Chapter 7 of the NWMS deals with Integrated Waste Management Planning. The primary objective of which is to integrate and optimise waste management so that the efficiency of the waste management system is maximised and the impacts and financial costs associated with waste management are minimised, thereby improving the quality of life of all South Africans.

In accordance with the NWMS the responsibilities for the generation of IWMPs are as follows:

- Local Government is responsible for the production of Integrated Waste Management Plans for General Waste.
- Provincial Government is responsible for the production of Hazardous Waste Management Plans.
- Individual industries / businesses are responsible for production of Waste Management Plans for their respective businesses.

The Gauteng Province (GP) is therefore responsible for the development of an IWMP for the management of Hazardous Waste. District and Local Municipalities are responsible for the development of IWMPs.

IWMPs are also a statutory requirement of the NEMWA. Section 11 of NEMWA states that each provincial department and local authority must prepare an IWMP. IWMPs prepared by local authorities must be approved by the MEC and be incorporated in the IDP of each municipality.

### 3.1.3 The IWMP in the Context of the Integrated Development Plan (IDP)

The Municipal Systems Act (Act 32 of 2000) defines the IDP as one of the core functions of a municipality and makes it a legal requirement for every council to adopt a single, inclusive and strategic plan for the development of the municipality. The IWMP is an integral part of the IDP and therefore it must align with each Municipality's IDP.

IWMPs ensure that service requirements arising from local development priorities are integrated into both the LM and DM IDP's. The IWMPs contain a summary of the current solid waste management priorities for inclusion within the IDPs and must include objectives, strategies and projects with targets and time frames.

The LM IWMP ensures that solid waste management requirements arising from local development priorities are integrated into both the LM and DM IDPs. This ensures that these requirements are communicated to the District Municipality so that they are included into the District's IWMP and IDP.

Key aspects identified in most IDPs that relate to general waste management which need to be taken into account in the development of their IWMP, are summarised as follows:

The broad development goals in IDPs are:

- Meeting Basic Needs: to alleviate poverty by ensuring that indigent residents have access to free lifeline basic services including food and security through the implementation of co-ordinated urban / peri-urban renewal and integrated development throughout the Municipality
- Good Governance: to ensure sustainable and representative governance through efficient and sustainable utilisation of resources in consultation with local municipalities of MCLM

The development priorities and strategic objectives may include:

- Developing regional landfill sites in order to ensure effective waste management and to contribute to a safe and healthy environment.

- Providing and sustaining solid waste collection services, to ensure that all areas are kept clean, to promote waste minimisation in municipalities; to promote sanitary waste disposal in all disposal sites; extending the current services areas in Local Municipalities to all who require such services through refuse removal as well as a clean environment.

An IWMP constitutes the waste sector-planning instrument in respect of solid waste management and presents a summary of the relevant issues, priorities and requirements within each municipality.

The local IWMP ensures that solid waste management requirements arising from local development priorities are integrated into both the LM and district IDPs. This ensures that these requirements are communicated to the District Municipality so that they are included in the district's IWMP and IDP.

The content, format and processes associated with the development and adoption of IWMPs are specified by the national Department of Environmental Affairs and Tourism (DEAT).

## 3.2 National Legislation / Policy

### 3.2.1 Constitution: Republic of South Africa (Act 108 of 1996)

Environmental Rights

Section 24 of the Constitution deals with Environmental Rights and gives the right to all citizens:

> *"to an environment that is not harmful to their health or well being; and*
> *to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:*
> - *prevent pollution and ecological degradation;*
> - *promote conservation; and*
> - *secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development".*

Government at the national, provincial and local level is, in terms of Section 24, obliged to take reasonable legislative, operational and other measures to ensure the rights stated above are fulfilled.

Local Government Matters

Chapter 7 deals with Local Government Matters.

Section 151 – Status of municipalities:

"(3) A municipality has the right to govern, on its own initiative, the local government affairs of its community, subject to national and provincial legislation, as provided for in the Constitution."

Section 152 – Objects of local governments:

"(1)(b) to ensure provision of services to communities in a sustainable manner;
*(1)(d) to promote a safe and healthy environment; and promote social and economic development; encourage the involvement of communities and community organisations in matters of local government.*
*(2) A municipality must strive, within its financial and administrative capacity, to achieve the objectives set out in subsection (1)."*

Section 156 – Powers and functions of municipalities:

(1) " a municipality has executive authority in respect of, and has the right to administer-

a. *the local government matters listed in Part B of Schedule 4 and Part B of Schedule 5; and*
b. *Part B of Schedule 4:*
    - *Air pollution*
    - *Building regulations*
    - *Child care facilities*
    - *Electricity and gas reticulation*
    - *Fire fighting services*
    - *Local tourism*
    - *Municipal airports*
    - *Municipal Planning*
    - *Municipal health services*
    - *Municipal public transport*
c. *Part B of Schedule 5:*
    - *Beaches and amusement facilities*
    - *Billboards and the display of advertisements in public places*
    - *Cemeteries, funeral parlours and crematoria*
    - *Cleansing*
    - *Control of public nuisances*
    - *Control of undertakings that sell liquor to the public*
    - *Facilities for the accommodation, care and burial of animals*
    - *Fencing and fences*
    - *Licensing of dogs*
    - *Licensing and control of undertakings that sell food to the public*
    - *Local amenities*
    - *Local sport facilities*
    - *Markets*
    - *Municipal abattoirs*
    - *Municipal parks and recreation*
    - *Municipal roads*
    - *Noise pollution*

- *Pounds*
- *Public Places*
- *Refuse removal, refuse dumps and solid waste disposal*
- *Street trading*
- *Street lighting*
- *Traffic and parking*

*d. any other matter assigned to it by national or provincial legislation.*

*(2) A municipality may make and administer by-laws for the effective administration of the matters which it has the right to administer.*

*(3) Subject to section 151 (4) , a by-law that conflicts with national or provincial legislation is invalid.*

*(4) A municipality has the right to exercise any power concerning a matter reasonably necessary for, or incidental to, the effective performance of its functions."*

Section 162 – Publication of municipal by-laws

"(3) Municipal by-laws must be accessible to the public"

Schedules Four and Five of the Constitution deal with the legislative, functional and executive competences of national, provincial and local government respectively and are divided into Parts A and B. Part B of both Schedules lists the areas over which local government has some executive authority.

Schedule Five lists functional areas of exclusive provincial legislative competence. Relevant matters relating to local government in Schedule Five Part B are: cleansing, control of public nuisances, refuse removal, refuse dumps and solid waste disposal. Municipalities have executive authority over the right to administer those local government matters listed in Part B of Schedules Four and Five or which were assigned to them in terms of national or provincial legislation. To this end municipalities may pass and administer by-laws for the effective administration of those matters.

Section 139 of the Constitution provides for provincial government to intervene in the event of local government not meeting this obligation. This could include issuing directives to local government or assuming responsibility to the extent necessary to ensure maintenance of essential national standards or establishing minimum standards for rendering the service to be met.

In cases where provision of basic services is unsatisfactory the MEC for Local Government may, in terms of Section 87 of the Local Government: Municipal Structures Act (Act 117 of 1998), allocate the functions to another Municipality.

Local Authorities can be subject to criminal legal liabilities in respect of actions that affect human health or cause pollution. Local Authorities are also subject to civil liabilities and the associated potential financial burdens, particularly in matters

related to the closure and rehabilitation of dumps and remediation of contaminated land for urban development.

### 3.2.2 White Paper on Integrated Pollution and Waste Management

The White Paper represents formal government policy regarding integrated pollution and waste management and deals with related vision, principles, goals and objectives. It highlights a number of important issues such as:

- A lack of priority afforded to waste management;
- Unacceptable high levels of water and air pollution;
- Sub-optimal use of natural resources; and
- Insufficient resources to monitor and implement the extensive South African waste and environmental legislation.

The White Paper seeks to invoke a paradigm shift from the 'end-of-pipe treatment' of waste management to an integrated pollution and waste management system and process of management. This system is aimed at pollution prevention and minimisation at source, managing the impact of pollution and waste on the receiving environment and remediation of Pondaged environments.

It identifies the following relevant strategic goals:

- Effective institutional framework and legislation;
- Pollution and waste minimisation impact management and remediation;
- Holistic and integrated planning;
- Participation and partnerships in integrated pollution and waste management governance;
- Empowerment and education in integrated pollution and waste management; and
- Information management.



### 3.2.3 National Environmental Management: Waste Act (Act 59 of 2008)

The purpose of the The National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) is to reform the law regulating waste management. It proposes this by "providing reasonable measures for the prevention of pollution and ecological degradation and for securing ecologically sustainable development while promoting justifiable economic and social development; to provide national norms and standards for regulating the management of waste by all spheres of government; for specific waste management measures; and for matters incidental thereto".

The act is the overarching legislation governing waste management in South Africa. As such compliance with its provisions is taken for granted by the IWMP. The IWMP highlights areas of waste management that are important in the context of the MCLM, but this does not absolve the local municipality from the responsibility of complying with every aspect of this piece of legislation.

The Act sets the framework for Integrated Waste Management in South Africa including:

- Giving effect to the National Waste Management Strategy. The NWMS is in the process of being reviewed and the draft framework is being finalised. The NWMS should be fully developed by 2011, according to NEMWA that states an NWMS should be developed within two years of promulgation of the Act;
- Providing for the written appointment of a waste management officer in each municipality. This officer is responsible for co-coordinating matters pertaining to waste management in the municipality.
- Setting National Standards in terms of classification of wastes, provision of waste management services, the waste management hierarchy, remediation of contaminated land, and waste treatment and disposal. Provincial Standards may also be set, but Local Standards must include Municipal By-Laws;
- Integrated Waste Management Plans must be prepared by Local and District Municipalities, and Provincial Waste Management Plans must be incorporated into Provincial Development Plans contemplated under the Local Government: Municipal Systems Act (Act 32 of 2000);
- Institutional arrangements including setting the general powers and duties of the Minister and the Provincial Departments, the general powers and duties of the MECs and Provincial Departments, and Municipalities. Decision-making powers are delegated to MECs and the Minister while majority of implementation duties are assigned to waste generators and provincial departments;
- The provision to identify priority wastes and set requirements for the management of such wastes. Priority waste will be declared as such by the Minister or MEC. This will have implications in terms of generation, minimisation, storage, re-use, recycling or recovery, treatment and disposal, trade or any other measures that the Minister or MEC believes are necessary to manage the threat posed by the waste;
- Establishing the concept of General Duty of any holder or generator of waste to avoid the generation of waste, to re-use, recycle or recover waste and manage waste so that it does not endanger health or the environment; and
- Establishing a list of waste management activities that may have a detrimental effect on the environment which require a waste management licence, and the licensing procedures. The following waste management activities require a licence in terms of NEMWA and should be equivalent to activities that require a basic assessment or EIA in terms of NEMA respectively.



Schedule A:

Storage and transfer of waste:

- Temporary storage of general waste at a facility, including a waste transfer facility and container yard, that has the

capacity to receive in excess of 30 tonnes of general waste per day or that has a throughput capacity in excess of 20m$^3$ per day, including the construction of a facility and associated structures and infrastructure for such storage; and

- The temporary storage of hazardous waste at a facility, including a waste transfer facility and container yard, that has the capacity to receive in excess of three tonnes of hazardous waste per day, including the construction of a facility and associated structures and infrastructure for such storage.

Recycling and recovery:

- The sorting and shredding of general waste at a facility that has the capacity to receive in excess of one ton of general waste per day, including the construction of a facility and associated structures and infrastructure for such sorting or shredding; and
- The recovery of waste, excluding recovery that takes place as an integral part of an internal manufacturing process, at a facility that has the capacity to receive in excess of three tonnes of general waste or 100 kilograms of hazardous waste per day, including the construction of a facility and associated structures and infrastructure for such recovery.

Treatment of waste:

- The biological, physical or physiochemical treatment of general waste or the autoclaving, drying or microwaving of general waste at a facility that has the capacity to receive in excess of 10 tonnes of general waste per day, including the construction of a facility and associated structures and infrastructure for such treatment;
- The biological or physiochemical treatment of hazardous waste or the autoclaving, drying or microwaving of hazardous waste, including the construction of a facility and associated structures and infrastructure for such treatment; and
- The treatment of waste in sludge lagoons.

Disposal of waste on land:

- The disposal of inert waste, excluding the disposal of less than 25 tonnes of inert waste for the purposes of levelling and building that has been authorised by or under legislation, including the construction of a facility and associated structures and infrastructure for such disposal; and
- The disposal of general waste to land covering an area of less than 100m$^2$ or 200m$^3$ air space, including the

construction of a facility and associated structures and infrastructure for such disposal.

Storage, treatment and processing of animal waste:

- The storage, treatment or processing of animal manure, including the composting of animal manure, at a facility that has a throughput capacity in excess of 10 tonnes per month, including the construction of a facility and associated structures and infrastructure for such storage, treatment or processing; and
- The processing of waste at biogas installations with a capacity for receiving five tonnes or more per day of animal waste, animal manure, abattoir waste or vegetable waste, including the construction of a facility and associated structures and infrastructure for such processing animal manure and abattoir waste.

Expansion or decommissioning of facilities and associated structures and infrastructure:

- The expansion or decommissioning of facilities and associated structures and infrastructure for activities listed in Schedule A.



Schedule B:

Treatment of Waste:

- The treatment of general waste by a method other than biological, physical or physiochemical treatment at a facility with the capacity to receive in excess of 10 tonnes of general waste per day, including the construction of a facility and associated structures and infrastructure for such treatment;
- The treatment of hazardous waste by a method other than biological or physiochemical treatment, including the construction of a facility and associated structures and infrastructure for such treatment; and
- The incineration of waste, including the construction of a facility and associated structures and infrastructure for the incineration of waste.

Disposal of waste on land

- The disposal of hazardous waste to land, including the construction of a facility and associated structures and infrastructure for such disposal; and
- The disposal of general waste to land covering an area of more than $100m^2$ or $200m^3$ of air space, including the construction of a facility and associated structures and infrastructure for such disposal.

- General requirements for the storage, collection and transportation of waste;
- The separation, treatment, processing, transformation and disposal of waste;
- Requirements for Industrial Waste Management Plans;
- The establishment of Waste Information Systems at both National and Provincial levels. Waste Information Systems must include at the very least:
  - Data on the quantity and type or classification of waste generated, stored, transported, treated, transformed, reduced, re-used, recycled, recovered and disposed of;
  - A register of licensed waste management activities; licence holders and location of licensed waste management activities;
  - It may include information on the levels and extent of waste management services provided by municipalities; information on compliance with the Act and other information necessary for the purposes of effective administration; and
  - Where the Minister or MEC requires a municipality to furnish data, information, documents, samples or materials and the verification of such information, by the municipality concerned may require any person or organ of state to provide such information within a reasonable time period.
- Compliance and enforcement in accordance with Chapter 7 of NEMA

The following laws have been repealed or amended by the NEMWA

**Table 16 Laws Repealed by NEMWA**

| No and year of Law | Short Title | Extent of repeal or amendment |
|---|---|---|
| Act No 73 of 1989 | Environmental Conservation Act, 1989 | 1. The amendment of section 1 by the delegation of the definitions of "disposal site" and "waste".<br>2. The repeal of sections 19, 19A, 20, 24, 24A, 24B and 24C.<br>3. The amendment of section 29 –<br>(a) by the substitution for subsection (3) of the following subsection:<br>"(3) Any person who [contravenes a provision of section 19 or 19A or fails to comply therewith, or] fails to comply with a direction in terms of section 31A(1) or (2), or prevents any person authorised in terms of section 41A to enter upon such land or hinders him or her in the execution of his or her powers, shall be guilty of an offence and liable on conviction to a fine, or to imprisonment for a period not exceeding three months and<br>(b) by the substitution for subsection (4) of the following subsection:<br>"(4) Any person who contravenes a provision |

| No and year of Law | Short Title | Extent of repeal or amendment |
|---|---|---|
| | | of section [20(1), 20(9),] 22(1) or 23(2) [or a direction issued under section 20(8)] or fails to comply with [a condition of a permit, permission or] an authorisation [or direction] issued [or granted] under the said provisions shall be guilty of an offence and liable on conviction to a fine not exceeding R100 000 or to imprisonment for a period not exceeding 10 years or to both such fine and such imprisonment, and to a fine not exceeding three times the commercial value of any thing in respect of which the offence was committed |
| Act No 79 of 1992 | Environmental Conservation Amendment Act, 1992 | The repeal of section 8 and 9 |
| Government Notice No 1986, 1 August 1990 | | The repeal of the whole |
| Government Notice No 292, 28 February 2003 | | The repeal of the whole |



As stated in the Act, it must be read with the National Environmental Management Act (Act 107 of 1998) unless otherwise indicated. Interpretation and application of NEMWA must be guided by the principles set out in Section 2 of NEMA.

### 3.2.4 The National Environmental Management Act (107 of 1998)

The National Environmental Management Act (Act 107 of 1998) (NEMA) is the framework Act dealing with environmental management in South Africa and all organs of State are bound by this Act. It has been amended twice since 1998, the last amendment being in 2009.

NEMA provides for cooperative governance and establishes principles for decision-making on matters affecting the environment such as:

- People and their needs must be placed at the forefront of environmental management;
- Development must be sustainable and therefore requires avoidance of pollution and degradation of the environment, disturbance of landscapes and sites of cultural heritage and with respect to waste: "*waste is avoided, or where it cannot altogether be avoided, minimised and reused or recycled where possible and otherwise disposed of in a responsible manner";*
- The integrated nature of the environment and that responsibility for environmental management exists throughout the life cycle of an activity (from cradle to grave);
- Public participation;
- Transparent decision making;

- Intergovernmental co-ordination and harmonisation of policies, legislation and actions; and
- Polluter Pays Principle: the Act provides for the cost of remedying pollution, environmental degradation etc.

Section 28 of the Act contains a Duty of Care Provision which requires that: *"every person who causes, has caused or may cause significant pollution or degradation of the environment must take reasonable measures to prevent such pollution or degradation from occurring, continuing or recurring, or, in so far as such harm to the environment is authorised by law or cannot reasonably be avoided or stopped, to minimise and rectify such pollution or degradation of the environment".*

Pollution is defined in NEMA as: any change in the environment caused by-

*(i) Substances; or*
*(ii) noise, odours, dust or heat, emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future*

Chapter Five of NEMA provides for integrated environmental management and defines the general objectives of IEM. Minimum procedures are laid down with respect to investigating, assessing and communicating the potential impacts of activities. The NEMA Amendment Act (Act 62 of 2009) replaces S24 under Chapter Five and deals with Environmental Authorisations.

Environmental Impact Assessments are controlled under NEMA, with the promulgation of three sets of regulations in terms of this Act.

Regulation No R385 (21 April 2006) sets out the procedures to be followed to obtain Environmental Authorisations for listed Activities that may have a substantial detrimental effect on the environment.

Regulation No 386 lists activities that are subject to a Basic Assessment, which include:

- "1(o) the recycling, re-use, handling, temporary storage or treatment of general waste with a throughput capacity of 20$m^3$ or more daily average measured over a period of 30 days, but less than 50 tons daily average over a period of 30 days; and
- 1(p) the temporary storage of hazardous wastes."

Regulation No 387 lists activities that are subject to an EIA, which includes:-

- "1(o) the final disposal of general waste covering an area of 100$m^2$ or more, or 200$m^3$ or more of airspace;

- 1(q) the incineration, burning, evaporation, thermal treatment, roasting or heat sterilisation of waste or effluent, including cremation of human or animal tissue; and
- 1(r) the microbial deactivation, chemical sterilisation or non-thermal treatment of waste or effluent."

### 3.2.5 The Environmental Conservation Act (Act 73 of 1989)

The objective of the Environmental Conservation Act (Act 73 of 1989) (ECA) was to provide for the effective protection and controlled utilisation of the environment. This Act was historically the main act that governed waste disposal in South Africa. As mentioned above, several sections of this Act has been repealed by NEMWA. However, the following sections are still effective:

Section 16A provides that *"every person or authority in control of or responsible for the maintenance of any place to which the public has access, shall within a reasonable time after any litter has been discard, dumped or left behind at such place (with the inclusion of any pavement adjacent to, or land situated between, such a place and a street, road or site used by the public to get access to such place) remove such litter or cause it to be removed".*

The ECA also contains a provision for the Minister to make regulations pertaining to waste management. This includes matter concerning *"the location, planning and design of disposal sites and sites used for waste disposal"*

Section 24(l) of the ECA allows for the Minister to introduce *"the imposition of compulsory charging, deposits or related financial measures on waste types or specified items in waste types with the concurrence of the Minister of Finance"* and furthermore in Section 24(B) gives authority to the Minister the power *"with regard to the prohibition, control, sale, distribution, import or export of products that may have a substantial detrimental effect on the environment or on human health"* (new section 24B).

In terms of the ECA, DWAF produced a Trilogy of Documents entitled: the Minimum Requirements for Waste Disposal by Landfill; Handling and Disposal of Hazardous Waste; and the Water Quality Monitoring at Waste Management Facilities (September 2005).

The Minimum Requirements documents cover:

- Classification of disposal sites. Ten classes of landfill sites are provided. The criteria used to classify a site is based on the type of waste, resulting in either a G (General) or H (Hazardous) classification, the size or volume of waste resulting in either a C (Communal), M (Medium) or L (Large), as well as the water balance, resulting in either a $B^+$ (positive water balance) or $B^-$ (negative water balance);
- Siting, investigation, design, permitting, operation, monitoring and closure requirements for landfills;

- Requirements for pre-treatment, disposal, handling, transportation and storage of hazardous waste, including waste prevention and minimisation; and
- Water quality monitoring.

While the Minimum Requirements documents are not law, they form the basis for the permitting process and are normally included as permit conditions, thereby becoming legally binding on the permit holder. The Minimum Requirements are currently being revised to be in line with NEMWA.

### 3.2.6 The National Water Act (Act 36 of 1998)

The National Water Act (Act 36 of 1998) (NWA) deals with, inter alia, the protection of South Africa's water resources, The NWA defines waste as:

*"any solid material, or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted"*

Along similar lines to NEMA, Section 19(1) of the NWA contains a pollution prevention requirement placing a pollution prevention duty on landowners, persons in control, users or occupiers of land to take all reasonable measures to prevent water pollution from occurring, continuing or recurring.

Section 21 of the NWA defines water use and includes:

> *"(f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit;*
> *(g) disposing of waste in a manner which may detrimentally impact on a water resource;*
> *(h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process"*

Section 22 deals with permissible water uses and deals with the use of water subject to a number of conditions which include registration and licensing provisions.

### 3.2.7 The National Health Act (Act No 61 of 2003)

The Act provides measures for the promotion of health of the inhabitants of South Africa.

Section One of the Act includes a lengthy discussion of nuisance, including:

> *"(c) any accumulation of refuse… which is offensive or is injurious or dangerous to health*
> *(g) any factory or industrial or business premises causing or giving rise to smells or effluvia which are offensive or which are injurious or dangerous to health and*

*(h) any area of land kept or permitted to remain in such a state as to be offensive"*

Section 14(1)(c) obliges the Department of National Health to 'take steps for the promotion of a safe and healthy environment'.

Section 20(1) compels local government to take measures:

*(a) To maintain its district at all times in a hygienic and clean condition;*
*(b) To prevent the occurrence within its district of- any nuisance; any unhygienic condition; any offensive condition; or any other condition which will or could be harmful or dangerous to the health of any person within its district or the district of any other local authority and*
*(c) To prevent the pollution of any water intended for the use of inhabitants".*

Proposed Regulations for the Control of Environmental Conditions Constituting a Danger to Health or a Nuisance were published in Government Gazette No 20796 dated 14th January 2000 dealing, inter alia, with medical waste and including a schedule of 50 trades which are potentially polluting and which will require registration.

### 3.2.8 The Occupational Health and Safety Act (Act 85 of 1993)

The Occupational Health and Safety Act (Act 85 of 1993) (OHSA) provides for the health and safety of persons at work and the protection of persons other than persons at work against hazardous to health and safety arising out of or in connection with the activities of persons at work. It places duties on employers and employees not to endanger the health of others and to provide a safe place of employment.

A number of regulations promulgated under the Act are important with respect to the manager of hazardous substances (and therefore) hazardous wastes:

- Hazardous Chemical Substances Regulations;
- Asbestos Regulations; and
- Lead Regulations.

### 3.2.9 Local Government: Municipal Structures Act (Act 117:1998)

This Act provides for the establishment of the three categories of Municipalities envisaged in the Constitution (which will replace the transition structures given in the Local Government Transition Act) and the division of powers and functions between the categories of Municipality.

Under Section 15 of the Act, if an existing municipality is wholly or partially superseded in terms of the act, the by-laws, regulations and resolutions of the existing municipality, to the extent that they continue to apply in the area or part of the area of the superseding municipality, must be reviewed and where necessary rationalised by the superseding municipality.

Section 88 deals with the co-operation required between the District and Local Municipalities

3.2.10 Local Government: Municipal Systems Act (Act 32: 2000)

The Act provides the enabling framework for planning processes. It also ensures environmentally sustainable service delivery by including the following definition in Chapter 1, with respect to the provision of a municipal service in a manner aimed at ensuring that:

> *"(a) the risk of harm to the environment and to human health and safety is minimised to the extent reasonably possible under the circumstances;*
>
> *(b) the potential benefits to the environment and to human health and safety are maximized to the extent reasonably possible under the circumstances;*
>
> *(c) legislation intended to protect the environment and human health and safety is complied with".*

The process to facilitate development at a local level is referred to as Integrated Development Planning (IDP). Chapter 5 of the Act provides for IDPs with Part 2 detailing the core components of IDPs. They must include, inter alia:

"a spatial development framework which must include the provision of basic guidelines for a land-use system for the municipality"

The Act aims to:

- Clarify the executive power of municipalities and in particular, develop the notion of a separation between the roles of "service authority" and "service provider". This lays the basis to enable municipalities to choose the most appropriate service provider from a menu of options, ranging from internal departmental delivery to corporatisation and joint ventures to private sector delivery options;
- Rationalise the system of planning into a single five year planning cycle, subject to annual monitoring and review, in which IDP's are adopted by Council as their core planning and management instrument;
- Provide a clear regulatory framework for municipal service partnerships; and
- Augment the legal capacity of municipalities to prosecute for contraventions of by-laws.

Section Four of the Act confirms the right and the duty of Council to:

*"ensure the provision of municipal services to all residents and communities in a financially and environmentally sustainable manner; and promote a healthy and safe environment in the Municipality".*

Section 78 assessments must be undertaken by a Municipality in terms of Section 78 of the Municipal Systems Act 2000 and Section 11 of the Municipal Systems Amendment Act 2003 whenever a municipality decides on a service delivery mechanism or whenever a municipality reviews a service delivery mechanism. There is no discretion in this regard – it is legal requirement.

S78 assessments are usually implemented in two distinct phases, viz.:

- Phase I: Situation Assessment, Output Specifications and S 78 (1) Analysis
- Phase II: Section 78(3) Analysis

Phase I of the analysis includes a detailed current situation assessment that generally includes:

- The current status of service delivery
- Service coverage, service levels, demographics and projections;
- Physical assets;
- Organisation structure & staffing;
- Cost of the service;
- Tariff structure;
- Comment on current situation;
- The identification of the policy and regulatory framework;
- The determination of needs and priorities;
- A study of existing reports, studies and documentation;
- Consultation with all stakeholders, including officials. Councillors and other interested and affected parties; and
- Field investigations may have to be undertaken to inform this phase of the assignment.

Phase I of the assessment also provides for an assessment of the ability of the internal mechanisms to render the service within the Municipality, and includes:

- The determination of the optimal internal mechanism
- The direct and indirect costs and benefits of service provision through an internal mechanism
- The effects on the environment, human health, well-being and safety of the internal mechanism
- The LM present and potential capacity to furnish the skills, expertise and resources for an internal mechanism;
- The potential for re-organisation and human resource development to effect delivery through an internal mechanism;
- The likely effect on development, job creation and employment patterns of an internal mechanism;
- The views of organized labour; and
- The effect of any developing trends in the sustainable provision of municipal services generally.

The municipality may, on the completion of this phase, per Section 78(2) of the Act, decide on an appropriate internal mechanism or it may decide to explore the possibility of providing the service through an external mechanism.

Phase II, the Section 78(3) Assessment, usually proceeds only if the Council decides to explore the possibility of providing waste management services through an external mechanism and usually includes:

- The identification of the optimal external services delivery mechanism;
- The direct and indirect costs and benefits;
- The capacity and future capacity of prospective service providers;
- The views of the local community;
- The likely impact on development and employment patterns;
- The views of organized labour; and
- Feasibility studies per Section 11 of the MSYA Amendment Act.

#### 3.2.11 The Polokwane Waste Summit Declaration

During September 2001, a National Waste Summit at Polokwane set a vision and ambitious goals for waste management in South Africa:

Vision: - To implement a waste management system, which contributes to sustainable development and a measurable improvement in the quality of life by harnessing the energy and commitment of all South Africans, for the effective reduction in waste

Goals: - To reduce waste generation and disposal by 50% and 25% respectively by 2012 and develop a plan for zero waste by 2022.

This declaration has significant implications for local government as it directs the way forward in accordance with the waste hierarchy, and supplies time frames for specific goals to be achieved. These goals are currently being reviewed as part of the update to the NWMS.



## 3.3 Mogale City Local Municipality – By-Laws, IDP and IWMP

Waste management has not been considered a major concern in the IDP document of Mogale City until recently. This document now acknowledges the development of a new IWMP as a gap and requested financial assistance to prepare this document.

In terms of Service Delivery objectives, this municipality aims to provide an additional 2 249 households with waste removal services in addition to the 62 000 households (IDP figures) that are currently being serviced.

Mogale City Local Municipality compiled and promulgated waste by-laws in 2006. This by-law makes provision for the municipality to prescribe waste containers for collection, conduct at disposal sites, littering and dumping and tariff charges.

Although this by-law was promulgated as recently as 2006, it does not take into consideration the newly promulgated Waste Act. It is currently not being enforced.

# 4 STATUS QUO INFORMATION

Information concerning current waste management practices is required in order to identify needs and gaps and hence to develop actions plans for future waste management.

This information has been gathered from the local municipality and covers aspects such as population estimates; current waste generation figures derived from the local municipality; the nature and extent of waste service provision; the current equipment used in waste management; details on the waste facilities in each area; whether there are recycling or re-use initiatives operating; the status of illegal dumping of waste as well as the financial status of waste management in each area.

This information has been obtained from a variety of sources. Principal amongst them are municipal records and a questionnaire that was completed by the official responsible for waste management in the municipality. Follow-up visits were made to the local municipality's facilities and depot to confirm the information provided in the questionnaire.

In addition, a workshop will be held on the draft Status Quo document which will be by representatives from local municipality, where the Status Quo details will be checked and verified.



## 4.1 Waste Service Delivery

The table below indicates that there is 0.4% increase in refuse being removed weekly by the local authority between the period 2001 (91.6%) and 2007 (92%). According to the Community Survey 2007, a remaining 5.5% of the population are dependent on private refuse dumps.

**Table 17 Availability of Waste Disposal Services**

| Refuse disposal | CS 2007 | Census 2001 |
|---|---|---|
| Removed by local authority at least once a week | 74.2% | 80.2% |
| Removed by local authority less often | 1.0% | 1.7% |
| Communal refuse dump | 2.8% | 2.4% |
| Own refuse dump | 17.6% | 11.5% |
| No rubbish disposal | 4.4% | 4.0% |
| Not applicable | 0.0% | 0.1% |
| **Total** | **100%** | **100%** |

From the above it is evident that the waste removal service offered by the local municipality did increase its coverage over the six years between 2001 and 2007. The percentage of community that does have access to waste removal services is currently middling and investigations should be conducted to provide a more universal waste removal service coverage to the community.

Using the data above, and assuming that waste removal at least one a week is the minimum acceptable standard, approximately 18 669 households do not receive a waste service.

There is an approximately 17% of households living in rural areas, which equates to 16 028 households. Thus it can be assumed that the vast majority of the households who do not receive a weekly waste management service are in the rural areas. Some 2 000 urban households do not receive a service.

## 4.2 Municipal Waste Management Structure

Waste management in the municipality is housed in the Integrated Environmental Management division, in the Municipal Health department. This department is divided into Waste Management: Operations, Landfill Management and Integrated Environmental Management. Operations is responsible for waste collection from residences, business and industries, street cleaning, illegal dumping clearing and the cleaning of public open spaces. Landfill Management is responsible for the operations and planning for the two municipal landfills. Integrated Environmental Management is responsible for waste management projects, enforcement and the re-use and recycling aspect of the waste stream.



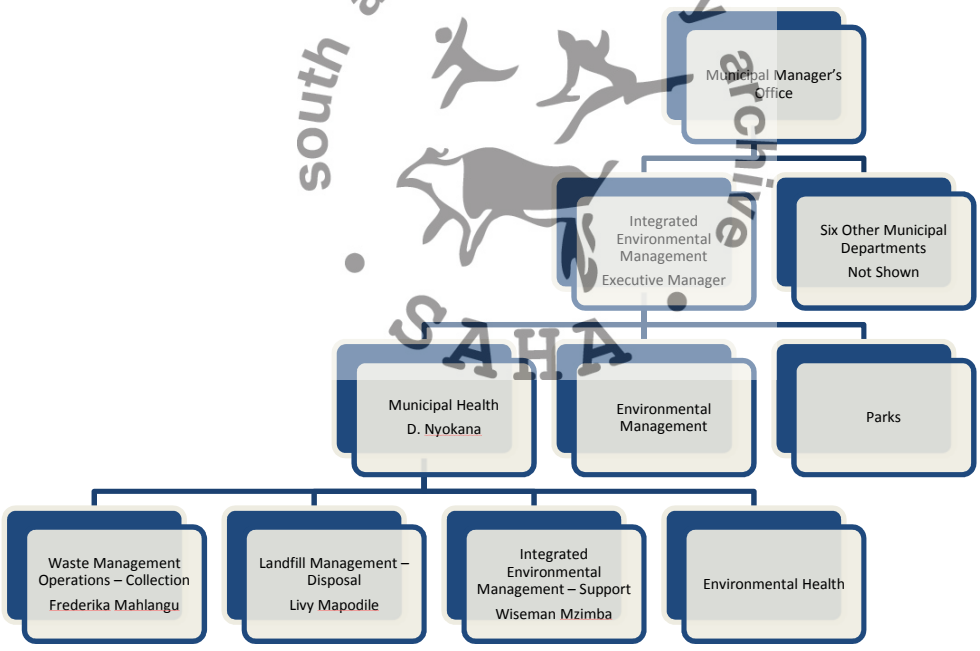


**Figure 5 Mogale City Local Municipality Waste Organogram**

All of the positions in the organogram are currently filled.

It was indicated during an interview with the head of department that sufficient capacity exists to operate waste management services in the municipality.

The staff headcount and designation of the Municipal Health department is shown in the table below.

**Table 18 Employee Headcount at the Cleansing Unit (Nov 2011)**

| Category | Work Area | No. Of Staff | % of Total |
|---|---|---|---|
| Management | Management | 4 | 2% |
| | Supervisors | 7 | 3% |
| | Inspectors | 2 | 1% |
| | Clerical | 2 | 1% |
| Skilled | Vehicle Operators: Operations | 29 | 11% |
| | Vehicle Operators: Landfills | 2 | 1% |
| | Weighbridge Operators | 3 | 1% |
| Un-skilled | Refuse Removal | 115 | 45% |
| | Container Services | 14 | 6% |
| | Sweeping/Cleaning | 55 | 22% |
| | Rural | 13 | 5% |
| | Landfills | 8 | 3% |
| | **Totals** | **254** | **100.0%** |

There are currently two vacant posts in the lower hierarchy, those of Operations Officers.

## 4.3 Waste Generation

No readily available data is available on waste generation in this municipality. The municipality does not carry out a periodic waste generation survey.

All waste vehicles, whilst operating in the main urban node of the municipality, dispose of their waste at the Luipardsvlei Landfill. This landfill is controlled by a weighbridge and the disposal volumes are thus known with reasonable accuracy.

Garden waste is a high percentage of the waste stream, especially during summer months. Anecdotal evidence shows that this fraction could be as high as 50% of the total waste stream in summer.

Waste generation was estimated in the 2010 West Rand District Municipality IWMP. This was a theoretical calculation based upon a waste generation rate of 0.5 kilograms of general waste per person per day. This estimate is likely to be equally accurate as the theoretical waste generation volumes calculated in Section 5 of this IWMP.

## 4.4 Waste Characterisation

A waste characterisation study was carried out as part of the IWMP process. The primary intention of the study was to understand the nature of the waste stream with a view to the recyclable component and the percentage of garden waste. The sampling methodology was sufficient to ensure that this task was achieved.

A secondary result was that the study could be used to estimate waste volumes, but the sampling methodology makes the conclusions from this use, subject to wide variance.

The study formed two parts; a household refuse analysis and a compactor refuse analysis. The studies were conducted in November/December 2011 and January 2012, respectively.

In addition to these two direct studies, a separate industrial waste survey was carried out in Krugersdorp. The aim of this study was to determine the types of waste and the quantities generated in a random sample of representative businesses located in Chamdor and other industrial areas.

### 4.4.1 Household Waste Survey

The household waste characterisation, as conducted in the period 21 November 2011 to 6 December 2011, involved collecting refuse bags from outside households. The refuse was brought back to the depot and weighed. Each household's waste was then split into the broad recyclable components and each component weighted. A total of 62 household's refuse was collected over the week, with an even distribution of waste from the three income categories, thirty six were low income; ten middle income and sixteen high income households.



**Plate 1 Sorting the Recyclable Fractions**

The total number of households in MCLM for 2007 was 94 288 according to the Community Survey 2007. This survey sampled fifty one households. Given that the sample was randomly chosen within each income group, and the number of sample

points exceeds the thirty two necessary to obtain representivity, it credence to the results of the survey.

The intention of the study was to understand the nature of the waste stream with a view to the recyclable component and the percentage of garden waste. The household surveys combined with the compactor surveys and visual studies were sufficient to understand the types of waste generated with the MCLM.

The Table below shows the average percentage, by mass, of the total household refuse volume, of each waste fraction present. For example, the average percentage composition of paper for low income households was 56% and for high income households it was 30%. Overall, the paper contributed 13% of the mass of the waste stream for the households analysed.

To calculate the table below, the average of a random selection of 5 households per income stream was taken.

**Table 19 Average Percentage, by Mass, of the Waste Stream**

| | Total Mass [%] | Low Income [%] | Medium Income [%] | High Income [5] | Total Mass of Item [%] |
|---|---|---|---|---|---|
| # of households | | 10 | 25 | 16 | 51 |
| Paper [kg] | 9% | 22% | 36% | 43% | 100% |
| Plastic [kg] | 9% | 25% | 30% | 45% | 100% |
| Metal [kg] | 3% | 26% | 39% | 35% | 100% |
| Alu. Cans [kg] | 2% | 8% | 56% | 35% | 100% |
| Glass [kg] | 6% | 21% | 23% | 55% | 100% |
| Nappies [kg] | 11% | 36% | 7% | 56% | 100% |
| Garden [kg] | 28% | 22% | 54% | 24% | 100% |
| Residual [kg] | 31% | 35% | 41% | 24% | 100% |
| Total Mass | 100% | | | | |



The Table demonstrates that 28% of the waste stream was garden waste and 31% was other waste. Other waste was generally household putrescibles. Neither of these two waste streams is recyclable.

This implies that the remaining 41% of the waste stream is potentially recyclable. Caution should be applied when using this figure since paper wastes are only recyclable when they are dry and thin plastic is generally not recyclable. As an estimate, 50% of this waste fraction would be recyclable. The sampling took place during November and December. Thus caution should be exercised with regards to the large percentage of garden waste found. During summer garden waste is highest thus accounting for 28% of the waste found.

The average mass values of the households surveyed as well as the standard deviation are shown in the Table below.

**Table 20 Average Waste Fraction Masses**

| | Low Income [kg] | Medium Income [kg] | High Income [kg] | Total Mass [kg] |
|---|---|---|---|---|
| # of households | 10 | 25 | 16 | 51 |
| Paper [kg] | 109.24 | 27.96 | 59.51 | 196.71 |
| | SD = 8.08 | SD = 1.10 | SD = 3.30 | |
| Plastic [kg] | 59.06 | 23 | 48.7 | 130.76 |
| | SD = 3.06 | SD = 0.91 | SD = 1.60 | |
| Metal [kg] | 13.46 | 8.06 | 13.88 | 35.4 |
| | SD = 0.57 | SD = 0.70 | SD = 0.66 | |
| Alu. Cans [kg] | 10.32 | 9.3 | 5.34 | 24.96 |
| | SD = 0.41 | SD = 21.22 | SD = 0.81 | |
| Glass [kg] | 50.44 | 33.82 | 40.16 | 124.42 |
| | SD = 3.62 | SD = 4.49 | SD = 2.40 | |
| Nappies [kg] | 52.5 | 6.88 | 94.16 | 153.54 |
| | SD = 4.29 | SD = 0.78 | SD = 7.25 | |
| Garden [kg] | 183.08 | 141.92 | 58.3 | 383.3 |
| | SD = 21.58 | SD = 15.68 | SD = 5.93 | |
| Residual [kg] | 118.92 | 89.96 | 292.82 | 501.7 |
| | SD = 8.95 | SD = 5.18 | SD = 11.12 | |
| **Total Mass [kg]** | **597.02** | **340.9** | **612.87** | **1 550.79** |



The standard deviations are in general small, indicating that the range of expected values is small and that there are few outliers in the dataset.

Amongst the unexpected waste types that were found was human faecal waste. Many packets and containers of such waste were found in the solid waste stream. This type of waste was found exclusively in the low income urban settlements of the municipality.

The study has the following limitations.

- The sampling was carried out over a single time period of the year. Sampling that is carried out periodically throughout different times of the year will yield a more complete picture of waste generation in the local municipality;
- Garden waste accounted for twenty eight percent of the total waste studied. This figure would be significantly reduced in winter months.
- Other limiting factors include the limited sampling period and sorting accuracy. All of these factors introduce variance into the results

### 4.4.2 Compactor Contents Waste Characterisation

A further waste characterisation survey was carried out on the contents representative waste compactors in low income and a middle income area. Waste from two compactors was collected and sorted for low income and middle income groups. The waste was collected, sorted and after 3 days it was weighed.

The methodology for this survey was to unload a full waste compactor onto a concrete pad, mix the waste using a wheeled loader and progressively halve the waste, mixing each division, until an approximately 400 kilogram sample remained. This sample was then dissected to yield the various waste fractions. Each waste fraction was then weighed.


**Plate 2 Sorting the Final 400 kg Waste Sample**

The table below presents the composition of the final sample.

**Table 21 Composition of the Compactor Waste Sample**

| | Low Income [kg] | Low Income [%] | Medium Income [kg] | Medium Income [%] | Total [kg] | SD | Total [%] |
|---|---|---|---|---|---|---|---|
| Paper [kg] | 49.05 | 11% | 68.06 | 14% | 117.11 | 13.44 | 13% |
| Plastic [kg] | 54.02 | 12% | 41.16 | 9% | 95.18 | 9.09 | 10% |
| Metal [kg] | 5.74 | 1% | 3.42 | 1% | 9.16 | 1.64 | 1% |
| Alu. Cans [kg] | 1.66 | 0% | 6.64 | 1% | 8.30 | 3.52 | 1% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Glass [kg] | 11.4 | 3% | 11.16 | 2% | 22.56 | 0.17 | 2% |
| Nappies [kg] | 33.3 | 7% | 16.1 | 3% | 49.40 | 12.16 | 5% |
| Garden [kg] | 116.42 | 26% | 142.08 | 30% | 258.50 | 18.14 | 28% |
| Residual [kg] | 175.22 | 39% | 190.22 | 40% | 365.44 | 10.61 | 39% |
| Total Mass [kg] | 446.81 | | 478.84 | | 925.65 | 22.65 | 100% |

Garden and Residual waste are the largest fractions at 64% for low income areas and 69% for middle income residential areas.

The waste sample did not contain very high percentages of the commonly recycled materials of glass, aluminium cans and metals. Aluminium drinks cans were responsible for 0% of the sample mass in low income households and 1% in middle income households. The bulk of the potentially recyclable portion was paper (11% and 12%) and plastic (12% and 9%) which represents a recycling opportunity in the waste stream.

Assuming that all plastic and all paper is recyclable, 23% of the waste stream is recyclable.

### 4.4.3 Visual Survey

A visual survey was conducted on two illegal dumpsites, in a three informal settlements and at one hostel site. The methodology followed in visual surveys was to sort the waste and draw visual conclusions on the average composition of waste.

**Table 22 Visual Study results**

| | Visual - Illegal Dumpsite 1 | Visual - Illegal Dumpsite 2 | Informal Settlement Soul City- Bagdad Section | Informal Settlement Soul City- Older Section | Magalies - Buya Africa | Kagiso Hostel -Skip 2 |
|---|---|---|---|---|---|---|
| Paper [%] | 10% | 10% | 20% | 10% | 10% | 10-20% |
| Plastic [%] | 10% | 10% | 20-40% | 30% | 20% | 10-20% |
| Metal [%] | 5% | 5% | 5-10% | 8% | 15% | 10% |
| Alu. Cans [%] | 5% | 0% | 0% | 0% | 10% | 5-10% |
| Glass [%] | 5% | 5% | 5-20% | 26% | 5% | 5-10% |
| Nappies [%] | 40% | 60% | 10% | 10% | 10% | 10-20% |
| Garden [%] | 15% | 5% | 10% | 10% | 15% | 10-20% |
| Residual [%] | 10% | 5% | 10% | 10% | 15% | 10-30% |

Visual surveys conducted at Illegal Dumpsite seemed to confirm that nappies were a significant proportion of waste disposal. This does indicate that disposable nappies should be an area of focus in the waste stream.

Informal settlement 2 was in Soul City, Bagdad Section. Here no wheeled bins are used and residents complained of irregular refuse collection. Two skips were overflowing with waste creating an illegal dumpsite. The survey indicated 20-40% of waste in the skips were plastic, followed by 20% paper and 5-20% glass indicating recyclable waste being dumped.

The results for Bagdad Section were similar to the Older Section of Soul City where recyclable waste made up most of the waste in the skips. In the 3 skips studied, 30% of waste seemed to be plastic while 26% was found to be glass.

The last visual survey was in Kagiso Hostel, where the composition of waste was found to be fairly even. Residual waste ranged 10-30% of the skips while paper, plastic, nappies and garden waste ranges 10-20% of the skips. This indicated that the hostel does not have much recyclable waste.

### 4.4.4 Summary of Results

The three waste characterisation samples detailed above allow the following conclusions to be drawn regarding the Mogale City Local Municipality Waste Stream

**Table 23 Average composition of waste**

| Composition | Household Survey | Compactor Survey |
|---|---|---|
| Paper [kg] | 13% | 13% |
| Plastic [kg] | 8% | 10% |
| Metal [kg] | 2% | 1% |
| Alu. Cans [kg] | 2% | 1% |
| Glass [kg] | 8% | 2% |
| Nappies [kg] | 10% | 5% |
| Garden [kg] | 25% | 28% |
| Residual [kg] | 32% | 39% |



The household studies and compactor survey revealed similar results with regards to the composition of waste.

Residual waste weighted the largest at thirty two percent in household waste and thirty nine percent of compactor waste. Garden waste followed at twenty five percent household and twenty eight percent from the compacter survey. In both surveys this was followed by thirteen percent of waste being paper. Metal and aluminium cans weighed the least at two percent each in households and one percent each in the compactor surveys. The biggest difference between the two surveys is that glass accounts eight percent of household waste and only two percent of compactor waste. This is probably due to the glass being crushed in the compactor and becoming part of the residual waste fraction.

Given that garden waste and residual waste average sixty two percent from the household and compactor studies, it can be concluded that between thirty and forty percent of the waste stream is potentially recyclable. These figures vary when looking at the visual survey where nappies seemed be a more significant fraction of the waste stream than that in the formal surveys. This is followed by plastic at which ranges from ten to about forty percent of waste in settlement and the hostel. Please note that these last data points are less reliable and the results of the formal surveys

The waste characterisation clearly demonstrates that the majority of the waste transport costs incurred by the municipality are to transport wastes that should not be transported, or disposed of, in landfills. This waste is the recyclable fraction and the garden waste. Waste diversion strategies should be implemented to ensure that increasing percentages of the garden waste and paper and plastic do not reach the waste compactors and hence the landfills.

The survey shows that the low percentages of metals in the waste stream indicate the success of recycling strategies for these products. The same cannot be said for glass whose waste fraction is not unexpectedly low.

The presence of significant incidences of human faecal waste in the low income waste stream indicates that there are sanitation problems in the dense settlements. Anecdotally, the researchers have concluded that a significant source of this problem is backyard dwellers that do not have access to formal sanitation, hence the need to use the solid waste stream to dispose of sanitation waste.



### 4.4.5 Industrial Waste Characterisation

This section aims to understand the type and quantities of waste that is being produced in the main industrial areas of the MCLM. In order to do this, random selections of companies in MCLM were surveyed. The surveys were telephonic, and if required followed by a written survey.

The telephonic response from companies was mostly forthcoming, however the written survey sent after the telephonic conversation was generally unresponsive.

The survey is important as it provides insight into the types of waste municipal services cater to companies. Information of the whether the municipality plays an active role in waste management or not.

More importantly it provides information into the types of waste that is generated by industry. This will allow the municipality to attempt to cater for all the necessary types of waste generated.

The survey comprised of 10 questions, divided into sub questions. It was designed in order to understand the types and quantities of waste generation, how and where waste was disposed of and what role the municipality played in overall waste management.

A telephonic survey was first conducted, where questions were asked to the relevant company representative. An attempt was made to gather all information where possible telephonically.

Based on the telephonic conversation, a survey with the same questions was sent to the company to be completed. The primary reason for the written survey was to allow companies to gather information they could not provide telephonically and submit in a week.

A process of random selection was followed to select companies to participate in the survey in Mogale City LM. However the survey focused primarily on companies in Chamdor, an industrial area of MCLM. Industrial areas were found to produce significantly more waste when compared to small or office based companies. Furthermore, the type of waste generated by industrial companies varies beyond office waste and paper, allowing for a better understanding on the different wastes produced in MCLM.

All companies who took part in the survey will remain anonymous.

Thirty companies were identified to take part in the waste survey. These companies were randomly selected through internet searches for companies in the Mogale City Local Municipality.

From these companies, a response was received from twenty eight companies. It will be assumed from this point on that twenty eight companies took part in the survey and all data is based on this.

About 68 percent of the 28 companies were co-operative on the telephonic survey. Most companies were unable to provide exact details on the quantities of waste produced. However they provided information on what they did know.

All companies were given the option to fill out the written survey, only 7 percent of companies chose to do so.

The response from the remaining thirty two percent of companies varied. Three companies were particularly defensive of their waste strategy refusing to answer any questions.

For some companies, phone calls were ineffective as people refused to take calls as they found the survey a waste of time and did not want to answer questions. Upon requesting that a written survey be conducted, an email was sent to those who obliged. No response was received following the email.

While the survey as designed to gather as much information as possible regarding companies generation details, this was not always possible. The survey broke down for most companies as they are unable to provide the information required. Thus while majority of the companies are willing to provide the information requested, the biggest limitation of this survey is that very little information is available due to inadequate record keeping.

Some companies are not able to break down the volumes of waste, but rather gave an overall volume figure. Other companies could only provide details on some of the waste generated not all the waste. Simpler questions such as how often the waste was collected or disposed of was found to be challenging for a number of companies.

The next section of this report will provide insight on the information what was available. An analysis of the findings will follow.

Categorisation of hazardous waste and non-hazardous waste was the addressed before any other questions were asked. Disposal strategies for the two differ significantly and thus a clear distinction was need.

Four companies were recorded to have hazardous waste. This waste includes:

- Florescent tubes
- Glass
- Heat transfer oil
- Laboratory and chemical waste
- Medical waste
- Oil rays
- Other oils
- Paint
- Polyurethane Insulation
- Used lubrication oil

All hazardous waste was disposed of by private companies who specialise in the disposal of hazardous waste.

Non-hazardous waste, generated by all companies included:

- Boxes
- Building Material
- Cans
- Cardboard
- Cartons
- Clay
- Flour
- Garden Waste
- General Waste
- Metal
- Mixed Waste
- Off Cuts of Timber
- Paper
- Paper Packets
- Plastic
- Scrap Metal
- Shrink Wrap
- Steel
- Stones/Cement
- Strapping
- Tyres
- Wood Pallets
- Wood Shavings

Save for “mixed waste”, “office waste”, stones, cement, clay and flour; all other wastes are recyclable.

The MCLM waste service is used by most companies. Majority of companies with hazardous waste used MCLM services for non-hazardous waste and private services for all hazardous waste.

Annual waste generation were assumed to be difficult to obtain from respondent companies. For this reason the survey broke down the waste generation questions to obtain waste disposal rates. Given the waste disposal weight and how often waste was disposed, the annual waste generated could be derived.

However, it was unforeseen that companies would struggle to provide information on how often waste was disposed of or that weight of waste. In some cases companies could not adequately describe what wastes were generated.

Only one company was able to provide annual generation and volumes of waste. Waste volumes that were provided by the rest of the companies were mostly based on their weekly/monthly disposal.

The survey was designed to allow companies who could not provide information regarding annual waste generation to provide enough information regarding monthly/ weekly data that would allow an estimated calculation of annual waste generation.

During the survey it was found that companies are not able to provide sound data regarding monthly / weekly waste generation. While a handful would be able to provide the volume of waste generated for a month, it was not known if this figure could represent the average waste generated for the year.

Another constraint was that majority of companies gave the quantity of bags or bins disposed of a week. This information alone is not sufficient to determine volumes of waste or to be converted into any sound data set.

For these reason, the data cannot be that is available cannot be presented in this report.

What the survey did provide was general conclusions, insights and observations on waste practices by business.

It was found that on average small business produce the standard domestic level of two wheelie bins or four refuse bags of waste a week. Most companies in the industrial area produce more than the domestic level.

The table below provides a list of presentable data which outlines annual waste produced by companies that is above typical domestic waste generation.

**Table 24 Waste figures above domestic level**

| | | |
|---|---|---|
| Cardboard and plastic | 5.061<br>1 216 | tons<br>tons |
| Off Cuts of Timber | 520 | bags |
| Paper | 52 | m3 |
| Plastic | 10 | bags |
| Paper/Carton/plastic | 277 | tons |
| Scrap Metal | 26.98 | tons |
| Steel | 9.6 | tons |
| Tyres | 8 | tons |
| Wood Pallets | 0.659<br>2600 | tons |
| Wood Shavings | 164 250 | bags |

Of the companies that responded to the survey, 20 percent produced hazardous waste. The closest disposal area is hazardous waste is Holfontein.

The table below shows presentable data for hazardous waste produced by companies.

**Table 25 Hazardous waste generated**

| | | |
|---|---|---|
| Oil | 3.05 | tons |
| Heat transfer oil | 125 | l |
| Used lubrication oil | 600 | l |
| Medical waste | 7.32 | box |
| Laboratory and chemical waste | 5 | l |
| Polyurethane Insulation | 1.5 | m3 bin |



Majority of companies disposed of their waste in refuse bags or wheelie bins, some companies have skips. One company has no containers but rather a designated waste area where waste is separated and loosely dumped. When collected the waste was loaded onto a truck.

The table below summarises the waste disposal on company premises. It should be noted that some of the companies surveyed had more than one type of container on site.

**Table 26: Waste disposal on Company Premises**

| Waste disposed in | Number of companies that use this |
|---|---|
| Skips | 5 |
| Refuse bags | 6 |

| | |
|---|---|
| Wheelie bins | 4 |
| Other bins | 1 |
| Loose | 1 |
| Stored on premises | 1 |
| None | 1 |
| Drum | 1 |
| Box | 1 |
| Canvas bags | 1 |
| Bulk bag for oil | 1 |
| Nampak Bins | 1 |
| Unrecorded | 4 |

Five companies used skips to dispose of certain wastes. One company used a combination of municipal and private skips based on the waste that was generated by the company. General "domestic" waste was used disposed of in municipal skips while hazardous waste disposed of using private skips. Only one other company used municipal skips as the last three companies used private skips.

An attempt was made at contacting private contractors who operate in the area. Information regarding the scale of the operations in MCLM, the types of waste collected and the amount of waste generated were requested.

Unfortunately no contractor was willing to provide the information. Contractors either refused outright or claimed that gathering the required information was time consuming to do.

The table below lists the contractors who operate in the area. This list is divided into companies provided by MCLM and companies which were found during the survey.

| **Contractors provided by MCLM** | **Contractors Found in Survey** |
|---|---|
| | Amalgamated Metals |
| | Enviroserv |
| | Nampak |
| | Nedbank Waste Management |
| | Oilkol Pty Ltd |
| | Phambili Waste |
| | Private Persons Resell |
| | Re Ethical Waste For Egoless Region |

| Contractors provided by MCLM | Contractors Found in Survey |
|---|---|
| | Stainmed - Medical Waste |
| | The Paper Waste Man |

About five of the nineteen companies had a permit to dispose of waste in the municipality. These were generally companies who had larger amounts of waste to dispose. Other companies use the make use of the municipal services for weekly collections if they have wheelie bins or monthly for skips.

Of all the companies that were surveyed only two said that MCLM inspected their waste management. The first company recorded claimed the MCLM inspected and issued a certificate to the company approving their waste management. The company could not say exactly how often inspections took place.

On the other hand, the second company assumed they were being inspected on an on-going basis. The reason they provided is that if a little drainage was found coming from the company; officials would threaten to close down the business. The company uses private services for all hazardous waste.

The industrial waste survey involved twenty eight companies from which nineteen responses were positive. This accounts for about seventy percent all companies. Thirty percent of companies would either not comment or were defensive of their waste management process. Reasons for this could not be explained.

There is a lack of good waste management information in the MCLM, making planning challenging. It is recommended that MCLM aims to improve on information storing as well as the quality of the information.

MCLM inspections took place in only 10 percent of companies. One method of data/ information gathering would be through inspections. It is therefore advised that inspections do take place.

Private contractors are surprisingly unwilling to help in providing waste information. It is suggested that the municipality attempts to get information on waste information from private contractors. The information gathered will provide useful information on the types of waste generated, the amounts as well what waste is recycled and what is disposed.

## 4.5 Service Areas and Equipment

Waste is collected on a weekly basis in residential areas and the frequency in the CBD varies from twice a week to daily collections.

Waste is nominally collected in the areas shown in Table 27 below.

**Table 27 Waste Collection Areas**

| Region | Service Area | Region | Service Area |
|---|---|---|---|
| Northern | Breaunanda | Northern | Dan Pienaarville |
| | Kenmare | | Heuningklip |
| | Mindalore Extension | | Kromdraai |
| | Rangeview Extension 1 | | Krugersdorp North |
| | Silverfields | | Mayibuye |
| | Noordheuwel Ext 1 & 2 | | Oaktree |
| | Noordheuwel Proper | | Protea Ridge |
| | Rangeview Ext 1 & Western | | Rant-En-Dal |
| | CBD | | Ruimsig |
| | Factoria | | Agavia |
| | Lewisham | | Apple Park |
| | Luipaardsvlei | | Boltonia |
| | Monument | | Burgershoop |
| | Munsieville/ Phatsima | | Delporton |
| | Olievana | | Helderblom |
| | Wentworth Park | | Oaklands |
| | West Rand Mines | | Quellerie Park |
| | Chancliff | | West Village |
| Southern | Kagiso 1 | Southern | Mayibuye: |
| | Sinqobile | | Rietvallei |
| | Tsakane | | Swaneville |
| | Hills View: | | Extension 8 |
| | Riverside | | Extension 12: |
| | East Park | | Kagiso 2 |
| | Hospital view | | Rietvallei 2 and 3 |
| | Azaadville | | Extension 6 |



Collection services in these areas are provided by double axle Rear End Loading (REL) compactors, led by a team leader. The compactors work on a saturation basis and do not cover defined routes. Up to three compactors will cover an area at once with the trucks working in close proximity to each other. This methodology was deemed necessary to cover for truck breakdowns, which seem to have been a historical issue with the older vehicle fleet. There are no vehicle satellite tracking systems in place.

The service areas above are not managed from the perspective of number of service points, or waste tonnages that can be expected from each area.

Once full, the compactors dispose of the waste at the nearest landfill and then return to their collection routes. The collection system is based upon wheelie

bins, which are supplied by the municipality. Wheelie bins coverage is high, about 80%, in the municipality, with areas that are uncovered being low income. In these cases, residents rely upon their own arrangements to package waste for collection.

**Plate 3 Informal Waste Containers, Kagiso**



Collection crews informally work on a production basis, in that they finish work once the route has been completed. No management oversight was evident to ensure that the route was effectively completed and that all waste was collected. Apart from truck tonnages taken at the weighbridge, no monitoring of production levels takes place. No links between the trucks tonnages and the work levels of the compactors crews are made.

In general overtime for the compactor crews is not necessary. During peak waste seasons, around public holidays, Christmas and Easter, double shifts are sometimes worked by the crews. Overtime pay starts when the eight normal working hours are exceeded.

Collection from informal settlements is haphazard and is not formally planned for by the municipality.

In addition to the municipal service, the municipality started using the services of Tedcor in November 2011. Tedcor is a waste management company with extensive experience in rural and peri-urban collection. The aim of the contract is to covers the informal settlements and areas of the dense formal settlements that the municipality struggles to cover. The use of this waste

contractor should increase the overall service level coverage in the municipality. Tedcor uses single axle REL compactors.

Garden waste is collected at a fee or disposed with domestic waste. No separate garden waste handling facility is in place in the municipality.

The municipality provides a skip hire and collection service. Skips are placed at sites and waste removed from each site as required. The owner of the site either pays a fee per skip or pays per month for a skip. The latter arrangement has been established for bulk waste generators with the tariff structure based on a minimum number of removals per month, not a maximum number. Hence, from the waste generator's perspective, the greater the volume of waste that is generated, the cheaper the unit waste disposal costs become. The incentive becomes even stronger when taking into account the fact that the costs of a twenty eight cubic meter container are the same as those for a twelve and ten cubic metre skips. This incentive is contrary to the aims of waste minimisation.

Tipper trucks and cleansing crews operate in the municipality to clear any problematic waste that cannot be removed by compactors. These crews focus on areas such as municipal entrance routes, open spaces, littering and dealing with waste that is generating public complaints. Street cleaning is also carried out, with there being fifty five street cleaners. The municipality does not own a mechanical broom. The tipper trucks and skip loaders are also hired out the out to members of the public as required.

Management of the ordering of waste services is managed by the waste depot, but invoicing and payment processing is managed through the existing municipal financial system.

The municipality uses a variety of waste management vehicles to carry out its daily activities. The table below summarises the salient features of this equipment.

**Table 28 Waste Management Equipment**

| Category | Vehicle | Municipal Identifier | Size Indication | Year Model | Age | Condition |
|---|---|---|---|---|---|---|
| Waste compactor | UD 290 Nissan | 1023 | Double Axle | 2010 | 2 | Good |
| | UD 290 Nissan | 1059 | Double Axle | 2010 | 2 | Good |
| | UD 290 Nissan | 1058 | Double Axle | 2010 | 2 | Good |
| | UD 290 Nissan | 1024 | Double Axle | 2010 | 2 | Good |
| | UD 290 Nissan | 1017 | Double Axle | 2010 | 2 | Good |
| | UD 290 Nissan | 1014 | Double Axle | 2010 | 2 | Good |
| | Isuzu FUZ Diesel | 1089 | Double Axle | 2011 | 1 | Good |
| | Isuzu FUZ Diesel | 1091 | Double Axle | 2011 | 1 | Good |
| | Isuzu FUZ Diesel | 1088 | Double Axle | 2011 | 1 | Good |

| Category | Vehicle | Municipal Identifier | Size Indication | Year Model | Age | Condition |
|---|---|---|---|---|---|---|
| | Isuzu FUZ Diesel | 1092 | Double Axle | 2011 | 1 | Good |
| | Isuzu FUZ Diesel | 1086 | Double Axle | 2011 | 1 | Good |
| | Isuzu FUZ Diesel | 1087 | Double Axle | 2011 | 1 | Good |
| Tipper Truck | UD 40 NISSAN | 1079 | $6m^3$ | 2011 | 1 | Good |
| | UD 40 Nissan | 1077 | $6m^3$ | 2011 | 1 | Good |
| | UD 40 Nissan | 1078 | $6m^3$ | 2011 | 1 | Good |
| Skip Loaders | | | | | | |
| | | | | | | |
| | | | | | | |
| Wheeled Loaders | Bell | ML 641 | | 1996 | 16 | u/s |
| | Komatsu | ML 199 | | 1984 | 28 | u/s |
| Landfill Compactors | Bomag | ML 1126 | | | | Fair |
| | Rex | ML 115 | | 1994 | 18 | u/s |
| Tyre Cutter | Unknown | 18 inch | | 2003 | 9 | Fair |
| Wood Chipper | Morbark 2072 | ML 082 | | 2003 | 9 | Fair |
| | Morbark 2072 | ML 083 | | 2003 | 9 | Fair |
| Tractor | Ford | ML 180 | | 1978 | 34 | Good |
| | FORD 4000 | ML 075 | | 1980 | 32 | Poor |
| | Komatsu Fell | ML 199 | | | | |

u/s = unserviceable

The collection vehicle fleet is mostly new, especially the waste compactors and the tipper trucks. The landfill equipment and the composting and recycling equipment is ageing and increasingly unreliable.

All of the new vehicles have been obtained on full maintenance lease contracts, which reduces the daily maintenance challenges for the waste management department.

**Plate 4 REL Compactor**

The unit uses two service options. The primary option is to use the municipal workshops, which have the facilities to carry out running vehicle repairs and regular servicing. Larger jobs, such as engine and gearbox replacements require sending the vehicles to their respective service agents. The second option is to have the running repairs and the servicing of vehicles completed by the vehicle's service agents. This second option tends to result in the vehicle being back on the road quicker than if the municipal workshops are used.

**Plate 5 Waste compactor**

In total, twelve waste compactors are available to the municipality, including two hired vehicles.

## 4.6 Waste Facilities and Disposal Sites

There are currently two landfill sites in the Mogale City Local Municipality. These are the permitted site at Luipaardsvlei and the unpermitted site in Magaliesburg.

### 4.6.1 Luipaardsvlei Landfill

The Luipaardsvlei is formally engineered and managed and is reaching the end of its life. Capacity constraints exist to the extent that the only further area for expansion is on top of the rehabilitation section of the landfill. This operation will require raising the top of the landfill above the skyline.

The landfill permit expires on 31 December 2012, at which time an alternative disposal site is to be identified, established and authorised.

Waste disposal is controlled with the southern working face having a workmanlike appearance. The northern working face relies upon end tipping, with the resultant lack of control.




**Plate 6 Standard Cell Operations on the Luipaardsvlei Landfill**

A large number of Waste Pickers sift through the waste on the site. For the most part waste pickers are controlled and their actions are monitored by a team of security guards deployed on the landfill.


**Plate 7 Waste Picker on the Luipaardsvlei Lanfill**

Recyclables are carted to the south of the landfill in a large laid down area. This laid down area acts as a storage space and a sorting area. Collection by recyclables buyers is formal, with buyers aware of the areas from which their waste is sourced. Waste pickers on the site are acutely aware of the current market price for recyclables and their numbers and organisation ensure that waste buyers purchase frequently and using cash.

**Plate 8 Waste Picker's Laid Down Area**

The figure below provides an aerial view of the landfill. The image is taken from Google Earth, with the photography date of 18 December 2011.


**Figure 6 Luipaardsvlei Landfill Locality**

The site itself is circled. The blue arrow shows the nearest residential township, that of Wentworth Park, which is less than 800m from the closest fence of the landfill. The red arrow shows the adjacent mining area, which is also the site for proposed future expansions of the site.


**Figure 7 Luipaardsvlei Landfill Site Layout**



In the zoomed image above, the blue arrow points to the landfill entrance, which houses the weighbridge, the site offices and workshop. The red arrow points to the waste recyclable laid down area. Between the two arrows is the landfill working face. The white arrow shows the current working face, which highlights the lack of airspace at the landfill.

The orange arrow shows the stormwater runoff and leachate evaporation Pond. There are very established footpaths leading to the landfill from the east and the south. These are testament to the number of people who derive a living from the landfill.

**Figure 8 Luipaardsvlei Landfill Leachate and Stormwater Evaporation Pond**

The majority of the site has been formally closed and the vegetation rehabilitated. This goes for the current top of the landfill, which is subject to the proposal to re-start disposal.

**Figure 9 Rehabilitated and Close Sections of the Luipaardsvlei Landfill**

The management of factors such as drainage control, nuisance factors, hazardous waste disposal, leachate and stormwater runoff is adequate. Security at the site is good and control over what is disposed on the landfill is good.

Vehicle access to the landfill during rainy periods is likely to be slightly restricted due to the lack of true wet weather access road.

Air quality, borehole and gas monitoring are not in place at the site.

Table 29 is a summary of the most important aspects evaluated during this status quo analysis.

**Table 29 Luipaardsvlei Landfill Details**

| Waste Facilities and Disposal Sites | |
|---|---|
| **Name of disposal site** | Luipaardsvlei Landfill |
| **Geographic location of landfill** | S: 26°07’ 12.8”<br>E: 27°47’ 08.4” |
| **Permitted?** | Yes – 16/2/7/C232/D2/Z1/P502 |
| **Class** | G:M:B- |
| **Remaining site life (Yrs)** | 3 months without expansion |
| **Annual disposal volume (m3)** | 150 000 tons (weighbridge value) |
| **Size of landfill [ha]** | 16ha |

| Waste Facilities and Disposal Sites | | | | | |
|---|---|---|---|---|---|
| **Equipment on site** | Landfill Compactor, tipper trucks | | | | |
| **Access control** | YES | X | NO | | |
| **Disposal tariffs** | Yes | | | | |
| **Onsite salvaging** | YES | X | NO | | |
| **Waste reclamation** | Waste Pickers on site but no formal waste reclamation | | | | |
| **Method of land filling (e.g. trench system)** | Standard Cell Operation with end tipping when the number of vehicles at the site are too large to be accommodated along the working face | | | | |
| **How is drainage controlled?** | The landfill is lined, drainage is directed to a leachate and storm water evaporation Pond | | | | |
| **Does adequate signage and proper access roads exist?** | Yes, signposts are erected at the entrance road to the site. | | | | |
| **Is this a co-disposal facility? If YES, explain** | No. This facility was developed to only accept general waste. Liquid wastes were not seen on site.. | | | | |
| **What management measures are applied for nuisance factors?** | Cover is applied, but not daily cover. Vecotr control thus suffers. | | | | |
| **How is leachate and gas managed?** | The infrastructure for management exists, the monitoring is not being carried out. | | | | |
| **Rehabilitation** | Rehabilitation has been completed over large areas of the site | | | | |
| **Final cover** | Yes | | | | |
| **Expansion or closure plans** | Expansion plans are to the north of an existing site, EIA process has started but stalled due to issues with securing the adjacent site. Alternative expansion is to raise the overall height of the landfill. | | | | |
| **Is hazardous waste accepted?** | YES | | NO | X | |

**Plate 9 Landfill Compactor Active on the Landfill**

The minimum operational requirements for the Lupaardsvlei, a medium landfill, are as follows:

**Table 30 Lupaardsvlei Landfill Compliance with Operating Requirements**

| Minimum Requirement | Status |
|---|---|
| 1. Signposting | Yes |
| 2. All weather roads | Partially present |
| 3. Waste Acceptance Procedure | Yes |
| 4. Fencing | Yes, needs maintenance |
| 5. Control of vehicle access | Yes |
| 6. Site Security | Yes |
| 7. Operating Plan | Yes |
| 8. Weighbridge | Yes |
| 9. Collection of waste disposal tarrifs | Yes |
| 10. Site Office | Yes |
| 11. Adequate plant and equipment | Partial, need tipper trucks |
| 12. Designated responsible person | Yes |
| 13. Sufficient qualified staff | Yes |
| 14. Compaction of Waste | Yes |
| 15. Daily Cover | Not present |
| 16. Two week's cell or trench capacity | Yes |

| Minimum Requirement | Status |
|---|---|
| 17. Protection of un-safe excavations | n/a |
| 18. One week's wet cell capacity | Not present |
| 19. Immediate covering of putrescibles | Not present |
| 20. End-tipping prohibited | Not present |
| 21. Three day's stockpile of cover | Not present |
| 22. Final cover | Yes |
| 23. Reclamation formalised in operating plan | Yes |
| 24. Registration of reclaimers | Yes |
| 25. Protective clothing | Partially present |
| 26. Control of nuisances | Partially present |
| 27. Waste burning prohibited | Yes |
| 28. Draining away water from the waste | Yes |
| 29. Contaminated runoff contained | Yes, visually, not confirmed |
| 30. Leachate contained | Yes, visually, not confirmed |
| 31. Storm water diversion measures | Yes |
| 32. 500mm freeboard for diversion and impoundments | Not present |
| 33. Grading cover to avoid ponding | Not present |
| 34. General site maintenance | Yes |
| 35. Sporadic leachate reporting | Not present |
| 36. Rehabilitation and vegetation | Yes |



The landfill is generally is a fair state, although in need of maintenance, expansion and the provision of sufficient funds to ensure daily cover. Monitoring of contaminants is an aspect that needs attention.

### 4.6.2 Magaliesburg Landfill

The Magaliesburg landfill started as a communal dump outside the small town of Magaliesburg. The current state of development resembles a quarry that has reached surface level by years of disposal. There is a lack of access control, very poor fencing, no cell development nor any discernible disposal methodology. The landfill was established due to the distance between Magaliesburg and the Luipaardsvlei landfill.


**Plate 10 Conditions on the Magaliesburg Landfill**

Magaliesburg landfill is not permitted and is not operated properly and there is no equipment on site to assist in waste management.

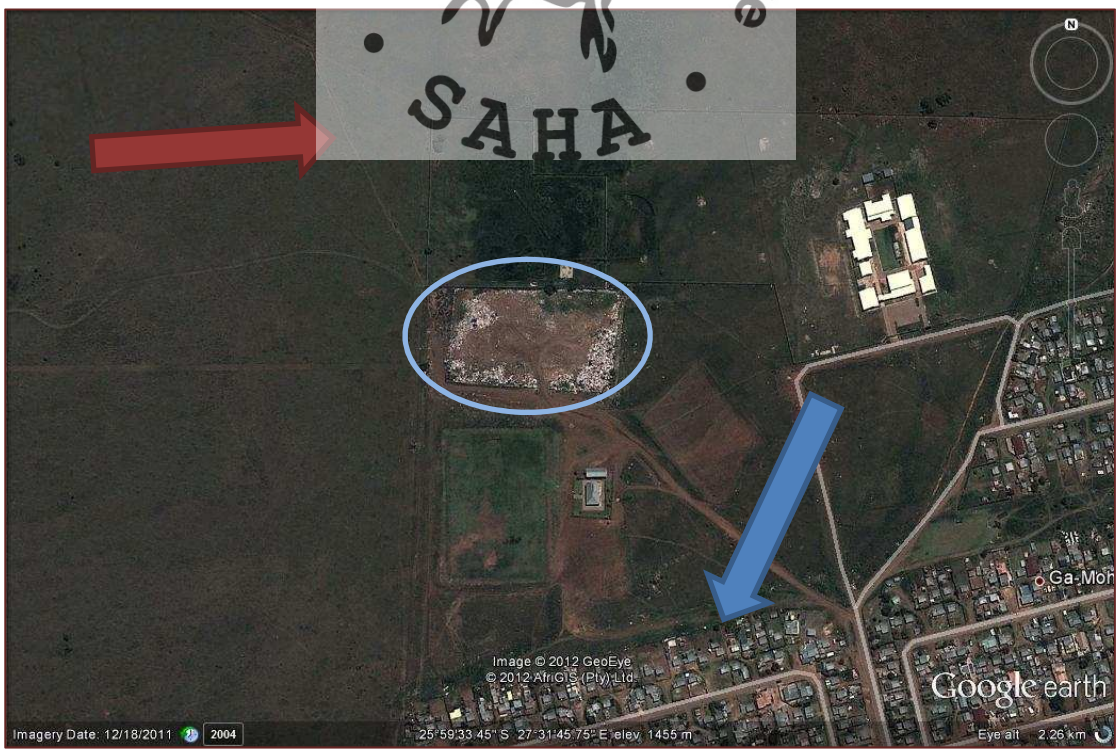


**Figure 10 Magaliesburg Landfill Locality**

The figure above provides an aerial view of the landfill. The image is taken from Google Earth, with the photography date of 18 December 2011.

The site itself is circled. The blue arrow shows the nearest residential township, that of Wentworth Park, which is less than 300m from the closest fence of the landfill. An un-surfaced road leads to the landfill which is manned by a volunteer, who derives his income from selling the recyclables that are sorted from the waste disposed of at the site.

It is estimated, using a waste generation rate of 0.5kg/cap/day, that the landfill accepts between 2 and 3.5 tons per day in 2010. Actual disposal volumes are unknown. Discussions with waste management officials at depot level have indicated waste collections as high as two double axle compactors per day, this figure could not be independently verified.

**Table 31 Magaliesburg Landfill Details**

| Waste Facilities and Disposal Sites | | | | | |
|---|---|---|---|---|---|
| **Name of disposal site** | Magaliesburg Landfill | | | | |
| **Geographic location of landfill** | S: 25°52' 32.5"<br>E: 27°31' 44.7" | | | | |
| **Permitted?** | YES | | NO | X | |
| **Class** | N/A | | | | |
| **Design disposal volume** | N/A | | | | |
| **Remaining site life (Yrs)** | Has reached surface level, the site is too small to allow raising the level above ground. It is practically full. | | | | |
| **Annual disposal volume (m3)** | Unknown | | | | |
| **Equipment on site** | None | | | | |
| **Access control** | YES | | NO | X | Fencing is poor, 24 hour control is not maintained |
| **Disposal tariffs** | None | | | | |
| **Onsite salvaging** | YES | X | NO | | |
| **Waste reclamation** | Waste Pickers on site but no formal waste reclamation | | | | |
| **Method of land filling (e.g. trench system)** | No apparent land filling method | | | | |
| **How is drainage controlled?** | Uncontrolled | | | | |
| **Does adequate signage and proper access roads exist?** | None | | | | |
| **Is this a co-disposal facility? If YES, explain** | No. This facility developed as communal dump site and is expected to only accept general waste but since there isn't any access control, co-disposal is possible. | | | | |

| Waste Facilities and Disposal Sites | | | | | |
|---|---|---|---|---|---|
| **What management measures are applied for nuisance factors?** | None | | | | |
| **How is leachate and gas managed?** | No management measures | | | | |
| **Rehabilitation** | No rehabilitation measures | | | | |
| **Final cover** | No covering | | | | |
| **Expansion or closure plans** | None | | | | |
| **Is hazardous waste accepted?** | YES | | NO | X | The likelihood of hazardous waste is low |


**Plate 11 Disposal at the Magaliesburg Landfill**

The minimum operational requirements for the Magaliesburg Landfill, a communal landfill, are as follows:

**Table 32 Magaliesburg Landfill Compliance with Operating Requirements**

| Minimum Requirement | Status |
|---|---|
| 1. Signposting | Not present |
| 2. Waste Acceptance Procedure | Inadequate |
| 3. Fencing | Inadequate |
| 4. Control of vehicle access | Inadequate |

| Minimum Requirement | Status |
|---|---|
| 5. Adequate plant and equipment | Not present |
| 6. Designated responsible person | Inadequate |
| 7. Sufficient qualified staff | Not present |
| 8. Two week's cell or trench capacity | Yes |
| 9. Protection of un-safe excavations | n/a |
| 10. Immediate covering of putrescibles | Not present |
| 11. Final cover | Not present |
| 12. Reclamation formalised in operating plan | Not present |
| 13. Registration of reclaimers | Not present |
| 14. Protective clothing | Not present |
| 15. Control of nuisances | Not present |
| 16. Draining away water from the waste | Not present |
| 17. Storm water diversion measures | Not present |
| 18. Grading cover to avoid ponding | Not present |
| 19. General site maintenance | Not present |
| 20. Sporadic leachate reporting | Not present |

Note: The classification of the Magaliesburg Landfill into the communal size class is based upon 2010 waste generation of between 2 and 3,5 tons per day. Disposal figures are not available, but the landfill volumes are unlikely to exceed the 25 tons per day to move the landfill into the next larger size class.



## 4.7 Recycling and Reuse Initiatives

There are currently very few recycling or reuse programmes run by the municipality.

The municipality does have a tyre shredder at the Luipaardsvlei Landfill. This shredder cuts tyres into quarters and then disposes of them on the landfill. The shredder is busy, and can only handle up to 18 inch tyres. The landfill accepts tyres larger of all sizes, hence the stockpile of tyres which are too large for shredding grows monthly

**Plate 12 Tyre Shredder at the Luipaardsvlei Landfill**

A composting area is allocated at the Luipaardsvlei landfill. Vegetative waste is then chipped and stored in the compost area. The municipal Parks Department is the main user of the resulting compost. The composting operation is currently in abeyance and has not been active for some time.

**Plate 13 Compost Heap at the Luipaardsvlei Landfill**

Private recyclers collect recyclables from the Luipaardsvlei landfill daily, in the case of metals, and weekly in the case of plastics and paper, from landfill Waste Pickers. The high numbers of Waste Pickers on the site (between 100 and 200) indicate that the recyclable yield is sufficient to provide a living from recycling. Given the scavenging methodology, it is likely however that the yield is low when compared to other methods.

**Plate 14 Recyclables at the Luipaardsvlei Landfill**

Since the market prices for recyclables fluctuates widely, recyclers are incentivised to stock pile their wares until the price improves. This leads to large volumes being stored on site, which represent a health and fire hazard.

Thus the main recycling currently being conducted in the municipality is driven by the private sector. Generators of high volumes of recyclables, such as retail outlets use private contractors to remove their waste. Much of this waste is then recycled. All of the large retail outlets in Krugersdorp follow this practice.

The Rose Foundation is active in the area, collecting used oils from generators - ranging from service stations, to industrial sites and other commercial enterprises.

## 4.8 Illegal Dumping and Disposal

During visits around the municipality it is apparent that illegal dumping is a major concern in the main nodes of the MCLM.

In general, the dumping seems to be most prominent in poorer neighbourhoods. Dumping does occur in central areas of Krugersdorp, but the street cleaning unit focuses its efforts on the cleaning of these areas. The poorer neighbourhoods do not receive the same attention, and many persistent dumps were seen.

**Plate 15 Informal Dumping around a municipality supplied skip**



The practise of placement of skips for community waste disposal is laudable in that a basic service is being provided. However evidence during the site visits suggest that often this practise is cause of further waste disposal problems. The plate above demonstrates two issues: that waste is not collected from this skip frequently enough and the skip placement does not allow for children and older people to lift the waste into the skip. This area, once it reaches this state, is a health hazard, as well as a safety no-go area. The practise has reduced the space which the community has to go about their business and has reduced the entire area to a state of squalor.

It was indicated by waste management officials that collection reaches 100% of households in urban areas, apart from in some informal areas, hence illegal dumping should not occur.

Based upon site observations and past experience, it seems that the illegal dumping is a symptom of ineffectual waste collection.

The system of waste containers being supplied by households, places a burden on poorer households and it may be cheaper to dump waste illegally rather than lose the container or bag in the collection process

A further aspect of ineffectual collection is that collection routes may not be formalised and compactors and their crews are not monitored for service quality. Hence it is possible that refuse collection crews do not run all of their

routes all of the time, with shortcuts and gaps in the service being likely. This irregular service would make illegal dumping the only option for waste disposal.

**Plate 16 Informal Dumping around an Informal Settlement**



The municipality has limited enforcement capacity to ensure that illegal dumping is curtailed through fines or awareness. Thus illegal dumping in the municipality is a largely risk free activity.

Waste cleaning is not done in a scheduled manner but is conducted as the need arises. Cleanups are focused on areas where the residents have the knowledge and means to bring illegal dumping to the attention of the waste management department.

**Plate 17 Street cleaning required, child waste pickers**

Illegal disposal, probably caused by ineffectual collection practise is an issue that requires serious attention in the MCLM.

## 4.9 Finance

The waste budget allocated for Waste Management in the annual budget of the Mogale City Local Municipality, was R41.8 million in the 2010/11 financial year.

The bulk of the budget is for operational expenditure, landfill expenditure having been made in the previous year. Thus the operational budget for the Waste Management department was R41.7 million in 2011.

The per household operational cost is R551.94 per annum, taking into account a service coverage of 80.2%. This figure has allocated all waste collection costs to households, including the costs for street cleaning and CBD collection. It is therefore an overestimate.

The highest household collection fee in 2009 was R96.44 per month, which amounts to R1 157.28 per year. Thus there is a surplus of R641.34, per year, per household. The household income collection rate therefore exceeds the costs of proving the service. This surplus is increased when taking into account revenue derived from street cleaning and special collections.

Projected revenue for the waste service in 2010/11 totalled R112.5m.

It should be noted that the budgets for the waste-management department do not include the costs of depreciating vehicles, nor for depretiating the capital costs of the landfills. In this sense the surplus shown by the department is misleading since the full costs of waste management are not borne by the department.

## 4.10 Identification and Prioritisation of Needs

The Status Quo analysis has highlighted the status of waste management in the municipality and in many cases, waste management is not as effective as it could be. In this regard, there are clear gaps and needs that should be addressed. Once these needs have been addressed, it follows that overall waste management will improve, benefiting all the residents and businesses within the municipality's boundaries.

The needs will be addressed in terms of the waste management principles established in terms of NEMWA. These principles include:

- Waste Prevention, Minimisation and Recycling – as far as possible waste should be prevented in the first place, Typical measures to achieve this goal include packaging design awareness amongst manufacturers. Further, and more direct measures, that should be taken include diverting from the collection/disposal cycle any waste that can be recycled or reduced through composting. This will reduce waste loads dramatically, save airspace in the landfill and reduce the current high demands on the vehicle fleet;
- Waste Collection and Transportation – Once the waste has been generated, efficient collection procedures should be established and control over the transportation of waste ensured;
- Waste Treatment Facilities – this includes the treatment of waste prior to final disposal. The aims of waste treatment are to reduce the volumes of waste going to landfill and to make the waste less harmful to the environment;
- Waste Disposal Facilities – this aspect covers the final disposal of waste. The aim is to ensure that waste is finally disposed of in an acceptable manner with the minimum of nuisance during disposal and as low an impact upon the receiving environment as possible. This includes the reduction of health risks;
- Informational Requirements – in order to plan for future waste types and volumes, it is necessary to collect sufficient information, with sufficient accuracy, to enable this planning. Having the necessary equipment and procedures in place to gather this information is one of the first steps towards achieving accurate planning outcomes;
- Institutional Arrangements – Waste management is a local government responsibility and, as such, should be managed and controlled in a manner that ensures optimal economic and environment outcomes. Institutional arrangements covered in this IWMP apply mainly to the management of the Waste Management department;
- Financial Arrangements – waste management should be economically viable. Without this essential viability, waste management will depend upon subsidies for its effectiveness.

These act as a tax upon the sources of the subsidy. Waste Management is a local government function and should be controlled and paid for by the residents of local government; and

- Monitoring and Compliance Arrangements – without overseeing of waste management, it is likely not to adhere to both legal standards and to accepted norms and standards. It is also likely to rise in cost and reduce its overall efficiency. None of these outcomes is desirable and a monitoring and compliance enforcement aspect should be built into all waste management programmes.
-

# 5 MODELLING OF WASTE GENERATION

## 5.1 Introduction

The 2010/2011 West Rand DM IWMP Report created its own model of waste generation and population forecasts. In this report, the waste generation figures that were estimated for 2005 were provided.

The 2010/11 WRDM IWMP study used a waste generation model to estimate waste from 2009 to 2023, this model data will also be analysed in this report.

No other formal measurement of waste generation has been conducted in the local municipality. This is a limiting factor in determining accurate waste generation and disposal volumes for the study area.

Thus a separate waste generation model was created with the aim to estimate the likely amount of waste generated within each area and to compare results to reported amounts. The purpose of the waste generation model is to estimate waste generation rates up to 2017. Estimations will be based on population figures for 2001 and 2007 and literature based waste generated rates. This data will then be escalated to 2017 to obtain estimates for the next five years.

This model was also created to estimate waste generated in areas where no information was available as recorded in the Status Quo, and to provide a consistent set of estimated waste generation data for MCLM.

Population figures have been used as the first variable in the creation of this model. People generate waste, whether in industry or domestic waste generation, therefore population size has been considered the most important factor in creating this model. The model was compiled with the Census 2001 data, obtained from Statistics SA. Estimated population figures were refined using data from the Community Survey 2007, also conducted by Statistics SA. From these two sources, the population growth rate of each residential area was determined and the estimated population figures escalated to 2017. It

remains to be seen if population growth trends as used in this model will continue.

Although residential waste generation per area depends on various factors such as population size, commercial sources of the area, seasonality and cultural aspects, to name a few, it has been established that income levels are the greatest determinant in waste generation rates.

Income levels have therefore been used as a further variable in the residential model. Income was classified into Low, Medium and High income groups.

In addition to the waste generation from residential areas, the model also includes an estimate of the general waste generated from various industries active in the MCLM. This aspect of the model was based upon the number of employees active in each industry and the literature-based waste generation rates for each industry. The results demonstrate that the waste generated by these sectors cannot be ignored.

## 5.2 Population

Population data was obtained from Census 2001, conducted by the National Census Bureau and Statistics South Africa to determine population size in the local municipality. Statistics SA conducted a Community Survey in 2007. The Community Survey measured the number of persons and/or number of households in the municipality. The study area of the Community Survey covers the persons and households that were sampled within all different enumeration areas as demarcated in the 2001 Census. In order to generate new population estimates, this study has adopted the view that the Census 2001 is the most thorough available source of data that provides the most granular geographic information. Therefore, the 2007 Community Survey estimates are an adjustment to the information provided from Census 2001.



Population growth rates were determined for the local municipality by comparing Census 2001 data with information presented in the Community Survey of 2007.

Population figures were then estimated for 2017, using the initial Census figures and growth rates for the municipality.

The following equation has been used to determine population growth rates between 2001 and 2016:

$$P_n = CP\ (1+I)^n$$

Where:
P – Estimated Population Figure for the specified time
CP – Population at start
*I* – Growth rate as decimal degree of percentage
n – Years over which growth is determined.

The population growth rates presented above were achieved during a period of economic growth in South Africa that saw Gross Domestic Product rise by

an average of 4.5% annually between March 2001 and March 2007 (Statistics SA, 2009).

Given that a period of lower economic growth is currently being experienced, it is reasonable to assume that these population growth rates will not be exceeded. This is due to a relative lack of incentive for further inward migration towards the municipality based upon high levels of economic activity. Thus these figures are likely to be conservative from a waste management perspective and will be used, unchanged, in subsequent analyses.

## 5.3 Per Capita Waste Generation Rates

Waste generation rates vary in many aspects, and waste generated by sectors such as the various socio-economic groups, commercial and industrial centres and institutions have been presented in the National Framework Guidelines for Integrated Waste Management Plans (DEAT, 2006), presented in Table 33 below:

**Table 33 Typical Waste Generated per Land Use/ Activity**

| Land use type / activity | Typical Waste Generated | Typical generation rates |
|---|---|---|
| Residential Houses<br>o Low Income<br>o Medium Income<br>o High Income | Kitchen / Food<br>Packaging<br>Clothing<br>Furniture<br>Electronic<br>Ash<br>Garden Waste | (Rate: kg/person/day)<br>o Low: 0.2 – 0.7<br>o Medium: 0.7 – 1.9<br>o High: 1.5 – 3.0 |
| Residential Flats | Kitchen / Food<br>Packaging<br>Clothing<br>Furniture<br>Electronic | (Rate: kg/person/day)<br>0.5 – 2.2 |
| Schools, hostels, educational centres and other institutions | Office paper and books<br>Packaging<br>Electronic<br>Furniture<br>Kitchen / Food<br>Plants and grass cuttings | (Rate: kg/occupant/day)<br>0.5 – 1.3 |
| Suburban business centre / office park | Old office material<br>Packaging<br>Furniture<br>Electronic<br>Food<br>Plant and grass cuttings | (Rate: kg/employee/day)<br>0.8 – 1.7 |
| Central business area / office buildings and towers | Old office material<br>Packaging<br>Furniture<br>Electronic<br>Food<br>Street sweepings / litter | (Rate: kg/employee/day)<br>0.7 – 2.0 |
| Restaurants, hotels and fast food outlets | Food<br>Packaging<br>Cutlery<br>Electronic<br>Textiles | (Rate: kg/client/day)<br>0.5 – 1.5 |
| Industrial:<br>o Light<br>o Heavy<br>o Services / Garages<br>o Chemical<br>o Allied | Packaging / crates<br>Used chemicals<br>Old lubricants<br>Used spares<br>Old tyres<br>Old office material | (Rate: kg/employee/day)<br>0.5 – 3.0 |
| Building / Construction | Demolished buildings, wood, concrete, tiles, roof sheeting, | (Rate: kg/company/day)<br>10 – 1000 |

| Land use type / activity | Typical Waste Generated | Typical generation rates |
|---|---|---|
| | bricks, pipes, packaging, old paint, used chemicals | |
| Hospitals, clinics, doctors, dentists and healthcare facilities | Old medicines, food, human organs/ tissue, textiles, syringes, needles and sharps, packaging, bloodstained bandages/ material | (Rate: kg/patient/day) 1.0 – 3.0 |

From Table 33 above it is evident that waste is not only generated within residential areas but also within different industries. Waste generation rates will therefore be discussed in two sections – industry waste generation and household waste generation.

### 5.3.1 Industry contribution to waste streams

From Table 33 it is evident that per capita waste generation rates should account for sector-related waste generation as well. A detailed analysis on the land use / activities listed in Table 33 cannot be quantified for Mogale City Local Municipality due to unavailability of information. An example of the information required includes the waste generated by restaurants, hotels and fast-food outlets. For this information to be used in the model, a database with all restaurants will be needed, along with the average daily clientele for the entire Mogale City Local Municipality. This type of information is not currently available.



Therefore, the following sector activities will be excluded and the waste generated by these activities will be accounted for in daily household waste generation:

- Residential Flats
- Schools, hostels, educational centres and other institutions
- Restaurants, hotels and fast food outlets
- Hospitals, clinics, doctors, dentists and healthcare facilities

However, information regarding the following land uses / activities is available and will provide an overview of typical waste generation per sector per day. Waste generation rates from this table, below, have wide ranges that make the selection of a suitable rate a matter of experience and judgement.

**Table 34 Land use activity and waste generation rates**

| Land use / Activity | Typical generation rates (DEAT) [Kg/pp/day] | Average [Kg/pp/day] |
|---|---|---|
| Suburban business centre | 0.8 – 1.7 | 1.3 |
| Central Business area / office park | 0.7 – 2.0 | 1.4 |
| Industrial (includes Manufacturing) | 0.5 – 3.0 | 1.7 |
| Building / Construction (per company | 10 – 1 000 | 505 |

| | | |
|---|---|---|
| per day) | | |

Census 2001 data divided the working population into twelve sectors. Some of these sectors match categories in Table 34, while others such as "Undetermined" cannot be classified. Each sector has therefore been assigned an estimated waste generation rate according to Table 34.

Some industry's waste generation is accounted for as part of normal household waste and due to the uncertainty of the percentage waste generated, they has been accounted for as part of normal residential waste. These sectors appear highlighted in Table 35 below.

**Table 35 Land use activity, typical waste generation rates**

| Industry | Typical waste generation rates | Applied WGR [kg/emp/day] |
|---|---|---|
| Agriculture; hunting; forestry and fishing | 0.2 – 3.0 | 2.2 |
| Mining and quarrying | 10 – 1000 | 10 |
| Manufacturing | 0.5 – 3.0 | 2.5 |
| Electricity; gas and water supply | 0.5 – 3.0 | 2.5 |
| Construction | 10 – 1000 | 30 |
| Wholesale and retail trade | 0.8 – 1.7 | 1.8 |
| Transport; Storage and communication | 0.8 - 1.7 | 1.8 |
| Financial; insurance; real estate and business services | 0.7 – 2.0 | 1.9 |
| Community; social and personal services | 0.8 – 1.7 | 1.8 |
| Other and not adequately defined | 0.2 – 3.0 | 1.6 |
| Private Households | 0.2 – 3.0 | 1.6 |
| Undetermined | 0.2 – 3.0 | 1.6 |



Mining and quarrying rates have been given the lower range of 10 kg/employee/day. The justification for this decision is that the majority of the waste created by employees in a mine consists of the results of mining, which is not formally classified as waste. Using a lower range accepts that a small portion of all the waste generated by the mining sector will be general waste.

The construction waste figure of 10-1000 kg/company/day is too wide a range to be used in the model. The range itself is three orders of magnitude, whilst no indication is given of the size of the company contemplated in the figure. In order to quantify how much waste is produced by the construction industry; figures from the Luipaardsvlei landfill Site were used. Based on the amount of waste disposed at the Landfill, a loss factor of 50% was added given for waste that is illegally dumped, waste dumped at other landfill sites, waste reused and waste that is unaccounted for at the Luipaardsvlei Landfill Site. this the total allocated to the Landfill site is 30 kg/pp/day.

### 5.3.2 Household contributions to the waste stream

Household waste generation rates are influenced by income levels. They are directly proportional to the amount of waste generated by a particular individual.

**Table 36 Waste generation rates per income group (kg/person/day)**

| Income Group | Data Source | |
|---|---|---|
| | DEAT | GDACEL |
| Very Low | - | 0.2 – 0.4 |
| Low | 0.2 – 0.7 | 0.4 – 0.7 |
| Medium | 0.7 – 1.9 | 0.7 – 1.1 |
| High | 1.5 – 3.0 | – 1.2 |
| Very High | - | – 2.5 |

According to the waste characterisation study conducted during the end of 2011, the following average residential generation figures were found:

**Table 37 Waste generation found in waste characterisation survey**

| Income level | Waste generated (kg/c/d) | Weighted average (kg/p/d) |
|---|---|---|
| Low income (R0 – R38 600) | 0.95-1.45 | 0.95 |
| Medium income (R38 601 – R153 600) | 0.92-1.58 | 1.2 |
| High income (R 153 601 and above) | 0.64 -2.95 | 1.7 |



The figures above suggest that while middle and high income households generate waste within the standards provided in the literature, low income households tend to produce more waste. Thus for the purpose of the model, low income household generation rates will be slightly increased to represent Mogale City LM more accurately.

The WRDM IWMP model takes population size and multiplies this by a waste generation rate of 0.75 per person. In contrast out model will separately determine waste generation for income groups and industries. It should be noted that WRDM IWMP rate is almost equivalent to the low and middle income average waste generation rate of 0.775 per percent used in this model. This accounts for 97% of the population.

Waste generation rates were obtained from different sources. Sources that were considered include DEAT (national level) and GDACEL (provincial level). Each of these sources indicated typical waste generation in terms of income group.

For the purposes of this study the model will take into account three different income levels; low, medium and high.

Averages of waste generation per income group were calculated and the table below presents the values that will be used in the model.

**Table 38 Income levels and waste generation rates used in the model**

| Income level | Waste generated (kg/c/d) |
|---|---|
| Low income (R0 – R38 600) | 0.75 |
| Medium income (R38 601 – R153 600) | 1.1 |
| High income (R 153 601 and above) | 1.85 |

## 5.4 Assumptions and Limitations of the Model

Although the model represents the most accurate analysis that can be carried out with the data at hand, it is important to treat the results with caution for the following reasons:

- The possible waste generation rates are subject to wide ranges – the implication is that the final figures for waste generated is highly sensitive to the waste generation rate selected in the model. Since the range of possible rates that could be selected is wide, the model is unduly sensitive to what is essentially a subjective selection of a waste generation rate;
- The assumption is made that the proportions of people in each income group will not change over time. This assumption has been made for simplicity, but a more natural result would find people moving up the income ladder, thereby increasing their waste generation as their wealth increases. Thus, for the same population, waste generation will increase. This "wealth effect" has not been captured in the model;
- A further assumption is made that the proportion of the total population able to find employment will remain the same until 2017. The additional assumption is made that the proportion of the working population employed in each of the industrial categories will remain the same. This assumption will be challenged should the economic profile of the municipality change or the municipality suffer a severe economic downturn which will decrease the working population, in total, as well as within industrial categories; and
- There is a lack of information to calibrate the model accurately. This limitation takes on two dimensions. The first is that there are no systematic measurements of the waste being disposed of in the municipality. Even if the measurements were to exist, this measure would capture only the amount of waste being disposed of, not the amounts being generated. A detailed waste generation survey would have to be conducted to obtain better waste calibration data.

These assumptions demonstrate that the results of the model are likely to have a relatively high level of divergence from reality. The calibration will prove some agreement to this.

## 5.5 Model Results

The residential waste generation model used population and income levels as the independent variables.

Population growth figures were derived using Census 2001 and the 2007 Community survey figures. Population figures were then escalated to 2017.

Waste generation per day was multiplied to obtain waste generation in tonnes per annum. This was done for the three broad income levels in the local municipality and a total estimated mass of waste generated was obtained.

The same principles were followed for waste generation in industry sectors. Employee data was obtained from the Census 2001 and assigned to the different industry sectors. Employee growth was applied in each sector in line with the overall population growth in the local municipality.

Estimated waste generation per sector per day was used and the total waste generation per sector in the municipality presented in tonnes per annum.

### 5.5.1 Residential Results

Table 39 illustrates the expected population for 2017 according to population growth rates described above. Population figures include all income levels in the municipality.



**Table 39 Population increase - Households**

| Local Municipality | 2001 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| MCLM | 289,833 | 317,666 | 337,189 | 357,912 |

In Table 40, a summary is given of estimated residential waste generation [tons per annum] of the municipality for 2001, 2007 and 2017.

**Table 40 Residential Waste Generation (t/a)**

| Local Municipality | 2001 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| MCLM | 92,200 | 101,054 | 107,264 | 113,857 |

According to this model, the Mogale City Local Municipality residential waste generation is estimated at 92 200 t/a in 2001 increasing by 21 percent to 113857 t/a in 2017. The population increases by 19 percent over the 16 year period, showing a small 2 percent difference between population growth and residential waste generation growth

### 5.5.2 Industrial Results

Table 41 illustrates the working population figures according to the Census 2001 data, adjusted by the assumed working population growth rates for the local municipality.

**Table 41 Employee increase in Industry**

| Local Municipality | 2001 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| MCLM | 78,104 | 83,899 | 89,055 | 92,300 |

Table 42 indicates estimated general waste generation for the municipality emanating from industry for the years 2001, 2007 and 2017.

**Table 42 Industrial Waste Generation (t/a)**

| Local Municipality | 2001 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| MCLM | 125,308 | 134,605 | 142,878 | 148,083 |

From this information, it is evident that waste generated by residential houses is about 40 percent thus waste generated by industry accounts for 60% percent. General waste generated by industry will form part of the municipal waste stream and will then affect waste figures as presented by the municipality. However, some industrial waste does not form part of the municipal waste stream and gets disposed of at private landfill sites. Information on these volumes will not be reflected by this study due to the lack of information regarding waste management at individual industrial waste generators.

### 5.5.3 Total Model Results

The results from the model of the residential and general industrial waste generation have been added in Table 43 below to arrive at the total waste generation in the local municipality.

**Table 43 Total Model Results (t/a)**

| Local Municipality | 2001 | 2007 | 2012 | 2017 |
|---|---|---|---|---|
| MCLM | 217,508 | 235,659 | 250,142 | 261,940 |

## 5.6 Model Calibration and Conclusions

The model calibration will use the following data available found in the WRDM IWMP 2010/11

1. 2005 Mogale City waste generation data
2. 2009-2023 estimated waste generation
3. Luipaardsvlei Landfill site data for 2004 and 2009

### 5.6.1 2005 data found in WRDM IWMP 2010/11

It was estimated that a total of 215 010 tonnes of waste is generated annually in 2005. In 2005, there were a number of waste surveys on different types of waste generated; hence this report will assume 2005 data as the most recent accurate reflection of reality.

In order to account for model misspecification, and allow for error, this calibration will provide a range in which waste generation is most likely to fall in.

The table below summarises the waste generation in 2005 as shown in the WRDM IWMP 2010/11.



**Table 44 Waste Generation t/a 2005 (WRDM IWMP)**

| Type of waste generated | Quantities of waste generated t/a in kg |
|---|---|
| Domestic | 80 954 |
| Garden | 24 134 |
| Garden | 548 |
| Illegal Dumping | 3 998 |
| Industrial | 22 368 |
| Mixed | 49 932 |
| Rubble | 32 595 |
| Soil | 482 |
| **Grand Total** | **215 010** |

The current model estimated that waste generation would be 235 659t/a in 2007. In comparison, the 2005 rates provided in the WRDM IWMP show that waste generated to be 215 010 t/a, as shown in the table below. This reflects an estimated increase of 10 percent in waste generation over the two years.
In 2005 the domestic waste generation, interpreted as residential is 80 954 t/a, the calculated residential waste generated in 2007 is 101 050t/a. Indicating an increase in waste generation of 20 percent.

### 5.6.2 2009-2023 estimated waste generation in WRDM IWMP 2010/11

The WRDM IWMP 2010/2011 rate for waste generation in 2017 is 266 899 tons per year almost perfect to the estimated 261 940t/a calculated in the model.

**Table 45 Waste Generation t/a 2010-17 (WRDM IWMP)**

| Detail | 2010 | 2011 | 2012 | 2017 |
|---|---|---|---|---|
| Population | 327 359 | 331 287 | 335 262 | 355 865 |
| Waste kg/person/year | 245.519 | 248.465 | 251.447 | 266.899 |
| Waste kg/person/day | 0.67 | 0.68 | 0.69 | 0.73 |
| Waste t/person/year | 0.245 519 | 0.248 465 | 0.251 447 | 0.266 899 |
| Waste t/population/year | 80 373 | 82 313 | 84 301 | 94 980 |

### 5.6.3 Luipaardsvlei Landfill site

The Luipaardsvlei Landfill site conducts an annual information sheet with regards to the weight of mass that goes into the site and the type of waste it is. The mass of the waste is weighed using a weigh-bridge system and is measured in tonnes.

Below is the summary provided by the Luipaardsvlei landfill site on waste disposed of at the site.

**Table 46 Type of waste disposed of (Luipaardsvlei Landfill Site, 2010/11)**

| Type of waste | Tonnes per annum |
|---|---|
| Household | 65 560 |
| Garden refuse | 11 681 |
| Building rubble | 52 238 |
| Industrial mixed waste | 20 779 |
| **Total** | **150 259** |



A total of 150 259t/a of waste reach the Luipaasrdsvlei Landfill site each year. This amount should be view with caution, during a site visit it was discovered that waste dispose of after 5pm is not accounted for. A margin of error of 20 percent will be allocated to allow for all for this waste.

Building rubble -waste produced by the construction industry- accounts for 35% of the total waste stream reaching Luipaardsvlei. The current model estimated that construction waste accounts for 30 of the waste stream.
The table below is a summary of the waste salvaged from the landfill site.

**Table 47 Waste salvages from Luipaardsvlei Landfill Site, 2010/11**

| Type of waste | Tonnes per annum |
|---|---|
| Paper / wood fibre | 34.56 |
| Plastics | 1843.2 |
| glass | 7.2 |
| Scrap metal | 16.56 |

The Luipaardsvlei Landfill Site waste generation provides an indication of types of waste that is disposed of at the site. Plastic accounts for over 95% of all salvaged waste. 34 tons of paper/ wood fibre is salvaged for the year and 16.65 tonnes of scrap metal.

The divergence in values demonstrates that the lack of accurate waste management information hampers forward-planning in the municipality. This is however not a problem unique to the MCLM; it is a nation-wide issue and is one of the main motivations for the NEMWA mandating the establishment of a national Waste Information System. Once this system is operational, the resultant data can be analysed and used in future waste management planning.