Critical analysis of current quantum models to calculate closure costs for municipal waste sites in the North West Province

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Mini-dissertation submitted to the Faculty of Natural Sciences, North-West University, Potchefstroom in partial fulfilment of the requirements for the Degree Master of Environmental Management

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March, 2016

Declaration

I declare that this research report, apart from the contributions mentioned in the acknowledgements, is my own unaided work. It is being submitted for the attainment of the degree Master of Environmental Management at the North-West University, Potchefstroom Campus. It has not been submitted before for any degree or examination at any other university.

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(Signature of candidate)

15th Day of April 2016

Abstract

In South Africa (SA) Waste landfill sites are known polluters and cause negative impacts on the receiving environments. They need to be rehabilitated and closed upon reaching capacity or reaching the end of their operational lifespan. It is also a legal and financial requirement to make financial provision for these final rehabilitation and closure costs. The lack of a standardised basis or guidelines complicates the accurate determination of the provision amounts reflected in the Annual Financial Statements (AFS) of municipalities. Consultants or determiners of these amounts currently use different bases, methods and means for the annual valuations and this has resulted in discrepancies or uncertainties in determining the correctness (over- or understatement) thereof. Godschalk *et al.* (2015:27) referred to the lack of a standardised methodology as a limiting factor for municipalities in calculating the provision disclosure. Auditing the AFS and notes particular to the waste landfill and closure provisions supported and collaborated with the afore-mentioned.

Although there is a serious lack of a proper framework or guidelines in the financial provision cost determination, there are some comprehensive specifications or legislative requirements for the actual rehabilitation and closure of the waste landfill sites. Most waste landfill site licences include or impose an obligation to rehabilitate, repair and close these sites in conformance with Section 12 of the Minimum Requirements for Waste Disposal by Landfill, further referred to as Minimum Requirements (DWAF, 1998:1-8). Section 12 is specific to rehabilitation, closure and end-use and emphasises the environmentally acceptable rehabilitation or reparation of the landfill site as a prerequisite for proper closure (DWAF, 1998:1-8). The fact is that legislation in South Africa is more focused on ascertaining rehabilitation and closure of waste landfill sites and to prevent further pollution after closure, with an obvious absence of specific guidelines or criteria to ensure uniform, accurate and reliable determination of these provision amounts.

In the 2013/14 financial period the nineteen local municipalities in the North West Province of South Africa used nine different consultants or external specialists to determine their waste landfill rehabilitation and closure provisions. Only two of the local municipalities performed their own determinations, based and elaborated on

previous external calculation models. By scrutinising the various quantum calculations and basis for determination as well as physical visits to the applicable waste landfill sites, a critical evaluation of the determination basis or criteria used in determining the waste landfill financial provision was done. The research methodology also included a questionnaire completed and submitted by the consultants or specialists as well as the AFS and waste landfill specifics (status quo). The expectation or outcome perceived was that the basis used to determine the waste landfill rehabilitation and provision costs might differ per calculator or costing model.

The research results emphasized the fact that some of the determiners of waste landfill rehabilitation and closure costs used different bases or criteria for calculating the provision disclosures as well as some significant discrepancies in calculating the provisions for similar types of facilities or operations. Comparisons between the waste landfill site specifics, AFS figures and notes (2014 and 2015) as well as the quantum models used for determination, however, also reflected some basic similarities in the parameters used for valuation. Although there is no obligation to use or follow a particular base or guideline in the provision determination process, there is a pressing need to establish standardised guidelines or specific criteria to align or be used in costing models. This will ensure a more consistent, comparable and reliable determination of the final provisions reflected in the AFS and would also be in line with the processes established and followed in developed countries. The different bases, variables or parameters used in South Africa ensure confusion and uncertainty in determining the accuracy of waste landfill provision calculations.

Key words:

Quantum calculations, provision amounts, waste landfill closure and rehabilitation.

Opsomming

In Suid-Afrika (SA) is vullisterreine bekend vir besoedeling en veroorsaak dit negatiewe impakte op die onmiddellike omgewing. Dit is noodsaaklik om hierdie terreine te rehabiliteer en te sluit sodra hulle kapasiteit bereik word of aan die einde van hulle lewensduur. Dit is ook ‘n wetlike en finansiële vereiste om finansiële voorsiening te maak vir hierdie finale rehabilitasie- en sluitingskostes. Die gebrek aan ‘n gestandardiseerde basis of riglyne kompliseer ‘n akkurate berekening van die voorsieningsbedrag wat gereflekteer word in die jaarlikse finansiële state van die munisipaliteite. Konsultante of berekenaars van hierdie bedrae gebruik tans verskillende basisse, metodes en middele vir die jaarlikse skattings en dit veroorsaak teenstrydighede of onsekerheid oor die korrektheid (oor- of onderstatering) daarvan. Godschalk *et al.* (2015:27) verwys na die gebrek aan ‘n gestandardiseerde metodologie as ‘n beperkende faktor vir munisipaliteite om die voorsiening te bereken en openbaar te maak. Ouditering van die jaarlikse finansiële state en notas verwant tot die vullisterreinsluitingsvoorsiening onderstreep die voorgenoemde.

Nieteenstaande die feit dat daar ‘n ernstige gebrek is aan ‘n behoorlike raamwerk of riglyne om die finansiële voorsieningskoste te bereken, is daar omvattende spesifikasies of wetgewende vereistes vir die fisiese rehabilitasie en sluiting van die vullisterrene. Meeste vullistereinlisensies sluit in of vereis rehabilitasie, herstel en sluiting in ooreenstemming met Afdeling 12 van die Minimum Requirements for Waste Disposal by Landfill, met verdere verwysing na die Minimum Requirements (DWAF, 1998:1-8). Afdeling 12 is spesifiek tot die rehabilitasie, sluiting en eindgebruik en benadruk die omgewings aanvaarbare rehabilitasie of herstel van die vullisterrein as ‘n voorvereiste vir deeglike sluiting (DWAF, 1998:1-8). Die ongelukkige feit is dat wetgewing in Suid Afrika meer fokus op die rehabilitasie en sluiting van die vullisterreine en om verdere besoedeling te voorkom na sluiting; daar is egter ‘n duidelike afwesigheid van spesifieke riglyne of kriteria vir ‘n eenvormige, akkurate en betroubare berekening van die voorsieningsbedrae.

Gedurende die 2013/14 finansiële jaar het die negentien plaaslike munisipaliteite in die Noordwesprovinsie van Suid-Afrika nege verskillende konsultante of eksterne spesialiste gebruik vir die berekening van hul vullisterreinrehabilitasie en sluitingsvoorsienings. Net twee van die plaaslike munisipaliteite het hul eie

berekenings gedoen wat gebaseer was of uitgebrei het op vorige eksterne spesialiste se berekeningsmodelle. Ondersoek na die verskeie hoeveelheidsberekenings en basisse vir berekenings asook die fisiese besoeke van die toepaslike vullisterreine, ‘n kritiese evaluering van die berekeningsbasis of -kriteria gebruik vir die vullisterrein finansiële voorsieningsberekening is gemaak. Die navorsingsmetodologie sluit ook ‘n vraelys in wat voltooi en ingedien is deur die konsultante of spesialiste asook die finansiële state en huidige vullisterreintoestande. Die verwagting of uitkoms voorsien was dat die basis wat gebruik is om die vullisterreinrehabilitasie en voorsieningskoste te bereken mag verskil per berekenings- of kostemodel.

Die navorsingsresultate beklemtoon die feit dat sommige berekenaars van die vullisterreinrehabilitasie en sluitingskoste verskillende basisse of kriteria gebruik in die berekening van die voorsienings soos bekendgemaak asook betekenisvolle gebreke in die berekening van voorsienings vir dieselfde tipe fasiliteite of bewerkings. Vergelykings tussen die vullisterrene, jaarlikse finansiële state en notas (2014 en 2015) asook die berekeningsmodelle het egter ook verskeie ooreenkomste getoon in die waardasies. Nieteenstaande die feit dat daar geen vereiste is om ‘n spesifieke basis of riglyne te gebruik in die voorsieningsberekeningsproses nie, is daar ‘n dringende behoefte om gestandaardiseerde riglyne of spesifieke kriteria daar te stel om voorsieningsberekeninge of kostemodelle te rig. Dit sal ‘n meer bestendige , vergelykende en betroubare berekening van die berekening van die finale voorsienings soos geopenbaar in die finansiële state verseker en sal ook meer in lyn wees met die prosesse wat ontwikkel en gevolg word in die ontwikkelde lande. Die verskillende basisse, veranderlikes of parameters wat gebruik word in Suid-Afrika veroorsaak onsekerheid en verwarring in die berekening van die akkuraatheid van vullisterreinvoorsieningberekeninge.

Sleutelwoorde:

Hoeveelheidberekenings, voorsieningsbedrae, vullisterreinsluiting en -rehabilitasie.

Acknowledgements

Studying during the latter stage of your life and career is not easy, and it becomes even more difficult with a career that requires constant travelling. Without the necessary support and guidance from your employer, family, friends and the university enrolled at, it just would not be possible. I am very grateful to and particularly want to honour the following individuals who played an intrinsic part in the success of my studies and directly or indirectly contributed to this research:

- My wife, Philippa, who stood by and supported me through very tough and challenging times,
- My supervisor, Francois Retief, for being instrumental in my research and requirements relating to the research,
- To Dr Claudine Roos for her continuous help and assistance in the planning, layout and finalisation of this mini-dissertation,
- To Carli Steenkamp, Jan-Albert Wessels and all the excellent lecturers I engaged with through classes and interaction over the past three years,
- To Professor Johan Nel and his excellent team at the Centre for Environmental Management, for their consistent and ongoing support, willingness to help and guidance,
- My Business Executive, Mr L Alley, Deputy Business Executive, Lorraine van der Grijp for your support, motivation and assistance to ensure that I could manage my studies in conjunction with my career,
- Last, but not least, I want to dedicate this degree to my two sons who inspired me through their studies and outstanding achievements.

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GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AFS	Annual Financial Statements
AGSA	Auditor-General South Africa
AASB	Australian Accounting Standards Board
ASB	Accounting Standards Board
CAE	Centre for Advanced Engineering
CSIR	Council for Scientific and Industrial Research
DACE	Department of Agriculture, Conservation and Environment
DEHP	Department of Environment and Heritage Protection
DEA	Department of Environmental Affairs
DEQ	Department of Environmental Quality
DWAF	Department of Water Affairs and Forestry
EA	Environmental Agency
ECA	Environmental Conservation Act, Act 73 of 1989
EIA	Environmental Impact Assessment
ELAW	Environmental Law Alliance Worldwide
EMF	Environmental Management Framework
EPA	Environment Protection Agency
EPA OEE	Environment Protection Agency: Office of Environment Enforcement
EP Act	Environment Protection Act
GAAP	Generally Accepted Accounting Practice
GN	Government Notice
GNR	Government Notice Requirement
GRAP	Generally Recognised Accounting Practice
Health Act	Health Act, 61 of 2003 (previously 63 of 1977)
IAS	International Accounting Standard
IASB	International Accounting Standards Board
I&APS	Interested and Affected Parties
ICA	Institute of Chartered Accountants
IDP	Integrated Development Plan
IFRIC	International Financial Reporting Interpretations Committee
IFRS	International Financial Reporting Standards

IMFO	Institute of Municipal Finance Officers
ISWA	International Solid Waste Association
IWMP	Integrated Waste Management Plan
LFCA	Landfill Full Cost Accounting
LUMF	Land Use Management Framework
ME	Ministry of the Environment
MFMA	Local Government, Municipal Finance Management Act, Act 56 of 2003
MPRDA	Mineral and Petroleum Resources Development Act, Act 28 of 2002
MSA	Municipal Structures Act, 117 of 1998
LG: MSA	Local Government Municipal Systems Act, 32 of 2000
MINIMUM REQUIREMENTS	Minimum Requirements for Waste Disposal by Landfill, DWAF, 1998 (2nd Edition)
NEMA	National Environmental Management Act, 107 of 1998
NEM: AQA	National Environmental Management: Air Quality Act, 39 of 2004
NEMWA	National Environmental Management Waste Act, Act 59 of 2008
NHRA	National Heritage Resources Act, 25 of 1999
NRTA	National Road Traffic Act, 93 of 1996
NWA	National Water Act, Act 36 of 1998
NWP: SDF	North West Provincial Spatial Development Framework
NWMS	National Waste Management Strategy, 2012
OHS Act	Occupational Health & Safety Act, Act 85 of 1993
PEOA	Protection of the Environment Operations Act, 1997
PFMA	Public Finance Management Act, Act 1 of 1999
PIWMP	Provincial Integrated Waste Management Plan
RCRA	Resource Conservation and Recovery Act, 2001
ROD	Record of Decisions
SA	South Africa
SABS	South African Bureau of Standards
SANS	South African National Standards
SAWIS	South African Waste Information System

SDF	Spatial Development Framework
SEA	Strategic Environmental Assessment
IMFO	Institute of Municipal Finance Officers
WSA	Water Services Act, Act 108 of 1997

GLOSSARY OF TERMS

Provision	A provision is a liability of uncertain timing or amount. It should only be recognised where there is a liability and only deals with genuine present obligations and not planned future expenditure. It should be the best estimate of the expenditure required to settle the present obligation at the balance sheet date.
Legal obligation	A legal obligation is an obligation that derives from a contract (explicit or implicit terms), legislation or other operation of law
Liabilities	Liabilities are present obligations of the entity arising from past events, the settlement of which is expected to result in an outflow from the entity of resources embodying economic benefits or service potential
Obligating event	This is an event that creates a legal or constructive obligation that results in an entity having no realistic alternative to settling that obligation
Contingent liability	A contingent liability is a possible obligation that depends on whether some uncertain future event occurs or a present obligation is on the table, but the payment thereof is not probable or the amount cannot be measured reliably.
Contingent asset	This is a possible asset that arises from past events and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity. A contingent asset is not recognised, but disclosed where an outflow of economic benefits or service potential is possible.

Constructive obligation	This is an obligation that derives from an entity's actions where through an established pattern of practice, published policies or a sufficiently specific current statement, the entity has indicated to other parties that it will accept certain responsibilities and as a result, the entity has created a valid expectation on the part of those other parties that will discharge those responsibilities
Contingent asset	A contingent asset is a possible asset that emanates from past events and whose existence will be confirmed only by the occurrence or non-occurrence of one or more uncertain future events not wholly within the control of the entity
Quantum calculations	This means amounts calculated in the determination of the provision amounts disclosed in the AFS
Valuation of closure costs	An estimation of the worth of the closure costs determined by the external service providers (consultants) *IAS 37*

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CHAPTER 1

INTRODUCTION

1.1 Introduction

This chapter consists of a discussion of the research background and problem statement (1.2 and 1.3), followed by the research question (1.4), aim and objectives of the research (1.5), scope of the research (1.6) the significance and contributions of the research (1.7) and concludes with detail on the structure followed with the research (1.8).

1.2 Background

This research topic emanated from experience obtained during a long career within the supreme audit institution of South Africa, the Auditor-General of South Africa (AGSA), who by law, has to audit and report on the accounts, financial statements and financial management of the public sector and for the purpose of this research particular to local authorities within the Municipal Finance Management (MFMA) cycle. Since 2003 the AGSA had started to periodically consider and include environmental matters within their audits to consider whether financial statements reflect environmental costs and liabilities, compliance with environmental legislation, policies and progress on environmental objectives.

In SA, waste and solid waste landfill management is the responsibility of local municipalities. Section 156 (schedule 5, part B) in The Constitution (1996:83-84; 146-147) includes refuse dumps and solid waste disposal as a function of provincial government, with the minimum requirements and standards evolving from national government.

In the journal article published in IMFO, Godschalk (2013) defined landfills as “waste management facilities designed to receive and hold such waste indefinitely” also

stating that these landfills are “engineered designs with a predetermined lifespan, after which they have to be rehabilitated and closed”.

Reference was also made to the fact that although there are “strict specifications for the rehabilitation and closure of landfills, there are no standards for closure cost determinations” (Godschalk, 2013). The Minimum Requirements, Section 2.1 refer to landfilling as the dumping or depositing of waste on land and may involve various engineered designs, methods and means (DWAF, 1998:1-2). An interesting fact included in these Minimum Requirements was that approximately 95% (compared to the international average of 85%) of the waste generated in South Africa is disposed of in landfills but this is still regarded as environmentally acceptable if properly managed. Improper landfilling, however, can have severe and adverse impacts on the environment (and all exposed to it), with a particular concern being the long-term impacts. The pollution of water resources and generation of landfill (methane and other) gases emanate from improper landfilling and landfill management, for which owners (municipalities) will have the liability to rehabilitate and repair.

Figure 1: Continuous waste landfill repair and rehabilitation for closure

Closure, rehabilitation and aftercare of waste landfill sites have become a legal requirement and due to the significant financial burden, local authorities are obliged to provide for the required funding to ascertain environmental, legal and financial compliance. Furthermore, most waste landfill site permits issued include or impose

an obligation to rehabilitate, repair and close these sites according to certain requirements. The fact is that legislation is more pertinent to the requirements of rehabilitation and repair of waste landfills and to prevent further pollution after closure, with an obvious absence of specific guidelines or criteria to ensure the accurate and reliable determination of these provision amounts in the AFS. Cost estimates for waste landfill repair, rehabilitation and closure are highly variable due to the different local conditions and status quo per site. These variations, together with the absence of standardised bases or criteria for provision determination, are not only placing a risk on the qualifications of a municipality's AFS, but also complicates the review and auditing of the provision amounts stipulated. Legislation and accounting standards only focus on the obligation to rehabilitate and close the waste landfill sites as well as the requirement to raise a provision where there is a known or obligating event.

The AGSA, in performing their mandate, also focuses on the legislative and financial requirements of local authorities and in this regard on the financial provision for rehabilitation, repair and closure of their waste landfill sites as included in their AFS. Godschalk (2013:22) also emphasized in his article the consequences for municipalities not making provision for their waste landfill rehabilitation and closure. The AGSA's focus on these provisions has resulted in audit qualifications where financial statements excluded or incorrectly stated these amounts. This new and comprehensive audit approach in environmental audit matter (AGSA) triggered the research topic and focus on the provision disclosure requirement in the AFS of local municipalities for waste landfill rehabilitation, repair and closure costs.

1.3 Problem statement and substantiation

In South Africa there are currently no guidelines or standardised criteria for municipalities or external specialists to determine or calculate the rehabilitation, repair and closure costs of waste landfill sites. Furthermore, there is also not much information available on waste landfill rehabilitation and closure provision determination in SA when compared to the mining closure guidance available.

Currently, most local municipalities in South Africa make use of consultants or external specialists to determine the costs of waste landfill rehabilitation and provide

the provision amount for this obligating event (with some exceptions, these amounts are determined by municipalities themselves). The problem is that there are obvious inconsistencies regarding the basis and criteria used to determine the rehabilitation and closure costs. This emanates from the lack of standardised requirements or criteria to determine or calculate these costs, with a haphazard approach followed by some municipalities, whilst others are more comprehensive to include pre-closure, closure and post-closure requirements and subsequent costs. The lack of a framework or guideline to determine waste landfill closure cost resulted in much uncertainty when it comes to accurately ascertaining the correctness (over- or under-statement) of the provision amounts as reflected in the AFS of local municipalities.

1.4 Research question

The background and problem statement have emphasized the fact that there is currently no standardised framework or guideline for waste landfill rehabilitation and closure provision determination in South Africa. In the absence of such guidelines, the following research question arises that is relevant for the research topic:

What is the basis used for the determination of municipal waste landfill site closure costs in the North West Province of South Africa?

The research question however immediately triggers another important **sub-question** of why different basis are used for the determination of these closure costs.

The research topic and subsequent question/s wanted to establish and analyse the main guiding basis (also referred to as criteria) used by the Consultants (or waste landfill rehabilitation and closure provision calculators) to perform their valuation process. This analysis critically considered the information available on the waste landfill sites of all nineteen local municipalities in the North West Province of South Africa and the implicit incorporation thereof in determining the cost estimates of the waste landfill sites rehabilitation, repair and closure provisions.

1.5 Aim of the research

Considering the fact that there is no framework or specified baseline to follow in determining waste landfill rehabilitation, repair and closure costs, the research aim can be formulated as follows:

To critically analyse the current quantum models and determine the overall guiding basis used in the calculation of the waste landfill closure costs (disclosed in the AFS) of local municipalities in the North West Province of South Africa.

Ultimately, the results will emphasize the different guiding bases used **(and why)** in the waste landfill provision quantum models and subsequent calculations of the provision amounts for waste landfill rehabilitation and closure. Furthermore, the lack of and need for a standardised framework or guideline against which the provision calculation models and determinations can be based will be proved and motivated.

The overall objective of the research will be to motivate or prompt relevant authorities to consider the need for implementing a standardised methodology in the calculation of waste landfill closure costs in South Africa. It is envisaged that the results will be applicable or relevant to all waste landfill provision determinations within the entire municipal sphere of South Africa.

1.6 Scope of the research

The scope of the research included a critical analysis of the quantum models used to calculate the rehabilitation and closure costs for all the waste landfill sites of the nineteen local municipalities in the four districts of the North West Province of South Africa.

Local Municipalities in the four districts of the North West Province (AFS)	**19**
Total Waste Landfill Sites to provide for in the North West Province (2014)	**66**
Consultants (external) used for provision determinations (2014)	**9**
Municipal (own) provision quantum calculations determined (2014)	**2**

1.7 Significance and contributions of the research

The means towards or guiding basis to determine a waste landfill rehabilitation, repair and closure requirement that must be provided for in the AFS at local municipalities in South Africa is not pertinent or specified in legislation and financial requirements. The need and benefits of a transversal and uniform framework or guideline to be used for determining these quantum calculations (by using the same basis and criteria) in South Africa will be emphasised in this research and comparative results will be obtained.

Currently, there is much uncertainty by the users of financial statements on the accuracy of the provision amounts determined for the rehabilitation, repair and closure of waste landfill sites, hence the various methods, criteria and means of determination. This research emphasizes the discrepancies or differences in the calculation basis that may result in possible under- or over-statements of the provision amounts disclosed in the AFS.

The results can assist in establishing the need for a standardised basis framework or pre-determined set of criteria in establishing costs related to closure and rehabilitation of waste landfill sites. Ultimately, it will contribute to conformity and consistency or a more harmonised approach in the quantum calculation methods and means, not only in the North West Province, but in South Africa as a whole.

1.8 Structure of the research

The research is structured in such a way as to clearly align the research aim with the selected research methodology used, the findings and conclusions per method used and an overall interpretation of all the data towards the final conclusion and statement.

This dissertation comprises five chapters, including:

Chapter 1: Introduction (1.1), background (1.2), problem statement (1.3) research question (1.4), aims and objectives of the research (1.5), scope of the research (1.6), significance and contributions of the research (1.7), and structure of the research (1.8).

Chapter 2: Introduces the literature reviews performed for introductory and background purposes to this research (2.1) with particular reference to the: definition and aim of waste landfill rehabilitation, repair and closure (2.2) legislative requirements towards waste landfill rehabilitation and closure provisions (2.3), accounting and reporting standards for waste landfill rehabilitation and closure provisions (2.4) comparative mining rehabilitation and closure guidelines and regulations towards financial provision thereof in South Africa (2.5), international best practice regarding waste landfill rehabilitation and closure provision (2.6), and a conclusion on the literature used (2.7).

Chapter 3: Provides information and a brief introduction of the research methodology (3.1) the selected research methods and means (3.2) and particular to: data acquisition, analysis and comparisons (3.2.1) municipal waste landfill site visits (3.2.2), interviews and questionnaires (3.2.3), conclusion on the methodologies selected (3.3), and limitations to the methods and means used in this research (3.4).

Chapter 4: This chapter summarizes, interprets and analyses the research methods and means used with an introduction (4.1), and particular paid to the detail interpreted from the data acquisition, analysis and comparisons (4.2), including information accumulated, analysed and compared between the local municipality's Integrated Waste Management Plans (4.2.1), Waste Landfill Site Licences and Licence conditions (4.2.2), Minimum Requirements for Waste Disposal by Landfill (4.2.3), Annual Financial Statements of local municipalities (4.2.4), Quantum Calculation Models from provision calculators (4.2.5) with concluding remarks on the data acquired, analysed and compared (4.2.6). Site visits were also introduced (4.3) and these include a background assessment of municipal waste landfill sites in the North West Province (4.3.1), municipal waste landfill site visits performed (4.3.2), site findings and needs for rehabilitation, repair and closure (4.3.3), with a summary or concluding remarks on the physical visits performed (4.3.4). The final methods and means used in accumulating and analysing the data required were interviews and questionnaires introduced (4.4), and the process included detail or specifics required through the interviews and questionnaires (4.4.1), a comparative analysis of the inputs and feedback (4.4.2), the main drivers of waste landfill closure costs in the North West Province (4.4.3), with concluding remarks on the methodology used

(4.4.4). The final part of this chapter summarizes the data analysed and results thereof (4.5).

Chapter 5: This chapter gives an overall conclusion on the research and related results (5.1), overall recommendations (5.2) and proposals for further research (5.3).

As indicated in the chapter layouts there are five basic steps that were followed in this research process (and included in the structure of the research, Table 1) that ensured the success in achieving the research aim and question:

Step 1: Determine the legal requirements (general, environmental and financial) to provide for waste landfill rehabilitation and closure, the lack of and need for standardised guideline and criteria in the cost determination thereof;

Step 2: Determine the current basis or framework guidance and processes used to calculate or determine waste landfill site rehabilitation, repair and closure costs and the provision disclosures thereof;

Step 3: Determine and compare data, records and models of the local municipalities and consultants to discuss and ascertain the basis or criteria used for waste landfill rehabilitation and closure provision amounts as well as the assumptions and parameters used for the evaluation thereof;

Step 4: Analyse and evaluate results of the determination criteria, methods and means towards the disclosure amounts; and

Step 5: Compile an overall conclusion on the research topic and questions with recommendations and proposals for further research.

Table 1: Structure of the research (5 steps followed)

Determine research aim (see Chapter 1, Section 1.5)	**Methodology** (selected – see Chapter 3)	**Process followed** **(**See structure Chapter 1, Section 1.8)	**Chapter references** (see Chapter 1, Section 1.8)
Determine the aim of the research: **To critically analyse the current quantum models and determine the overall guiding basis used in the calculation of the waste landfill closure costs (disclosed in the AFS) of local municipalities in the North West Province of South Africa.**	Literature reviews on the background, needs, legislative- and financial requirements, local and international best practices **(Chapter 2)**	**Step 1:** Determine the legal and financial requirements (and related obligations) for local municipalities to accurately provide for waste landfill rehabilitation, repair and closure costs Research the lack of and need for standardised guidelines and criteria for determining or providing for waste landfill rehabilitation, closure and repair costs	**Chapter 2:** Literature reviews **2.2** Definition and aim of waste landfill rehabilitation and closure **2.3** Legislative requirements for waste landfill rehabilitation and closure **2.4** Accounting and auditing standards for waste landfill rehabilitation and closure provisions **2.5** Comparative mining rehabilitation and closure guidelines and regulations for financial provision in SA **2.6** International Best Practice regarding waste landfill rehabilitation and closure provision **2.7** Conclusion on literature reviews
Formulate a research question: (see Chapter 1, Section 1.4) **What is the basis used for the determination of municipal waste landfill site closure costs in the North West Province of South Africa?** *Consider the most appropriate research methodology towards the aim and subsequent research question*	Data acquired, analysed and compared (methods and means) Results of data analysed and compared Results of site visits Results of interviews and questionnaires **(Chapter 4)**	**Step 2:** Determine the current basis or framework guidance and processes used to calculate or determine waste landfill site rehabilitation, repair and closure costs and the provision disclosures thereof **Step 3:** Determine and compare data, records and models of the local municipalities and consultants to discuss and ascertain the: * basis or criteria used for calculations and * Quantum models assumptions and parameters used for evaluation **Step 4:** Analyse and evaluate results of the determination criteria, methods & means towards the disclosure amounts	**Chapter 4:** Data analysis and discussions **4.2** Data acquisition, analysis and comparison from: **local municipalities** **and** **External service providers** (determiners of landfill provisions) **Other methodologies used:** **4.3** Site Visits to all local municipalities and waste landfill sites provided for (determine the needs & status quo) **4.4** Interviews and Questionnaires (to obtain the basis or criteria used by calculators or determiners) *Conclusions on analysis* ***(4.2.6 & 4.3.4 & 4.4.4)*** ***Summary of data analysed and discussed***
		Step 5: Compile an overall conclusion with recommendations and proposals for further research	**Chapter 5:** Overall conclusion, recommendations and further research **5.1** Overall conclusion **5.2** Overall recommendations **5.3** Further research

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature reviews should be particular to address the need to make financial provision for waste landfill site rehabilitation, repair and closure at local authority level in South Africa. This need will be emphasized through legislative requirements as well as accounting and reporting standards applicable thereto. Furthermore, available and comparative guidelines to close, rehabilitate and provide for mining waste sites in South Africa will be briefly explored, whilst also looking at some selected international best practices.

This research methodology selected initially started with a review of local literature on municipal waste landfill closure requirements that can be divided into the following broad categories. Firstly, it was important to grasp what waste landfill rehabilitation, repair and closure entail and what the need for them is. Although there is no standardized guideline or basis on which the rehabilitation, repair and closure, provision costs should be determined in South Africa, there are some legislative and financial requirements that guide the calculators of these costs. The next step in the literature review was to consider the legislation as well as the accounting and auditing standards applicable to waste landfill rehabilitation, repair and closure provision. The third category focused on the lack or need for a standardized framework or guideline to determine the waste landfill rehabilitation, repair and closure provision with reference to the guidelines available and used in the mining sector of South Africa. The final part of the literature review focused on international perspectives and best practices regarding the subject matter with a brief look into guidelines and bases for calculation used in some selected first-world countries.

Due to the fact that there is little formal research available on the environmental rehabilitation needs for waste landfill closure and subsequent financial provision, the literature mainly covered the legislation and financial requirements as well other

guidelines used by the consultants or determiners of the waste landfill rehabilitation, repair and closure provisions.

2.2 Waste landfill rehabilitation, repair and closure

Landfills refer to physical facilities designed, constructed and operated for the disposal of waste. Landfilling on the other hand refers to the process of incoming waste and involves the monitoring, control, placement and compaction of the waste. According to section 12 of the Minimum Requirements the final step in the operation of a waste landfill site is closure (DWAF, 1998:1) and further describing that closure should be preceded by progressive and extensive rehabilitation to ascertain that the site is environmentally and socially acceptable. Rehabilitation should be in accordance with the legislative, permit requirements and end-use plan. Improper site operations or neglect will require more intensive repair or remedial measures prior to closure with proper after-care to maintain its acceptability. The aims or objectives of waste landfill closure are to affect the proposed and accepted end-use plan and rehabilitate the site in accordance with this plan to ensure the environmental and public acceptability thereof.

As confirmed in SAWIS, not all waste landfill sites in South Africa and the North West Province specifically were permitted or in the process of being permitted, with operational activities mostly neglected, thus causing serious degradation and pollution to the receiving environment. No site can be closed without a permit and where permitted for closure the emphasis will be on closure design and rehabilitation. According to Section 12 in the Minimum Requirements all waste landfill sites need proper investigation and analysis prior to closure to ensure that closure requirements are implemented and adhered to (DWAF, 1998:3). Although the Minimum Requirements have been superseded by the new NEMWA (2008) and its Waste Classification and Management Regulations of August 2013, it is still applicable in terms of the criteria needed to operate a landfill and for the rehabilitation and closure thereof (South Africa, 2013:34).

Depending on the historical site operations and status quo, rehabilitation, closure and repair may be a very expensive process; hence the need to make a financial provision for rehabilitation and closure costs. Owners or operators of waste landfill

sites need to ensure or demonstrate that they have sufficient funds available for the cost of rehabilitation, repair, post-closure and closure during and at the end of the lifespan of the site. Literature reviewed and auditing experience revealed that waste management is mostly under-provided for at the local level. Du Plessis (2015:438-440) also emphasized the importance of proper and effective budgeting and financial management for waste services at local municipalities that include waste landfill sites and needs.

2.3 Legislation for waste landfill rehabilitation and closure provisions

In South Africa, local government has an explicit legal mandate to manage waste. The Constitution, section 7(2) and 24 should be read in conjunction with the overall objectives of local government and in particular section 152(1: b; d) (Constitution 1996:7-104). The NEMWA (2008:32-34) substantiates this duty through uniform measures to manage, reduce, recycle, recover and ultimately landfill the waste in an environmentally acceptable manner. Any operational waste landfill site now also includes a legal obligation to rehabilitate, repair and prevent pollution after closure and a subsequent financial requirement to provide for these perceived costs. Regarding waste management, local authorities in South Africa have a clear legal mandate to manage waste services and waste disposal in an environmental friendly manner and in accordance with national and provincial directives. Closure is the final step in a waste landfill operation and prior to that, the site needs to be rehabilitated in an environmentally acceptable manner to limit or prevent future adverse effects. Section 28 of the National Environmental Management Act 107 reads 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” (NEMA, 1998:63). Municipalities or administrators of waste landfill sites should consider the National Environmental Management Act 107 of 1998 (NEMA), National Environmental Management Waste Act 59 of 2008 (NEMWA) section 20(b) and the Environmental Conservation Act 73 of 1989 (ECA) Section 20(1) and read with the

Minimum Requirements of 1998 Section 12, mostly enforced by the waste landfill permit requirements to rehabilitate the site during and after closure or end-use.

Waste legislation in South Africa is pertinent to the fact that the operator of the waste landfills needs to rehabilitate and repair these sites to prevent or limit further environmental impact after closure. Municipalities should consider and comply with the legislative requirements and guidance noted in Table 2. Recent landfill permits issued under Section 50 of the NEMWA (2008) as well as some still permitted under Section 20 of the ECA (1989) include a requirement to rehabilitate and close the landfill when it reaches the end of its life-span The onus for the restoration, repair, rehabilitation and closure of the site (as operator and legally obliged) is therefore the responsibility of the municipality.

Before the financial requirements and current basis or criteria for calculations were determined, it was important to firstly consider the most pertinent general and financial legislation and guidelines applicable to waste management and calculations of costing provision for waste landfill rehabilitation, repair and closure in South Africa. The MFMA, 2003 and the National Treasury Specimen Municipal Annual Financial Statements requires from municipalities to disclose information (based on recognized accounting practice and standards) on the provision of costs associated with the rehabilitation and closure of the landfill sites under their control. Municipalities are legally obliged to address any environmental degradation from their waste landfills and restore or repair the environment back to its original state upon their reaching the end of their lifespan and need for closure. This is exactly the aim of the provision requirement and disclosure (AFS), to fulfil their responsibilities and provide for the necessary funding for current and future costs relating.

Tables 2 and 3 of this research refer to the most pertinent legal framework, policies, standards, notices, requirements and guidelines applicable to waste landfill rehabilitation and closure in South Africa, as summarized from the various waste landfill rehabilitation and closure Quantum Calculation Models received from the External Service Providers for the North West Province local municipalities, Quantum Calculation Models (2014). North West provincial and local documentation that also needs consideration includes various relevant and applicable environmental management tools (such as IDP, LUMFs, SFDs, EMFs, SEAs, EIAs) and IWMPs.

Table 2: South Africa: Most pertinent legislation for waste landfill rehabilitation and closure (not inclusive)

Legislation	Specific section / reference	Detail
Constitution (1996)	Chapter 2 and Section 24, Section 152(1)(b) and (d)	***Bill of rights:*** Environmental rights that include an environment not harmful to health and well-being and protection of the environment. *Overall objects of local government*
NEMA (1998) & NEMAA Amendment Act (2008)	Chapter 5 (24P) Chapter 7, Part 1 (28). Section 2 (substitution of Section 24 of Act 107 of 1998	Financial provision for remediation of environmental damage. Refer to duty of care and remediation of environmental damage. To further regulate environmental authorisations
NEMWA (2008)	Chapter 4, Section 20(b), Chapter 5, section 45 & 50. National Norms & Standards for Disposal of Waste to Landfill (2013) – GNR 636	Requirement of a waste management licence for listed waste management activities. Application and issuing of waste management licences (and requirements) Lesser impact on capping and rehabilitation of landfill – Minimum requirements still applicable.
ECA (1989)	Section 20(1)	The requirement for waste landfill sites to be permitted and waste managed.
NWA (1998)	Section 19	Pollution prevention and remedying effects of pollution.
WSA (1997)	Chapter II	Includes Regulations on Compulsory National Standards and Measures to conserve water
NEM:AQA (2004)	Chapter 2 (Part 2), Chapter 4 (Part 2 – 5), Chapters 5 and 6	Includes provincial and local ambient air quality and emission standards and requirements.
NHRA (1999)	Chapter I - III	Principles, powers and functions, protection and general provisions for heritage resources – includes roles of local authorities.
NRTA (1996)	Chapter VIII	Waste Transportation Requirements
LG: MSA a (2000)	Chapters 3 and 8	Municipal powers and functions that include waste management as well as municipal services.
LG: MSA b (1998)	Chapter 5	Provide for establishment of municipalities (Chapter 5 in particular about functions and powers)
MFMA (2003)	Chapters 122 (1) and (3), 125 (2) (c)	States the obligation for each municipality or municipal entity to prepare annual financial statements (yearly) in accordance with GRAP. Requires that Notes to the AFS should include particulars of any contingent liability of the municipality or municipal entity at year end.
PFMA (1999)	Chapter 91 (1)(b)	Particular to standards set by Accounting Standards Board in terms of their functions (GRAP)
MPRDA (2002)	Regulation 54 (1)	Guideline for evaluation of quantum closure related to financial provision of a mine

GLOSSARY OF ABBREVIATIONS AND ACRONYMS (ix) *Acts see South Africa*

Table 3: South Africa: Other requirements for waste landfill rehabilitation and closure (not inclusive)

National Policy, Standards, Requirements & Guidelines	Detail
NWMS (2012)	National Strategy towards Waste Management in South Africa (8 Goals) and (10 Challenges)
GN 636 (2013)	National Norms and Standards for Disposal of Waste to Landfill
GN 635 (2013)	National Norms and Standards for Assessment of Waste for Landfill Disposal
GN 926 (2013)	National Norms and Standards for the Storage of Waste
GN 1210 (2009)	National Ambient Air Quality Standards in terms of NEM:AQA (Section 9(1)(a) and (b)
GN 634 (2013)	Waste Classification and Waste Management Regulations
GN 921 (2013)	List of waste management activities that have, or are likely to have ,a detrimental effect on the environment
GN 625 (2012)	Waste Information Regulations
SABS 10228	Code of Practice in the Identification and Classification of Dangerous Substances and Goods
SABS 10229	Code of Practice for Packaging of Dangerous Goods for Rail Transportation in SA
SANS 1200	Standards Specifications for Civil Engineering Construction
SANS 1526	Thermoplastic sheeting use as geomembrane
SANS 10234	Globally Harmonised System of Classification and Labelling of Chemicals
SANS 10409	Design, selection, and installation of geomembrane
Minimum Requirements for Waste Disposal by Landfill (1998)	**Section 12** is particular to rehabilitation, closure and end-use of landfills (but the entire process from site selection to after-closure monitoring needs to be considered)
Minimum Requirements for Water Monitoring at Waste Management Facilities (1998)	**Section 2**: Includes a Policy and Strategy for Groundwater Quality Management in SA.
Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (1998)	**Section 2.7**: Disposal of a Hazardous Waste (See Policies, Standards, Requirements and Guidelines – Bibliography)

GLOSSARY OF ABBREVIATIONS AND ACRONYMS (ix)

The literature review clearly indicates that legislation in South Africa is not specific as to how to determine waste landfill rehabilitation and closure provisions per se, but rather on waste management requirements and remedying the impacts or effects thereof. The NEMWA (2008:22-30) provides for the necessary planning and management as well as national, provincial and waste service standards - more particularly on the municipality's waste management roles and responsibilities, whilst the NWMS informs waste management in South Africa. Goal 6 of the NWMS describes the need to ensure sound budgeting and financial services for waste services, whilst Goal 7 sets out regulatory measures for managing contaminated land (DEA, 2011:7). Waste norms and standards regulate and direct waste management within the waste hierarchy. Waste landfill licensing includes conditions that landfills must adhere to in conserving or protecting the environment. The Minimum Requirements, section 12 (DWAF, 1998:1-8), although pertinent on rehabilitation, closure and end-use, is not legally binding if not included in the waste landfill permit conditions. Chapter 2.4 of this research provides more detail on the financial legislative requirements as well as the accounting and auditing standards applicable to waste landfill rehabilitation and closure provisions. Chapter 4 elaborates on the use of these guidelines by consultants or determiners as bases or criteria to calculate the provision for rehabilitation and closure to be disclosed in the AFS.

2.4 Accounting and reporting standards for rehabilitation and closure provisions

As an introduction, it is important to consider the evolution of accounting and reporting standards applicable to South Africa and particular to providing for the rehabilitation and closure costs of waste landfill sites. The IASB was established in 2001 and now part of the IFRS Foundation and their main responsibilities include developing and approving quality international financial reporting and accounting standards and related documents. In 2010, the IASB issued the Conceptual Framework for Financial Reporting with various amendments since adoption in 2001 to 2010 (IFRS, 2012:A7–A8). This guidance document includes detail of IAS 37 on Provisions, Contingent Liabilities and Contingent Assets (IFRS, 2012:A1089–A1113). From the standard it was clearly established and stated that provisions should only

be recognised where there is a liability (present obligation from past event) and in this respect applicable to municipal waste landfill sites.

According to IAS 37 (and confirmed by IFRIC 1), “the amount to be recognised as a provision to be the best estimate of the expenditure required to settle the obligation at the balance sheet date (present value)” and further stating that the measurement should be at a “current market-based discount rate” (Deloitte, *n.d.*).

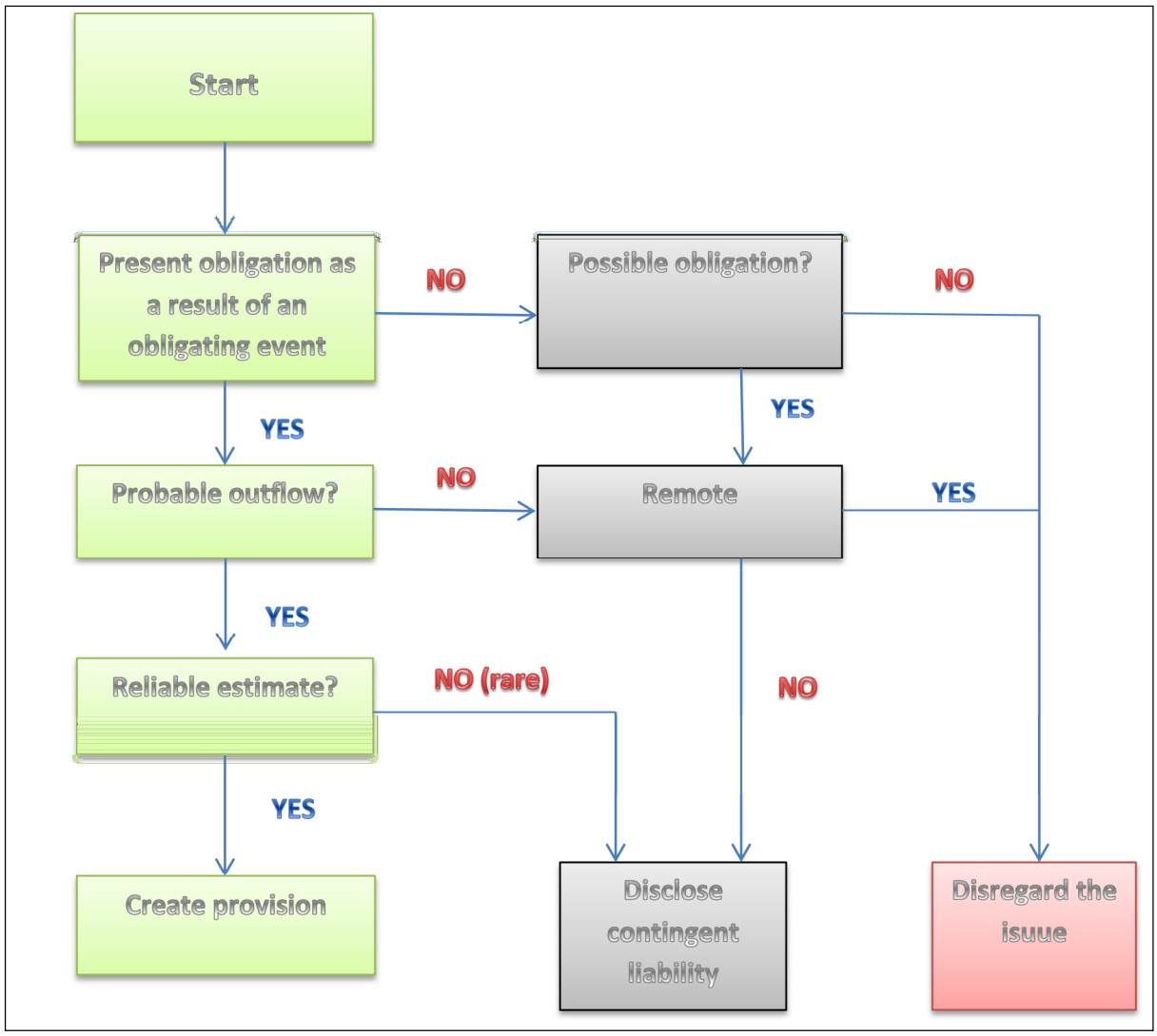


Figure 2: The main recognition requirement of IAS37–Decision Tree (ASB, 1998:46)

Figure 2 describes the decision tree and main recognition requirements of IAS 37 from recognising the obligation to the actual provision and disclosure thereof.

In South Africa, public entities are compelled by legislation and the accounting standards to provide detailed, accurate and reliable information on its performance- and financial reporting information (AFS with substantive notes and records thereto). At the various governance levels the accounting requirements for considering and determining closure costs of waste landfill sites evolved from the MFMA (2003:856-863) where Sections 122(1) and (3) require of local authorities to prepare their annual financial statements in accordance with Generally Recognised Accounting Practice (GRAP), prescribed by Section 89 of the Public Finance Management Act 1 of 1999 (PFMA 1999:81-82). Relevant to the waste landfill site rehabilitation and repair, it should include detail of any contingent liabilities of the municipality at year-end with specific reference to section 125(2) (c) (MFMA, 2003:136). In section 91 (1) (b) of the PFMA (1999:81-82), the standards set by the ASB are prescribed and include the GRAP Standard 19, Provisions, Contingent Liabilities and Contingent Assets as well as GRAP Standard 17, Property, Plant and Equipment to be considered for the waste landfill rehabilitation and closure provision (ASB, 2010a; 2010b). Interpretations of IGRAP 2 (2010) referred to the ASB as a requirement from the PFMA to "determine generally recognized accounting practice" (GRAP) (ASB, 2009: 4).

As the focus of this research was more directed at local governance level, it was also deemed necessary to consider Chapter 8 (MFMA, 2003) where Section 62 describes general financial management requirements and functions within municipalities, whilst Section 74 refers to the general reporting obligations thereof. In accordance with Section 62(1)(c)(i) of MFMA (2003), "the accounting officer of a municipality is responsible for managing the financial administration of the municipality, and must for this purpose take all reasonable steps to ensure that the municipality has and maintains effective, efficient and transparent system of financial risk management and internal control". Interpretations of IGRAP 2 (2010) referred to the ASB as a requirement from the PFMA to "determine generally recognized accounting practice" (ASB, 2009:4).

Local municipalities in the North West Province of South Africa experienced some difficulties in determining their provision costs for waste landfill rehabilitation and closure. Most landfills have an extensive time-frame and the financial challenges

experienced at most municipalities often lead to ignorance or disregard of the needed costs to rehabilitate and repair. The lack of a proper framework and guidance linked with complicated engineering and technical requirements are a further deterrent in attempts to plan and provide for these costs.

According to the High Level Summaries of the GRAP Standards (National Treasury, 2011: 1) the provision determination process is guided by accounting standards to be used for preparation of financial statements, thereby ensuring that it is usable and understandable to all users of the financial statements as well as overseeing bodies such as the AGSA. These accounting standards guide accountants or preparers of financial statements as to proper measurement, recognition and presentation of their performance- and financial information, but the entity is still ultimately responsible to ascertain that the information is reliable, relevant, comparable and properly understood. Where accounting standards are implemented or followed, it increases confidence in the entity in managing their resources effectively and efficiently and in conformance to financial legislative requirements. GRAP 19 (IAS 37) specifically refers to provisions, contingent liabilities and contingent assets and converge the globally and nationally accepted International Financial Reporting Standards (IFRS), (National Treasury, 2008:88-93). The objective of this GRAP 19 Standard stipulates the circumstances under which a provision should be recognised, the measurement thereof and how it should be disclosed. The Standard goes further by detailing the information disclosure requirements on contingent liabilities and contingent assets to be included within the notes to the AFS, for stakeholders or users to comprehend or understand the nature, timing and amounts reflected (ASB, 2010b). Although GRAP 19 is specific in the requirement of a financial provision with the rehabilitation and final closure of the waste landfill sites is it not always easy to determine as the liability continuously grows, aggravated by the lack of a uniformed framework or guidance to calculate the financial provision costs. GRAP 19 paragraph 17 defines the terms used in this standard (ASB, 201b). It was further summarised to include the most pertinent definitions applicable to the waste landfill provision determination at local authority level (included in the Glossary of Terms)

The main findings of waste landfill rehabilitation and closure provisions at local municipal level (North West Province) refer to specific GRAP 19 paragraphs not

adhered to. Examples in this regard include (but are not limited to), GRAP 19.20, specifically to the provision for the rehabilitation and closure of waste landfill sites, whilst GRAP 19.21 requires the formulating of a provision where there is an obligating event. Furthermore, in terms of GRAP 19.49, the amount recognised as a provision shall be the best estimate of the expenditure required to settle the present obligation at the reporting date. Estimates are widely used in provisions, which by their nature are more uncertain than many other items in the statement of financial position. If a reliable estimate of the amount of the obligation cannot be made, a contingent liability should be disclosed. As already emphasized, there is, however, currently no specified legislative framework or guideline to the municipal waste landfill rehabilitation and closure provision determination. This lack of guidance or uniform methodology is a constraint for municipalities to determine the scope and financial provisions for their waste landfill sites from a current to end-of-life perspective. It is important for local municipalities to ascertain that their accounting policies consider and include the latest accounting standards and disclosure with particular reference to GRAP 19, IAS 37 and GRAP 3. The ASB (2010c) referred to some revisions (improvements) to the standards of GRAP 19 (latest revised version issued on 1 April 2015).

GRAP 17 is again important in describing the “accounting treatment for property, plant and equipment so that the users of financial statements can comprehend information about an entity’s investment in its property, plant and equipment and the changes in such investment” (ASB, 2010a:7). With waste landfill site rehabilitation, closure and where applicable dismantling of infrastructure, this standard needs to be considered and reflected in the AFS. Paragraph 80 – 86 of GRAP 17 is of particular importance for disclosure (AFS) considerations (ASB, 2010a:21-24).

To conclude, it should be noted that IFRS applies to all general purpose financial statements and includes recognition, measurement, presentation and disclosure requirements that deal with transactions and events considered important for general purpose financial statements. It is based on the Conceptual Framework of the IFRS that addresses the concepts underlying the information presented in general purpose financial statements.

2.5 Available and comparative mining closure guidelines in South Africa

South Africa relies heavily on the mining sector for wealth generation and contributing to economic and infrastructural development as well as employment. Mining, however, has a substantial impact on the environment and historical irresponsible mining companies, methods and means had left vast areas un-rehabilitated or degraded upon closure. Table 4 refers to specific mining rehabilitation focus areas and Best Practice Guidelines. This prompted government to develop a South African legislative framework for mine closure. The Mineral Petroleum Resources Development Act (MPRDA, 2002) includes an overall cradle-to-grave approach with an obligation to protect the environment, ensure ecologically sustainable development and promote economic and social development. Section 41 of Act MPRDA (2002:46) is specific on financial provision for the rehabilitation and remediation of environmental impact or damage. Regulations in this regard prescribe the methods to be used for financial provision as well as detailed itemization of the applicable costs and subsequently the quantum for financial provisions. Very important recent amended regulations were issued in 2014 (Government Gazette No 38145 of 31 October 2014) “pertaining to financial provision for the rehabilitation, closure and post closure of prospecting, exploration, mining or production Operations under section 44(aG), (aH) read with sections 24(5) (b) (ix), 24P and 24R of the National Environmental Management Act, 1998” (NEMA, 1998). These Regulations are applicable to licence holders under the MPRDA (2002) with the aim and purpose of regulating and guiding the methods and means for estimating and budgeting for the costs associated with rehabilitation, closure and post closure as well as managing negative environmental impacts through the mining life production processes. The licence holder is obliged to make these financial provisions for closure and any remediation required for current and future purposes. Costs need to be re-assessed annually (provision disclosure) and the regulations also require an annual rehabilitation plan for this purpose. The impact of the new amended regulations to the waste landfill rehabilitation and closure provision determination is of particular importance where the Consultants (or External Service Providers) use the mining closure guidelines in the Quantum Calculation Models or methods.

Furthermore, these regulations pertaining to the methods for determining and making financial provisions in the mining sector are exactly what are also needed for waste landfill rehabilitation and closure provision determinations.

Table 4: Mining Land Rehabilitation Practice (Van Wyk, 2014)

MINING REHABILITATION FOCUS AREAS	(includes conservation for Agriculture & Forestry)
BEST PRACTICE - GUIDELINES	
MINING	**CONSERVATION**
Ecosystem service	Geology
Reclamation	Substrates
Land use	Soils
Monitoring	Vegetation
Planning and design/Modelling	Water
Tailings/Landfills	Waste products
Research/Training	Hazardous waste
Legislation/Policy	Green economics
Engineering	**CLOSURE QUANTUM MODELS**

The mining regulations give proper guidance to the determination, scope and method for determining the financial provisions, thereby ensuring a more standardised approach. These guidelines also emanated from the need for or availability of funds to manage the impacts of mining and the adequacy of financial provisions made by mining companies for rehabilitation and repair. Without proper provision and without proper standardised guidelines, it will be difficult to comply with the myriad of pieces of environment-related legislation and ascertain that there are sufficient funds for the required rehabilitation, repair or restoration.

For the purposes of this research, reference to the regulations and financial provisions within the mining sector of South Africa is specific to emphasize the lack or need for a standardised methodology or guideline for determining the scope and quantity for waste landfill rehabilitation and closure provisions. With no standardised framework or guideline, the determiners for the waste landfill rehabilitation and closure provisions may use own methods, criteria and means to determine these costs. The absence of proper regulations or guidelines also complicates the auditing or revision of the provision amounts, which may be over- or under-stated in the AFS of local municipalities.

2.6 International Best Practice for landfill rehabilitation and closure provisions

The next step in the literature review was to consider international best practice or guidance on determining the provision or financial assurance for waste landfill rehabilitation, repair and closure. These reviews were merely performed to establish whether the more developed countries do have waste landfill management guidelines and subsequent guidance in determining financial provisions or assurance for rehabilitation, closure and repair. Observations made by Johannessen and Boyer (1999:1) on *Solid Waste Landfills in Developing Countries* that included Africa, specified the need for regulations and guidelines governing solid waste landfills as well as guidance and criteria in landfill rehabilitation, repair and closure provision or financial assurance determination. There has been some significant progress since, but from a developing world perspective, the emphasis was more on guidance towards overall landfill management, and not the reality of preparing or determining the applicable provision or financial assurances per se. An article on the Waste 360 business site stipulated the process and proposed criteria for determining waste landfill financial assurance costs, but again stopped short of the actual quantum calculations thereof (Sebesta, 1998).

The literature reviewed clearly indicated much more substantial guidance for mining waste management, rehabilitation, closure and financial provision thereof, with an example included in Figure 3.

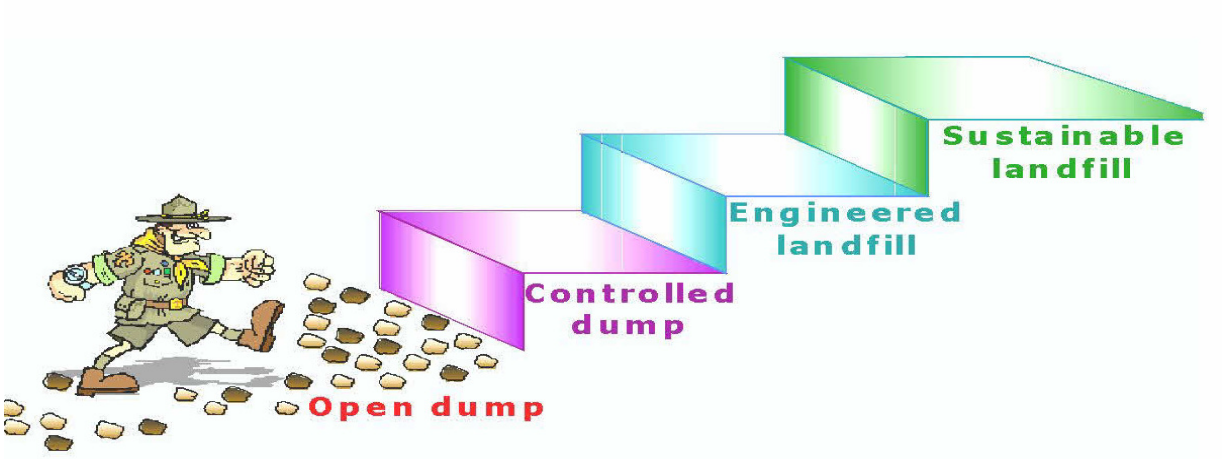


Figure 3: An example of mining waste landfill rehabilitation guidance (ELAW, *n.d.*)

For the purposes of this research, the target countries in Table 5 (a & b) were chosen with a brief review of their specific, legislative- and financial guidance in determining or calculating their financial assurance or provision costs for the rehabilitation, repair and closure of solid waste landfill sites. These countries provide specific guidance for waste landfill rehabilitation and closure and the financial provision determination thereof.

Table 5 (a): Guidance for waste landfill assurance in selected countries (reference per country)

Question	Country	Country	Country	Country
	AUSTRALIA	**USA**	**NEW ZEALAND**	**UK: ENGLAND (with reference to Wales & Scotland & Ireland)**
Intention: Financial provision / Assurances	*Financial assurances are intended to provide a guarantee that operators or occupiers of landfills will be ultimately responsible for the cost of remediation for site closure and post-closure liabilities.*	*Pollution costs should be borne by their creators. Financial assurance rules (financial responsibility or bonding requirements) require that potential polluters have adequate financial resources to correct and compensate for environmental damage that may arise in the future*	*Financial assurances are intended to secure or guarantee funding for works required under a licence and to satisfy that the site is stable and not polluting. This assurance will cover future liabilities, disputes or work required.*	*Financial provision is required to discharge the obligations of your permit as long as the landfill poses a hazard and should be sufficient, secure and available when required).*
Is there a guideline for (minimum requirements) for waste disposal by landfill? *Legislation relevant to these Minimum Requirements*	**Yes** **EPA:** Victoria: Best Practice Environmental Management, publication Siting, design, operation and rehabilitation of landfills Publication 788.2* October 2014, **(EPA 2015)** **Department of Environment and Heritage Protection:** Queensland Government: Guideline – Landfill siting, design, operation and rehabilitation (version 2), 2013. **(DEHP 2013b)** ***Landfill Guidelines*** *(to comply with Environmental Protection Act, 1994). The Landfill Environmental Management Plan should include a well-documented assessment of the potential cost for close-down, continue post-closure care, complete the required remediation*	**Yes** Solid Waste Landfills are regulated under Subtitle D of the Resource Conservation and Recovery Act**. The EPA** Federal Regulations: Chapter 40 of the Code of Federal Regulations, Part 258 – describes criteria **(EPA 2012)** **EPA:** Criteria for Solid Waste Disposal Facilities: A Guide for Owners/Operators March 1993 **(EPA 1993)** **Department of Environmental Quality:** Division 94: Solid Waste Municipal Solid Waste Landfills: Oregon Administrative Rules, Chapter 340 Divisions 93 – 97 **(DEQ 2015a)**	**Yes** **Ministry of the Environment** (May 2001): A Guide for the Management of Closing and Closed Landfills in New Zealand **(ME 2001)** ***Resource Management Act:*** *Requires upgrading of waste landfills* **Centre for Advanced Engineering** (April 2000): Landfill Guidelines :ISNB 0-908993-23-4 **(CAE 2000)** ***State of the Nation Report*** *(December 2012): Landfilling Practices and Regulations in New Zealand* ***(ISWA 2012)***	**Yes** **EA:** Guidance for the Landfill Sector: Technical Requirements of the Landfill Directive and Integrated Pollution Prevention and Control (S5.02) – April 2007. **(EA 2007)** **EA:** How to comply with your environmental permit: Additional guidance for: Landfill (EPR 5.02) …. Updated to reflect legislative changes March 2009 **(EA 2009)**

Table 5 (b): Guidance for waste landfill assurance in selected countries (reference per country)

Question	AUSTRALIA	USA	NEW ZEALAND	UK: ENGLAND (with reference to Wales, Scotland & Ireland
Is there a guideline for the determination of a financial provision or financial assurance for landfills?	**Yes** **EPA:** Victoria (Publication 777, September 2001). Determination of Financial Assurance for Landfills **(EPA 2001)** **Department of Environment and Heritage Protection:** Guideline: Financial assurance under the Environmental Protection Act 1994 **(DEHP 2013b)** Sections 364 & 367 of the **Environmental Protection Act** – permit the department to require a financial assurance. Sections 19 A (2A) and 21 of the **Environment Protection Act** 1970 – enable a financial assurance to be required **(EPA 2012)** **Accounting Standard: IAS 37 & AASB 137:** Provisions, Contingent Liabilities and Contingent Assets. **(BDO International 2015; DFD 2012)**	**Yes** **EPA:** Federal Regulations: Chapter 40 of the Code of Federal Regulations, Part 258 – Sub-part G describes financial assurance criteria and rules **(EPA 2012)** **Department of Environmental Quality:** Guidance on Closure/Post-closure Cost Estimates and Financial Assurance Regulatory reference: OAC 252:515, Sub-chapter 27 **(DEQ 2015b)** **Resource Conservation and Recovery Act:** Requires Financial Assurance for Environmental Obligations including solid waste landfills and hazardous waste treatment, storage, and disposal facilities **(U.S.EPA 2001)** **Accounting Standard: IAS 37 & GAAP AS 29:** Provisions, Contingent Liabilities and Contingent Assets **(BDO International 2015; AS 29 *n.d.*)**	**Yes** **New Zealand Ministry of Environment:** 1996 – Introduced a first landfill costing guideline, followed by the Landfill Full Cost Accounting Model (April, 2002) – that includes operations, closure / post closure costs and contingency costs (separately on capital and operations. **(Kortegast & Purchas, *n.d.*)** **Part 9.4 of the Protection of the Environment Operations Act, 1997** allows **EPA** to require licences to provide and maintain a financial assurance to secure or guarantee funding for works or programs. Part 9.4 is particular to Financial Assurance (Section 296 of **the Act** is to provide financial assurances to secure or guarantee funding for works or programmes section 298 – requiring financial assurances / 300 – amount of financial assurances / 301 – guidelines on financial assurances. **(PEOA 1997)** **Accounting Standard: IAS 37 & FRS-15:** Provisions, Contingent Liabilities and Contingent Assets **(BDO International 2015; ICA 2000)**	**Yes** **EA:** Guidance on Financial Provision for Landfill (EPR 5.02.2) to manage the financial provision requirements of the Landfill Directive and intended for use by applicants for landfill permits under the Environmental Permitting (England and Wales) Regulations 2010 **(EA 2011)** **Scotland Specific: SEPA:** A Consultation on changes to requirements for applicants to demonstrate financial provision for waste management activities 4 December 2015 **(SEPA 2015)** **And** **SEPA:** Technical Guidance Note: Estimate of Amount of Financial Provision for Landfill Feb 2005 **(SEPA 2005)** **Ireland Specific: EPA:** Guidance on Environmental Liability Risk Assessment, Residuals Management Plans and Financial Provisions **(EPA 2006)** **Accounting Standard: IAS 37 & FRS-12:** Provisions, Contingent Liabilities and Contingent Assets **(BDO International 2015; ASB 1998)**

Another example is the Dumpsite Rehabilitation Manual that focused on sustainable solid waste landfill management in Asia, with Chapter 4 referring particularly to dumpsite (landfill) closure and rehabilitation with a brief reference to cost of closure and rehabilitation of waste dumpsites, whilst the cost of landfill mining and determination thereof detailed in Chapter 5 (ELAW, *n.d.*:35-40; 105-110).

The reviews clearly indicated that most countries have general waste landfill guidelines, but not all include clear, pertinent criteria or guidance for calculating or determining the financial assurance or provisions for waste landfill rehabilitation, repair and closure (to be reflected in the AFS).

2.7 Conclusion

The literature review revealed that in most developed and developing countries the management of solid waste landfill sites is legislated with guidance on the pre-operations, landfill operations and rehabilitation, repair, closure and post-closure activities. The aim of the guidelines is to assist or guide developers, operators, and regulating authorities to comply with the relative legislation and/or related requirements. Effective waste management is considered essential to conserve resources and also in the quest towards sustainable waste management. In South Africa, however, the legislation available and reviewed is more specific on waste management requirements to address or remedy the impacts of waste disposal on landfills and not so much on how to or what basis to use for the valuation of the rehabilitation and closure costs.

Local municipalities are stressed in terms of their financial resources and obligations to supply sustainable basic needs and services in an effective and sustainable manner and therefore need proper financial planning and budgeting to continue as a going concern. International and general accounting or financial standards and practices assist in the process of uniform and effective financial management against which these entities are monitored and audited. Waste landfill management and in particular the rehabilitation, closure, repair and post-closure thereof can further stretch financial budgets, therefore the need to ascertain provisions or financial assurances to cover these costs. South African legislation as well as Accounting and

Auditing Standards are clear and to a great extent followed on the needs and how to determine and include the financial provisions of waste landfill rehabilitation and closure in the AFS.

The literature review to a great extent addresses the “why” of different bases or criteria used in South Africa and the need for the waste landfill rehabilitation and closure provision determination. In South Africa in particular there is no framework or guidelines to follow when determining the financial provision determinations for municipal solid waste landfill sites, in contrast with the South African mining sector and international perspective (developed or first-world countries) where there are scopes and methods in this respect.

This lack of a framework and guidelines is not only creating difficulties for the municipalities or determiners of the waste landfill rehabilitation and closure financial provisions, but also for the monitoring and auditing thereof as it is difficult to determine the validity or possible over- and understatements of the provision amounts disclosed in the AFS.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

This chapter introduces the research methodology and scope (3.1), followed by a brief reflection on the selected research methods and means (3.2). The methodology selected is particularly aimed at addressing the research questions introduced in Chapter 1.4. An analysis was done of the selected documentation and information to determine the overall guiding basis used in the calculation of waste landfill closure costs of local municipalities in the North West Province of South Africa. This section is summarised with a conclusion on the methodology selected (3.3) as well as limitations and challenges in the application thereof (3.4).

The reason for the specific methodology selected was essential in determining whether the eventual Quantum Calculation Models considered or included all the available guidelines, requirements, landfill status quo and needs for landfill rehabilitation and closure determination. The scope of the research (Chapter 1.6 refers) included all nineteen local municipalities within the four districts of the North West Province of South Africa as reflected in Figures 4 and 5.

Figure 4: North West Province Districts (local government, a.)

Figure 5: North West Province: Nineteen Local Municipalities in four districts local government, b)

Further elaboration on the scope of area and focus included the following information. The Dr Ruth Segomotsi Mompati District is located in the western region of the Province and is the largest of the municipal districts, consisting of the five local municipalities of Naledi, Mamusa, Greater Taung, Lekwa-Teemane and Kagisano-Molopo. Ngaka Modiri Molema District Municipality is the second largest of the four districts and lies in the north–central part of the Province that includes the local municipalities of Mahikeng, Ditsobotla, Tswaing, Ratlou and Ramotshere Moila. Dr Kenneth Kaunda District Municipality is the smallest of the four districts, located south-west of Johannesburg and consisting of the Tlokwe, Matlotsana, Maquassi Hills and Ventersdorp local municipalities. Located in the north-east corner of the province, the Bojanala Platinum District includes the local municipalities of Rustenburg, Madibeng, Moses Kotane, Kgetlengrivier and Moretele.

3.2 Selected research methods and means

The research methods and means developed from the initial literature review (Chapter 2) included both local and international reviews of the legislative requirements, financial requirements, accounting and reporting standards, guidelines for waste landfill management and particularly to the rehabilitation, repair, closure and after-care assurances or provisions required by local municipalities on their solid waste landfills.

It was imperative to initially determine what waste landfilling entails as well as the requirements for rehabilitation, repair and closure thereof. The following step was to consider the legislative, financial and accounting requirements regarding the provisions or financial assurances thereto, including the relevant accounting standards. In South Africa, where there is a known lack of proper framework or guidance to determine the waste landfill rehabilitation, repair and closure provision, comparison to the guidelines available and used in the mining sector was significant in emphasising the discrepancy or need thereof. To obtain a broad overview and understanding of best practices for determining waste landfill rehabilitation, repair and closure financial provisions, local literature was briefly compared with international literature to emphasize the benefits of a uniform framework or guidance.

This Chapter contains the following sections, with just a brief reference to the specific methods and means used in the research methodology:

Section 3.2.1	*Data acquisition, analysis and comparison*
Section 3.2.2	*Site visits, with the information and criteria to be used for implementation and analysis*
Section 3.2.3	*Interviews and questionnaires, determining the basis or criteria used for the landfill rehabilitation and closure provision calculations*
Section 3.3	*Conclusion*
Section 3.4	*Limitations of the methodology and means used in the research*

Details on the methods implemented, analysed, compared and results thereof follow in Chapter 4.

3.2.1 Data acquisition, analysis and comparison

To elaborate on the findings and results of the literature review (Chapter 2 refers) information, data and records were obtained from the local municipalities, consultants or determiners of the of the waste landfill rehabilitation, repair and closure provisions as well as North West Province waste landfill specific information from various media (such as the internet, municipal audits and general reports). The consultants or determiners of the waste landfill rehabilitation; repair and closure provisions were willing to share their quantum models or calculations and that provided significant inputs of the bases or criteria used for these determinations.

The data obtained, analysed and compared included the 2013/14 (01 July 2013 – 30 June 2014) and 2014/15 (01 July 2014 – 30 June 2015) financial periods of the selected local municipalities of the North West Province of South Africa. Valuable data and information towards this research, specific to the waste landfill status quo and needs for rehabilitation; repair and closure included the Integrated Waste Management Plans (IWMP) and waste landfill licences (and licence conditions). The focus in the above-mentioned periods was on the Quantum Calculations to determine the waste landfill rehabilitation, repair and closure provisions as reflected in the AFS for 2013/14 particular. To reiterate the findings in the literature reviews performed, the lack of a framework or standards for determination of closure costs meant that the local municipalities and determiners of these costs could decide what bases or criteria to use or what they wanted to exclude or include. Therefore, it was also important to obtain and compare the bases or criteria used by the various municipalities and determiners of their waste landfill provisions.

3.2.2 Site visits

The importance and contribution of the site visits to the local municipalities and relevant waste landfill sites were to get a proper understanding of the site conditions and a perspective on the financial needs to properly rehabilitate, repair and the ultimate closure thereof (current and long-term perspectives). Information from the site visits was then supported by the data acquired from the municipalities and literature reviews.

3.2.3 Interviews and questionnaires

It was decided to obtain information from the consultants or determiners of the waste landfill rehabilitation, closure and repair provisions (disclosed in the AFS) for the 2013/14 financial period through interviews and questionnaires. This information was then also considered and compared against their Quantum Calculations (for the period ending 30 June 2014) obtained during the data acquisition process.

The interviews and questionnaires focussed on determining or establishing the:

- Bases or main criteria used in the determination and calculation of the rehabilitation and closure of waste landfill sites at relevant local municipalities in the North West Province; and
- The process used for the determination and calculation of waste landfill and closure costs.

The focus relates to the research aim and question stated and covered in Chapter 1.4 and 1.5. The value thereof is implied in the confirmation and substantiation of the lack of guidance or collective approach in the waste landfill provision determinations.

3.3 Conclusion

Chapter 3 briefly introduced the research methodology followed and reasons why the approach was adopted. For proper comprehension or analysis of how the waste landfill rehabilitation, repair and closure provisions were determined it was important to consider all the detail and data of the particular waste landfill sites, get an aesthetic view or perspective on the current condition and needs through site visits and ultimately consider the basis or criteria used by consultants or determiners to calculate or determine these provisions (disclosed in the AFS). The methodology used was -selected and followed on a detailed literature review of the research topic and questions. Limitations or challenges experienced with this particular research methodology selected and used are briefly summarised in the next paragraph.

3.4 Limitations of and challenges to the methodology used in the research

The limitations and challenges relating to the methods and means used for this research can basically be divided into limitations and challenges to confirm or review current waste landfill rehabilitation and closure provisions reflected in the AFS of local municipalities and secondly, the lack of a general framework or standardized guidance for the rehabilitation and closure provision calculations.

The IWMPs at one District and some smaller local municipalities could not be obtained, whilst most IWMPs were outdated or excluded the latest waste landfill operations and needs. Although licensing status could be confirmed, the actual licences and licence conditions could not be obtained for all sites (closed and in operation). In the absence of a proper guidance framework to determine the landfill rehabilitation and closure provisions (and lack of detail in some Quantum Calculation Models reviewed), it was not always clear what processes were followed and how valuation costs were determined. Some engineering and technical requirements or terms used that drive landfill closure costs were not always clearly stated or easy to comprehend.

Visits to the landfill sites posed challenges in terms of access and at some of the sites there was no or very limited information available on the site specifics and needs.

The Quantum Calculation Models used to substantiate the waste landfill rehabilitation and closure provisions in the AFS are not in public domain and although used and referred to could not be referenced (to protect the rights of the product and privacy of the External Service Providers). Some of the Consultants or External Service Providers were also reluctant to share their costing models and valuation means as these might be used or misused by their competitors. It contributed to some incomplete questionnaires being returned without the questions being properly answered. The residing locations of most consultants prompted telephonic interviews and discussions regarding their provision valuations, methods and means.

The limitations and lack of research, information and relevant case studies on waste landfill rehabilitation and closure provision determination in South Africa prompted

some assumptions in addressing the uncertainties or issues that could not be confirmed or clearly defined.

CHAPTER 4

DATA ANALYSIS, DISCUSSIONS AND RESULTS

4.1 Introduction

Chapter 4 included an analysis and discussion of the methodology implemented and subsequent results thereof. The information and data obtained were analysed and compared through the literature reviews, municipal information on the waste landfill sites and waste landfill rehabilitation and closure provisions (AFS), waste landfill site visits and interviews and questionnaires from the waste landfill provision determiners (also referred to as consultants or calculators). The first part of this chapter is more pertinent on how the research was done (4.2) followed by findings and results through physical checks, confirmations and substantiations (4.3 and 4.4).

This Chapter will be important in terms of addressing the research aim and question emanating therefrom:

Aim of the Research: To critically analyse the current quantum models and determine the overall guiding bases used in the calculation of the waste landfill closure costs (disclosed in the AFS) of local municipalities in the North West Province of South Africa.

Research question: What are the bases used (and why) for the determination of municipal waste landfill site closure costs in the North West Province of South Africa?

The data acquisition, analysis and comparisons were performed by using the latest IWMPs, Waste landfill site licences and subsequent licensing conditions, Minimum Requirements for Waste Disposal by Landfill, AFS (2013/14 and 2014/15) and Provision Quantum Calculations (and disclosed in the AFS) of all 19 local municipalities of the North West Province. Information obtained through the physical municipal landfill site visits further assisted in determining the rehabilitation, repair and closure needs to be provided for in the AFS. All this information was then

compared with the bases or criteria used in the Quantum Calculations or determination of the waste landfill rehabilitation and closure provisions amounts (disclosed in the AFS). The focus was pertinently on the guiding bases used in determining these financial provisions and not on the actual determination process, means or figures disclosed.

Proper conclusions followed from each selected methodology process implemented, whilst limitations to these methods and means already documented (3.4).

4.2 Data acquisition, analysis and comparison

Detail and background of the solid waste landfill sites were obtained from the IWMPs of each local (and/or district) municipality in the North West Province. The next step was to ascertain and obtain the waste landfill licences and licensing conditions that included all requirements from planning, operation to the end of the lifespan and after-closure. Where waste landfill sites were not licensed, the Minimum Requirements (1998) – Trilogy was used to compare current operations with best practice requirements. After accumulation of the waste landfill detail, status quo and needs for rehabilitation, repair and closure, the AFS of each local municipality were obtained (2013/14 and 2014/15 financial periods) to confirm the provision amounts disclosed. The final data acquired and used included the Provision Quantum Calculation Models submitted by the calculators or determiners for 30 June 2014.

After all the above-mentioned data had been acquired, it was analysed and compared with the specific aim to ascertain the overall guiding basis or criteria used by the various calculators or determiners of the waste landfill rehabilitation and closure amounts (as reflected in the AFS). This refers to the objective of the research in determining whether different bases or criteria are used for the determination of these financial provisions, particularly in the absence of a standardised framework or guideline.

Based on experience of landfill site audit visits and analysing the needs for rehabilitation and closure against the financial provision determination it was important to consider and comprehend the bases or criteria that could be used in these calculations and figures stated in the AFS. Figure 6 refers to a typical process

of landfill operations towards rehabilitation and closure perceived which was then compared to the data and records from the local municipalities and consultants (external specialists).

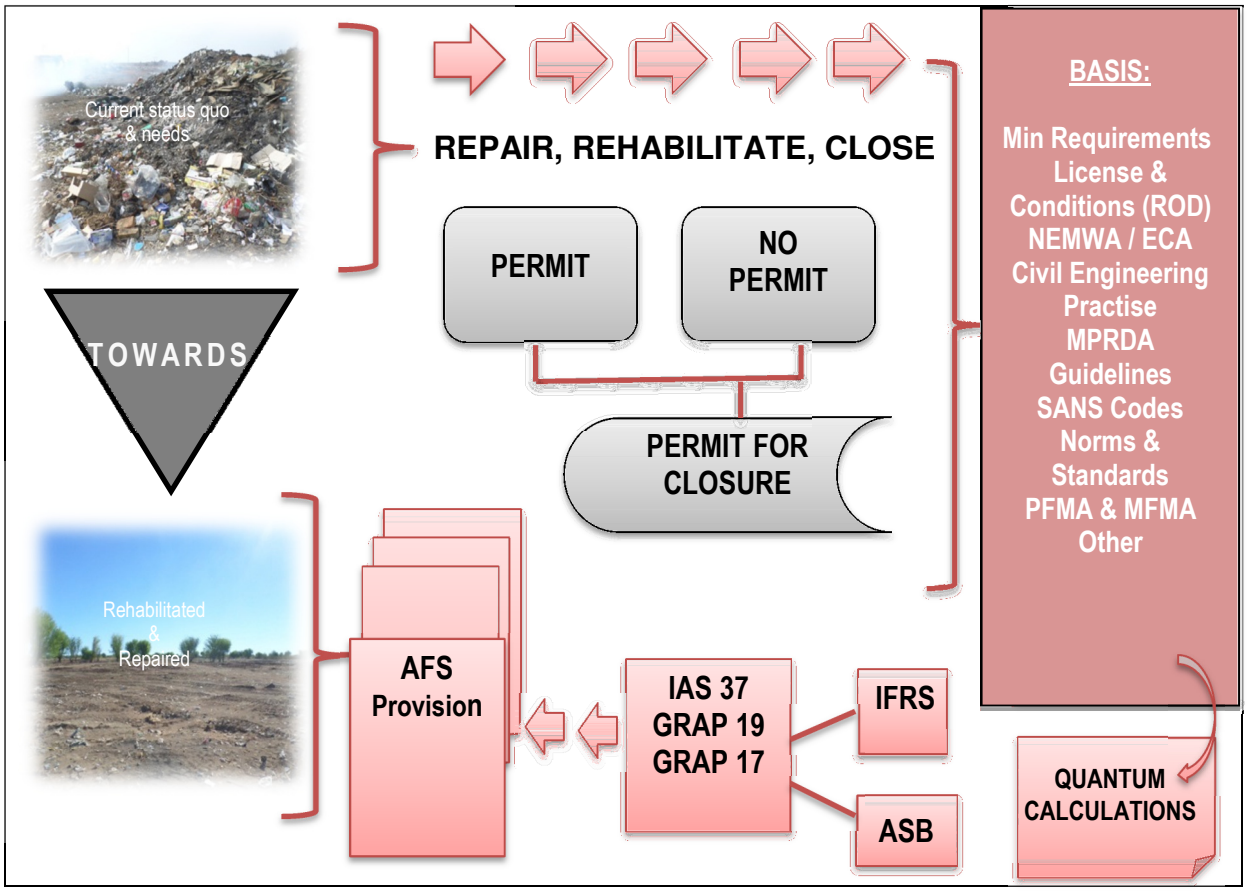


Figure 6: Typical considerations for waste landfill rehabilitation and closure costs

To accurately determine the financial provision for municipal solid waste landfill rehabilitation and closure, for current and future purposes, it was essential to know the site/s background and detail from initial operation (start) till current state and closure needs, consider legislation and guidelines in determining or calculating these costs against recognised accounting and auditing standards or practices.

4.2.1 Integrated Waste Management Plans

An Integrated Waste Management Plan (IWMP) is one of the instruments of local municipalities intended to affect and improve waste service delivery and use for waste landfill operational background. Each municipality is obliged to prepare an IWMP as required by section 11 of the NEMWA, whilst Section 12 is particular as to

the contents of the IWMP (NEMWA, 2008: 26-28). In South Africa, effective integrated waste management planning is important at local government level and with regard to waste landfill rehabilitation and closure provisions, should also include proper planning and implementation of the necessary financial arrangements. Without proper budgeting, financial planning and management, local municipalities might be required to fork out significant costs for that purpose within a particular financial period. Although the IWMPs include all aspects of waste management was the focus during the research particularly on the current status of the landfills and landfill management for subsequent provision determination. The following important waste landfill site details included and confirmed in the IWMPs of the North West Province local municipalities and used in the consideration for waste landfill rehabilitation, repair and closure provisions were the total sites (and identification); licensed or not (licence number); classification of the site; size of the site; waste volumes received; condition (current status quo) of the site; site facilities (infrastructure and dismantling); remaining lifespan of the site – not inclusive. Other considerations more particular to the operational activities and needs of water management and monitoring, sufficient drainage; enough cover material available, sufficient buffer zone as well as fencing and access control also need a mention considering the financial implications thereof. The North West Province PIWMP, District Municipalities' and some individual Local Municipalities' IWMPs used to accumulate and compare waste landfill details.

The landfill detail summaries and needs analysis (IWMPs) gave some perspective on the immediate operational discrepancies and extent of repair and rehabilitation required for closure and post-closure. Some of the most pertinent needs and recommendations included in the IWMPs that should be considered for provision determination include illegal disposal of waste, landfill sites to be licensed (for operation or closure), landfill sites to be upgraded (to include proper water control and monitoring measures), operations to be upgraded to include proper covering of waste, proper waste recording and records to be kept, detailed financial investigations to be performed.

Information and detail obtained from the IWMPs and Quantum Calculation Models for the municipal waste landfill sites at the local municipalities of the North West Province were summarised and included in Table 6 (a & b) of this research.

Table 6 (a): Waste landfill background information retrieved from IWMPs and Waste Landfill Licensing details (per municipality)

North West Province: Dr Kenneth Kaunda and Dr Ruth Segomotsi Mompati Districts											
Municipality	**Site**	**License**	**License (no)**	**Class**	**Size (ha)**	**Waste T p/d**	**Life remain**	**1**	**2**	**3**	**4**
TLOKWE	Felophepha	Yes	16/2/7C231/D13/Z2/P481	GMB-	24	344	20	yes	yes	yes	yes
	Old Potchefstroom	Yes	16/2/7C231/D13/Z1/P493	GSB-	16	**Closed**	**Closed**	na	yes	na	na
MAQUASSI HILLS	Wolmaransstad	Yes	B33/2/330/P166	GSB-	1.6	52	20	yes	no	yes	yes
	Makwassie	Yes	NWP/WM/DK3/2013/22	GCB-	0.5	14	To close	no	no	yes	yes
	Leeudoringstad	Yes	NWP/WM/DK3/2013/20	GCB-	1.5	15	To close	no	no	yes	no
	Witpoort	Yes	NWP/WM/DK3/2013/21	GCB-	1.5	2	To close	no	no	yes	yes
VENTERSDORP	Ventersdorp	Yes	NWP/WM/DK4/2011/01	GSB-	5	21.5	10	yes	no	yes	yes
MATLOTSANA	Klerksdorp Regional	Yes	16/2/7/C241/D4/Z2/P514	GLB-	4	59.4	20	yes	yes	yes	yes
	Klerksdorp (old)	Yes	822/2/0324/8/P52	GLB-	1.5	?	0	no	no	yes	no
	Orkney / Kanana	Yes	12/9/11/P50	GSB-	0.6	**Closed**	0	no	no	na	no
	Stilfontein	Yes	12/9/11/P44	GSB-	17	**Closed**	0	no	no	na	no
	Hartbeesfontein	Yes	16/2/7/C241/D3/P456	GCB-	2.5	2	18	no	no	yes	yes
MAMUSA	Schweizer-Reneke	Yes	NWP/WM/DR6/2012/22	GCB-	4.5	?	14	yes	no	no	yes
	Amalia (Transfer)	Yes	NWP/WM/DR6/2012/20	GCB-	0.5	?	To close	yes	no	no	no
	Glaudina	No	Closure	GCB-	**?**	**Closed**	**Closed**	na	no	na	na
	Migdol	Yes	NWP/WM/DR6/2013/18	GCB-	***Private***	?	No estimate	no	no	no	no
LEKWA	Bloemhof (Old)	Yes	NWP/WM/DR4/2011/08	GCB-	2	35	4	no	no	no	no
	Bloemhof (New)	Yes	NWP/WM/DR4/2011/11	GSB-	?	?	?	na	na	na	na
	Christiana (old)	Yes	NWP/WM/DR4/2011/09	GSB-	2.4	33	9	no	no	no	no
	Christiana (new)	Yes	NWP/WM/DR4/2011/10	GCB-	?	?	?	na	na	na	na
	Utlwanang	Yes	NWP/WM/DR4/2013/17	GCB-	?	**Closed**	**Closed**	na	no	na	na
NALEDI	Vryburg (old)	Yes	NWP/WM/DR1/2009/03	GMB-	5.2	30	**rehab**	yes	no	yes	no
	Vryburg (new)	Yes	NWP/WM/DR1/2009/01	GMB-	9	32	65	yes	yes	yes	yes
	Stella	Yes	NWP/WM/DR1/2013/18	GCB-	2.2	0.7	36.7	no	no	no	no
TAUNG	Taung	Yes	NWP/WM/DR2/2013/26	GCB-	2.5	22.45	4	no	no	no	no
	Pudimoe (old)	Yes	NWP/WM/DR2/2013/15	GCB-	2.25	na	0	no	no	no	no
	Pudimoe (new)	Yes	NWP/WM/DR1/2009/04	GCB-	6.7	na	na	na	na	na	na
	Reivilo (Boipelo)	No	Operational	GCB-	2.5	1	8	no	no	no	no
KAGISANO -	Ganyesa	No	Closure	GCB-	1.19	3.3	2.75	no	no	no	no
MOLOPO	Piet Plessis	No	Operational	GCB-	0.40	0.5	38	no	no	no	no
	Pomfret	No	Clean up	GCB-	4.6	6.8	25.2	no	no	no	no
	Morokweng	No	Closure	GCB-	0.69	8.1	1	no	no	no	no
	Bray	No	Closure	GCB-	0.21	0.4	4.2	no	no	no	no
	Tosca	No	Closure	GCB-	0.12	0.7	1.39	no	no	no	no

1: *Fenced / Access Controlled /* ***2:*** *Water / drainage managed /* ***3:*** *Sufficient cover /* ***4:*** *Buffer zone*

Na – not applicable

Table 6 (b): Waste landfill background information retrieved from IWMPs and Waste Landfill Licence details (per municipality)

North West Province: Ngaka Modiri Molema and Bojanala Districts

Municipality	Site	Licensed	License (No)	Class	Size	Waste T p/d	Life remain	1	2	3	4
MAHIKENG	Danville	Yes	16/2/7/D410/D2/Z1/P498	GMB-	31	277	15	no	no	no	no
DITSOBOTLA	Lichtenburg	Yes	B33/2/330/3/P58	GCB-	42	unknown	7	no	no	no	no
	Coligny	Yes	NWP/WM/NM3/2014/02	GCB-	5	unknown	0	no	no	no	no
	Biesiesvlei (Itekeng)	Yes	NWP/WM/NM3/2012/08	GSB-	3	unknown	0	no	no	no	no
	Itsoseng	Yes	NWP/WM/NM3/2012/07	GSB-	3	unknown	0	no	no	no	no
TSWAING	Delareyville	Yes	B33/2/330/44/P49	GSB-	9	unknown	0	yes	no	yes	no
	Atamelang	Yes	NWP/WM/NM3/2012/10	GSB-	1.5	6	11	yes	no	yes	yes
	Sannieshof	Yes	NWP/WM/NM4/2012/09	GCB-	7.9	unknown	0	no	no	yes	no
	Ottosdal	Yes	NWP/WM/NM4/2012/11	GSB-	27..5	21.3	6	yes	no	yes	no
RAMOTSHERE-MOILA	Groot Marico	Yes	NWP/WM/NM5/2013/28	GCB-	2	0.95	20	yes	no	yes	yes
	Zeerust	Yes	B33/2/130/7/P214	GCB-	6	25	3	yes	no	yes	no
	Lehurutshe	Yes	NWP/WM/NM5/2013/27	GCB-	3	26	20	no	no	yes	yes
RATLOU	Thultwane (south)	No	Illegal Dumping	GCB-	2	na	0	yes	no	no	no
	Ratlou (north)	No	Illegal Dumping	GCB-	3	na	0	no	no	no	no
RUSTENBURG	Bethanie	Yes	NWP/WM/BP1/2013/08	GCB-	3	0.97	10	no	no	no	yes
	Lethabong	Yes	NWP/WM/BP1/2013/07	GCB-	2	1.25	4	no	no	no	no
	Marikana	Yes	NWP/WM/BP1/2012/16	GCB-	0.2	1.8	3	no	no	no	no
	Monnakato	Yes	NWP/WM/BP1/2013/10	GCB-	0.64	1.16	25	no	no	no	no
	Phatsima	Yes	NWP/WM/BP1/2013/09	GCB-	1.5	1.4	5	no	no	no	no
	Townlands	Yes	B33/2/122/3/P129	GMB-	13.2	291.66	4.5	no	no	no	no
	Waterfall (new)	Yes	NWP/WM/BP1/2011/02	GLB-		na	na	na	na	na	na
MADIBENG	Hartbeesfontein	Yes	B33/2/0121/41/P81	GMB-	23	150	9	yes	no	yes	yes
MOSES KOTANE	Mogwase (old)	Yes	16/2/7/B200/C48/Z1/P267	GCB-	3	?	?	yes	no	yes	yes
	Mogwase (new)	Yes	NWP/WM/BP2/2010/03	GMB-		na	na	na	na	na	na
	Madikwe	Yes	B33/2/0122/82/P244	GCB-	3	?	?	no	no	yes	yes
MORETELE	Boplaas East	No	Illegal Dumping	GSB-	7.34	44	6	no	no	no	no
	Boplaas West	No	Illegal Dumping	GSB-	8.5	51.4	6	no	no	no	no
	Makapanstad	No	Illegal Dumping	GCB-	1,9	10.84	7	no	no	no	no
	Maubane	No	Illegal Dumping	GCB-	7.34	28.4	6	no	no	no	no
KGETLENGRIVIER	Swartruggens	Yes	NWP/WM/BP5/2013/24	GSB-	3	Not indicated	4	yes	no	no	no
	Koster	Yes	NWP/WM/BP5/2013/23	GCB-	3	No indicated	4	no	no	no	no
	Derby	Yes	NWP/WM/BP5/2013/25	GSB-	3	No indicated	11	no	no	no	no

***1:** Fenced / Access Controlled / **2:** Water / drainage managed / **3:** Sufficient cover / **4:** Buffer zone*

Na – not applicable

It was found (through interviews, questionnaires and comparisons between the IWMPs and IWMPs) that information documented in the IWMPs was extensively used by the consultants or determiners of the waste landfill rehabilitation and closure cost provisions for information or identifying the variables and cost elements to be used in their Quantum Calculation Models and means. All the Quantum Models received and reviewed did consider and include the waste landfill specifics and essentials for rehabilitation and closure specified in the IWMPs.

It was, however, found to be not a basis or framework guidance used towards these calculations, rather a tool for site information on the financial resources need for pre-closure, operations and closure as well as after-closure and monitoring.

4.2.2 Waste landfill site licences and licensing conditions

The licensing of waste landfill sites aims to identify and guide operations according to site-specific conditions that adhere to legislative requirements and address any potential detrimental environmental effects. Another important consideration for any waste landfill rehabilitation and closure provision determination would be the waste landfill licences and licensing conditions, which require finances to obtain and maintain. Whereas waste landfill sites are not licensed, application for licensing is required in terms of Section 45(1) of the NEMWA (2008: 57), with subsequent financial costs to the consultants (external service providers) who perform the application process as well as getting the landfill to an acceptable standard (Minimum Requirements). In cases where the waste landfill sites have reached the end of their lifespan or operations have ceased, municipalities also need to apply for a waste management licence for the decommissioning, closure and rehabilitation that also need to be financially provided for. The list of waste management activities that require authorisation through the NEMWA, 2008 was amended and published in GNR 921 of 23 November 2013.

The next step regarding the waste landfill licences was to consider whether the licensing conditions were included in the provision calculation criteria. Each of the licences obtained and reviewed included licensing conditions that were essential for the purpose of financial provision determination. The cost to rehabilitate, repair and

close a waste landfill will also vary, considering the condition and operational management of the site (throughout its lifespan). Conformance to the licensing conditions needs to be established to ascertain what repair and rehabilitation are needed for closure (immediate and long-term). Most licensing conditions include specifics regarding issues such as site details; management of site activities; construction; operation; water quality management; monitoring; methods of analysis; auditing; reporting; responsible authority inspection, internal audit; external audit; leasing and alienation of site; transfer of waste management licence; closure and rehabilitation of the site; general; appeal of licence. Where one or more of these licensing conditions were not adhered to, it should be considered (for the financial provision) and addressed to comply with the licensing conditions and other legislative requirements.

Tables 6 (a) & (b) alluded to the licensing status of the waste landfill sites in the North West Province as established from the IWMPs of the local and district municipalities and SAWIS. It should, however, be noted that some of the waste landfill sites are in the process of being licensed, decommissioned and closed and the data acquired may be outdated or not be included in the latest (2015) developments.

It was found that the waste landfill licences and licensing conditions were extensively used by the consultants or determiners of the waste landfill rehabilitation and closure costs and in particular for information or identifying the variables and cost elements to be used in their Quantum Calculation Models and means. All the Quantum Models received and reviewed did consider and include the waste landfill licences and licensing conditions stipulated for rehabilitation and closure.

The waste landfill licences and licensing conditions were used as a main basis or framework guidance for determining the rehabilitation and closure provisions.

4.2.3 Minimum Requirements for Waste Disposal by Landfill

The Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998) established a framework of standards for managing waste or upgrading waste disposal practices in South Africa. It goes further by guiding the waste landfill

permitting system and requirements relating as initially provided in Section 20(1) of the ECA (1989:1495-1496) and later also included in Sections 20, 45 and 50 of the NEMWA (2008:37-60). The Minimum Requirements is not a legislative requirement per se, unless included in the waste landfill licensing conditions where Section 12 (DWAF, 1998:1-8) covers the requirements for waste landfill rehabilitation, closure and end-use conditions. For any repair, rehabilitation and closure needs to be determined, it will also be necessary to consider the operations and condition of the site from start to the current state, closure and after-closure. The requirements for end-use are addressed during the permitting phase and set out in the End-Use Plan. When reaching the end of a lifespan, landfills should be managed and cared for in an environmentally sustainable manner. Objectives for waste landfill closure are to ensure proper implementation and acceptability of the End-use Plan and rehabilitate and repair the site to be environmentally- and publicly acceptable in accordance with the End-use Plan of the Minimum Requirements (DWAF, 1998:3-8).

Waste landfill sites not permitted and/or closed were initially controlled according to Sections 22, 22A and 23 of the previous Water Act (NWA, 1956) but since replaced by the NWA (1998) and WSA (1997). Section 2.3 of this research also referred to other legislative requirements of which an owner or operator of a landfill needs to take cognisance and adhere to. All waste landfills (except the ones closed prior to August 1990) need to be permitted for closure. The permitting process should include the NEMA EIA Regulations to ascertain environmental authorisation. It is a comprehensive and expensive process that will require specialists and the financial resources to obtain. The application of the Minimum Requirements towards closure of landfills is included in Figure 7 and also detailed in Table 8, where the end-use requirements will be instrumental in the provision determination.

Any landfill, whether permitted or not, should be thoroughly investigated to identify the needed closure requirements. This will be followed by a closure or upgrade design for inclusion in the Closure Report. The current status quo on site then needed to be aligned with the end-use and closure requirements with recommendations in the Closure Report for approval by the Department (as well as I&APs). The site can now be rehabilitated according to requirements and specifications of the Closure Report, with a notice to the Department of intention of

closure. As soon as the Department approves the condition of the site, it will issue written authorisation for closure and with closure the End-use Plan will be implemented. The Minimum Requirements indicate that continuous monitoring is required even after closure (DWAF, 1998:12-6).

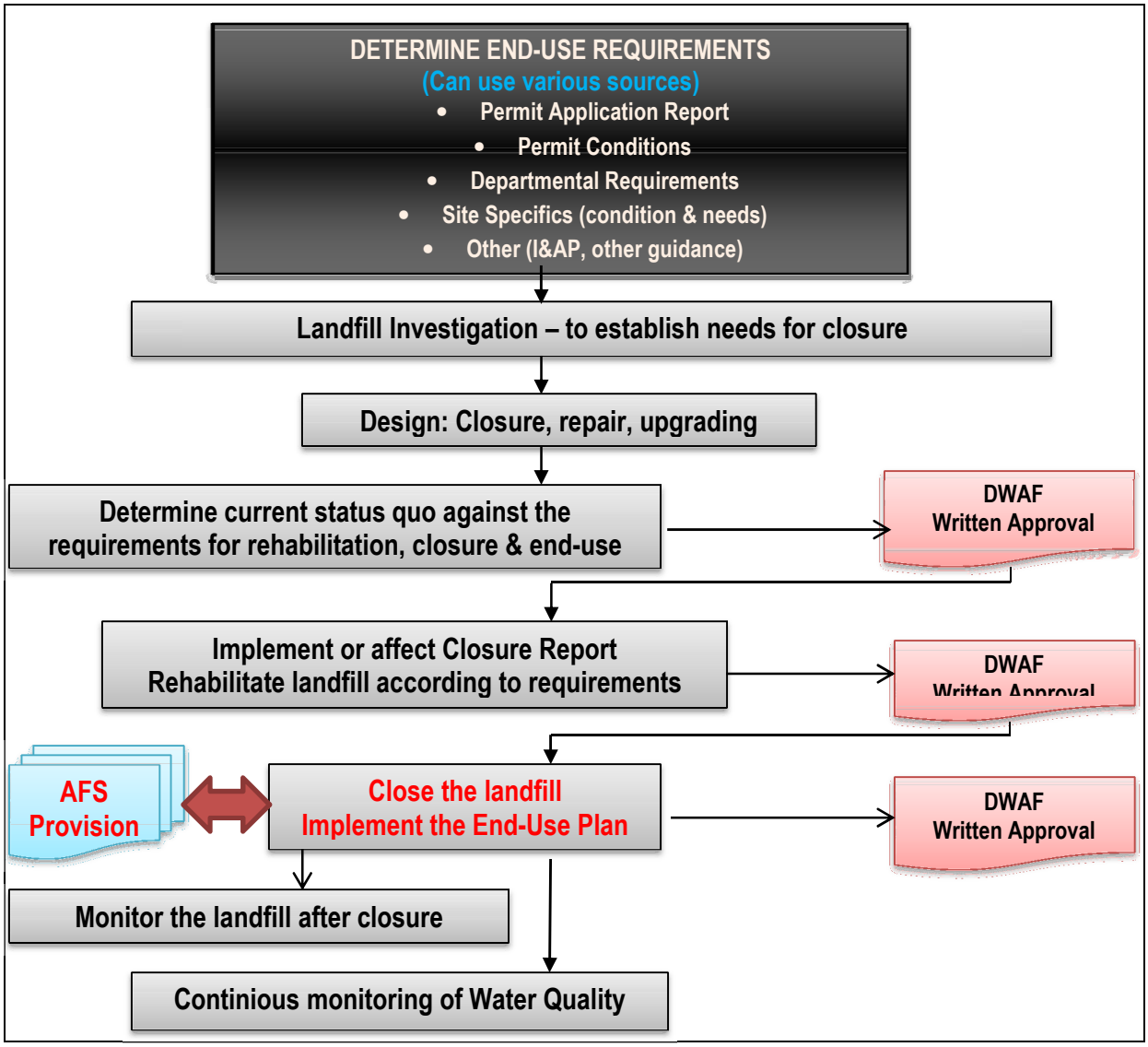


Figure 7: Application of Minimum Requirements towards closure of landfills (DWAF, 1998:12-2)

The Minimum Requirements overall framework of standards to follow with waste management and disposal, although not pertinent on guiding how (on what basis) the provision amounts for waste landfill rehabilitation and closure, needs to be determined or calculated, and does include the processes and requirements from planning, operation, pre- and post-closure of the waste landfill sites. Table 7 refers to

the other relevant and important figures and tables included in the Minimum Requirements relevant to planning, operation, closure and post-closure of waste landfill sites (DWAF, 1998: XV-XVI).

Table 7: Minimum Requirements for waste landfill site management (DWAF, 1998: XV-XVI)

PLANNING
OPERATIONS
REHABILITATION & CLOSURE
POST CLOSURE / MONITORING

List of relevant Tables & Figures in the Minimum Requirements for waste Disposal by Landfill (second Edition, 1998)

Figures / Tables	Minimum Requirements (phases)	Page	To note
Figure 1	Applying Minimum Requirements to the Development of a New Landfill	*1 - 9*	Includes process for landfills with and without permits
Figure 2	Applying Minimum Requirements to Non-Permitted/Concept Permitted Operating Landfills	*1 - 10*	A landfill cannot close until properly rehabilitated and alternative facilities made available. A landfill may continue to operate with a view to closure
Table 4	Minimum Requirements for Site Selection	*4 - 14*	Important step for landfill development due to economic, environmental & public impacts
Table 5	Minimum Requirements for Permitting	*5 - 8*	Permitting is a legal requirement – standardised process to follow
Table 6	Minimum Requirements for Site Investigation	*6 - 8*	Should include preliminary investigation, detailed site investigations and EIA
Table 7	Minimum Requirements for the Assessment & Mitigation of Environmental impacts	*7 - 8*	Assessment of environmental impacts and site investigations performed in parallel
Table 8	Minimum Requirements for Landfill Design	*8 – 13*	Landfill design is based on the outcomes of the site investigations & EIA
Table 8.1	Minimum Requirements for Liner Components	*8 – 16*	Engineering requirements for liner components
Table 8.2	Minimum Requirements for Capping Components	*8 – 17*	Engineering requirements for capping components
Table 9	Minimum Requirements for Site Preparation & Commissioning	*9 – 4*	Preparation & commissioning are required to ensure the site conform to all permit requirements
Table 10	Minimum Requirements for Landfill Operation	*10 – 16*	Includes all the operational requirements and needs
Table 11	Minimum Requirements for Landfill Operation Monitoring	*11 – 7*	To verify that the landfill conforms to the required standards and permit conditions
Table 12	Minimum Requirements for Rehabilitation, Closure and End-use	*12 – 7*	Prior to closure, repair and rehabilitation are needed including to address improper processes
Table 13	Minimum Requirements for Water Quality Monitoring	*13 – 5*	Post-closure and water monitoring can continue up to 30 years after closure
Table 13.1	Suggested Parameters for Background and Investigative Monitoring	*13 - 6*	Final step in landfill process
Table 13. 2	Suggested Parameters for Detection Monitoring	*13 - 6*	Final step in landfill process


Most relevant requirements (not inclusive) for determining the waste landfill rehabilitation & closure provisions

It must be noted that with most small, medium and large waste landfill sites all Minimum Requirements are applicable. With the communal landfill sites the requirements for end-use, closure reports, gas and leachate management, final capping and landscaping, on-going inspection and maintenance as well as vegetation monitoring are not a specific requirement, but can be included, as stipulated in Table 8.

All waste landfill sites in South Africa (and the North West Province – as confirmed in the IWMPs and Waste Licences and licensing conditions) are managed in accordance with the Minimum Requirements and included are Waste Management standards, technical specifications and best practice parameters from design, construction, operations, closure and monitoring (DWAF, 1998). Section 12 of the Minimum Requirements (DWAF, 1998) and the Waste Act (NEMWA, 2008) with subsequent Waste Classification and Management Regulations gazetted in August 2013 were also found to be important guiding frameworks used to base the waste landfill rehabilitation and closure provision determination. The 2013 Regulations that now also require of smaller landfills to comply with Type B more stringent and expensive liner systems had a notable financial impact on the latest provision amounts disclosed (2014/15), as indicated in Table 9.

It was already emphasized that the Minimum Requirements are mostly included or referred to in the waste licensing conditions, and then considered legally binding. In the North West Province the Minimum Requirements are used and referred to extensively in the calculation of the waste landfill rehabilitation and closure cost determination. The Minimum Requirements for Waste Landfill Rehabilitation, Closure and End-use is summarised in Table 8 of this research and are specific on the requirements per waste landfill classification (DWAF, 1998:7-8).

For the purpose of this research it was established that the Minimum Requirements was the most important basis or guiding framework upon which the calculations (cost elements and variables) were based.

Table 8: Minimum Requirements for Rehabilitation, Closure and End-use (DWAF, 1998:12:7-8)

	G: GENERAL WASTE								H: HAZARDOUS WASTE	
REQUIREMENTS	**C: Com**		**S: Small**		**M: Med**		**L: Large**		**h:h**	**H:H**
	B-	**B+**	**B-**	**B+**	**B-**	**B+**	**B-**	**B+**	**Rating 3 & 4**	**Rating 1 & 2**
* Determine / reassess End-Use Requirements	N	N	R	R	R	R	R	R	R	R
* Investigate - determine closure requirements/impacts	R	R	R	R	R	R	R	R	R	R
* Obtain inputs on End-Use Design by IAPs	N	N	R	R	R	R	R	R	R	R
* Confirmation of End-Use Design by Department	N	N	R	R	R	R	R	R	R	R
* Design for upgrade / rehabilitation if necessary	R	R	R	R	R	R	R	R	R	R
* Design final shaping and landscaping	N	N	R	R	R	R	R	R	R	R
* Design final cover or capping	R	R	R	R	R	R	R	R	R	R
* Design permanent storm water diversion	R	R	R	R	R	R	R	R	R	R
* Design anti-erosion measures	F	F	R	R	R	R	R	R	R	R
* Closure Report	N	N	R	R	R	R	R	R	R	R
* Compare actual condition of landfill to requirements	N	N	R	R	R	R	R	R	R	R
* Written acceptance of Closure Report	N	N	R	R	R	R	R	R	R	R
* Ongoing leachate management	N	N	F	R	F	R	F	R	R	R
* Ongoing gas management	N	N	F	F	F	F	F	F	F	F
* Ongoing Inspection and Maintenance	N	N	R	R	R	R	R	R	R	R
* Implementation of Closure Report / Rehabilitation	N	N	R	R	R	R	R	R	R	R
*** APPLY FOR PERMISSION TO CLOSE: Letter approving**	N	N	R	R	R	R	R	R	R	R
*** INSPECTION AND MONITORING: Frequency (months)**	12	12	12	12	6	6	F	F	F	F
* Cover integrity	R	R	R	R	R	R	R	R	R	R
* Integrity of drainage	R	R	R	R	R	R	R	R	R	R
* Control of ponding	F	F	R	R	R	R	R	R	R	R
* Control of fire	R	R	R	R	R	R	R	R	R	R
* Monitoring vegetation	N	N	R	R	R	R	R	R	R	R
* Monitoring security prevention of illegal dumping	R	R	R	R	R	R	R	R	R	R

B-: No significant leachate produced / **B+**: Significant leachate produced / **R**: Requirement / **N**: Not a requirement / **F**: Flag: Special consideration by expert or Department / na: Not applicable

4.2.4 Annual Financial Statements of local municipalities

The provisions for waste landfill rehabilitation and closure are included in the Notes to the AFS (provisions) of each local municipality. The municipality will incur rehabilitation costs to restore their waste landfill sites at the end of their useful lives. The amounts reflected (provision) in the AFS of the North West Province local municipalities were made at the net present value of these costs. These amounts are noted as the best estimates of the expenditure expected to be required to settle the present obligation at the reporting date. The Accounting Policies (provisions and contingencies) in the AFS give background to when provisions are recognised and detail thereof. Section 2.4 of this research alluded to the accounting and auditing standards (and particularly IAS 37 and GRAP 19) requiring a provision for the costs to rehabilitate and close their waste landfills at the end of their lifespans. If it happens within the financial year, it will be under current provisions and after year-end (future), non-current provisions.

The MFMA requires that the accounting officer prepares and present Annual Financial Statements that fairly present the state of affairs at the municipality at financial year end (30 June). The AFS are prepared according to GRAP Standards and any guidance or directives from the ASB. It was already established that waste landfill rehabilitation, repair and closure provisions are required under these standards and therefore the amounts reflected in the AFS were obtained and briefly analysed between the local municipalities of the North West Province. Within the local municipalities of the North West Province, all provided (in the AFS) for the rehabilitation and closure of their waste landfill sites as at 30 June 2015, whilst it was only one local municipality that not include such a provision for the period ending 30 June 2014. This research only wanted to establish that the local municipalities within the North West Province actually made provision for the rehabilitation and closure of their waste landfill sites, as required by legislation and financial standards and ultimately on what the calculations was based (criteria and guidance).

Within the mining sector it is the Department of Mineral Affairs that checks and monitors the financial provision for mine rehabilitation and closure, whilst the AGSA

monitors and audits the disclosure of the provisions for environmental liabilities and landfill sites in the AFS of municipalities (or other public institutions).

Table 9: Waste landfill provision disclosures in AFS of local municipalities

PROVISIONS FOR WASTE LANDFILL REHABILITATION, REPAIR AND CLOSURE				(AFS 2013/14 & 2014/15)
Final provision figures for the periods ending 30 June 2014 and 30 June 2015				*Provision Disclosures*
MUNICIPALITY	**DETERMINER 2013/14**	**LANDFILLS**	**2013/14**	**2014/15**
Tlokwe	CONSULTANT	1	R 10 813 033	R 12 270 731
Maquassi Hills	CONSULTANT	4	R 40 027 495	R 41 219 007
Ventersdorp	CONSULTANT	1	R 2 293 690	R 70 162 684
Matlotsana	CONSULTANT	3	R 14 354 384	R 16 031 129
Naledi	CONSULTANT	3	R 4 179 345	R 6 842 106
Kagisano-Molopo	CONSULTANT	3	R 10 533 126	R 11 306 673
Mamusa	CONSULTANT	1	R 9 034 387	R 3 957 986
Lekwa-Teemane	CONSULTANT	2	R 6 831 842	R 7 299 829
Greater Taung	CONSULTANT	4	R 10 087 057	R 11 117 520
Mahikeng	MUNICIPALITY (SELF)	1	R 51 854 063	R 84 949 041
Ditsobotla	CONSULTANT	4	R 18 301 199	R 19 272 927
Tswaing	CONSULTANT		R 11 992 310	R 13 684 607
Kgetlengrivier	CONSULTANT	3	R 12 565 630	R 13 237 910
Ratlou	CONSULTANT		R 978 250	R 1 014 520
Madibeng	CONSULTANT	1	R 15 129 957	R 17 154 826
Ramotshere-Moila	CONSULTANT	3	R 4 605 000	R 12 488 000
Moses Kotane	MUNICIPALITY (SELF)		R 15 874 545	R 15 963 099
Rustenburg	CONSULTANT	6	R 29 989 000	R 28 793 000
Moretele	CONSULTANT	4	R 30 238 040	R 0

A comparison of the provision amounts for similar size and needs (variables and cost elements) waste landfill sites as reflected in the AFS indicated that different processes, criteria or calculation means and methods were used. There were some significant differences and/or discrepancies between provision amounts calculated for the North West Province local municipalities (similar size and status landfills) and a possible over- or under-statement of these amounts in the AFS.

The lack of a standardised methodology, however, makes it difficult to determine the accuracy and make a sensible comparison between the provision calculations and figures reflected in the AFS. It was, however, important to firstly note the actual amounts provided for (and reflected in Table 9) prior to establishing the calculation methods and means thereof. The Quantum Calculations and Models were perceived

as the most important resource in determining the basis or criteria used for the provision calculations and subsequent disclosures.

4.2.5 Quantum calculation models of provision determiners

For the purpose of this research the quantum calculation models were considered the most important information in determining the basis or criteria used for the waste landfill rehabilitation and closure provisions. Therefore, the first step in using these models was to determine the calculators of these amounts per local municipality included in the research (see Table 10). Due to sensitivity of the information and private ownership of the quantum models, reference was only made to the Quantum Calculators (and Models) as well as the number of local municipalities determined for.

Table 10: Waste Landfill Sites provision determiners for 30 June 2014

Consultants (determiners of the provisions)	**Number of Local Municipalities performed for** *North West Province*
Consultant 1	**3**
Consultant 2	**1**
Consultant 3	**3**
Consultant 4	**2**
Consultant 5	**1**
Consultant 6	**3**
Municipality self (based on previous Model)	**1**
Municipality self (own calculations)	**1**
Consultant 7	**1**
Consultant 8	**1**
Consultant 9	**2**
9 Consultants or External Service Providers	***Total of 19 local municipalities***

Could not locate the Consultant / Service Provider

Only eight of the Quantum Models for the 2013/14 financial period could be obtained with particular focus on the details towards the valuation of the closure costs to the actual provision amounts disclosed. The analysis of these models provided some

clarity on the aim and research question that wanted to establish whether a different basis, criterion and process were followed in the determination and calculation of the waste landfill rehabilitation and closure provisions disclosed in the AFS for the period ending 30 June 2014 (see Table 11).

Only for three local municipalities in the North West Province of South Africa, the actual quantum calculations models could not be obtained (for the period ending 30 June 2014), but two supplied limited details for their own calculations, whilst with the other one there was no detail or substantiation of the provision amount reflected in the AFS for the said period.

Table 11: Quantum Calculations Models received from local municipalities

Dr KK District 30/06/2014	Dr RSM District 30/06/2014	NMMM District 30/06/2014	Bojanala District 30/06/2014
Tlokwe	Naledi	**MAHIKENG** **No Model – Self** (2013/14)	Rustenburg
Matlotsana	Taung	Tswaing	**MOSES KOTANE** **No Model – Self** (2013/14)
Ventersdorp	Lekwa	Ramotshere-Moila	Madibeng
Maquassi Hills	Mamusa	Ratlou	Moretele
	Kagisano-Molopo	**DITSOBOTLA** **No Model** – Consultant not traceable (2013/14)	Kgetlengrivier

Although the Quantum Models were instrumental in establishing whether the determiners or calculators based their approach on different criteria, means and methodologies, the lack of detail or clarity with some models was a limiting factor in the determination thereof. In the absence of a framework or standardised guideline, it was perceived that these calculations might be established or determined differently. The focus was not on the actual financial provision amounts, but rather the guiding basis used for determination. This section just provided some background on the consultants or determiners of the waste landfill rehabilitation and closure provisions with section 4.4 (4.4.1 – 4.4.3) more specific on the analysis of the quantum calculation models and the main basis or criteria used to determine these costs.

4.2.6 Conclusion

From the literature survey performed it was confirmed that there are no framework or standardised guidelines to follow or use in the determination of the municipal waste landfill rehabilitation and closure provisions in South Africa. The findings rather emphasize the need for consistency through regulated methods used and compared with the mining sector (provision regulations). This meant that the calculators of these amounts can basically decide on their main basis or drivers to determine these costs. Although national legislation and related guidelines are pertinent in terms of waste management and disposal in an environmentally friendly and sustainable manner, it was not specific on the processes or what to include in the quantum calculations in providing for the rehabilitation and closure of the landfills. In the absence of a proper framework and guidelines, it was obvious that the provision calculators had to revert to other guidance available, such as the Guidance on Mining Closure provisions, Waste Landfill Licensing Conditions, Minimum Requirements documents and most pertinent legislation. It was, however, established that a number of the waste landfill sites operated by the local municipalities of the North West Province (2013/14) were not licensed, whilst some were in the process to be licensed for operation or closure. It was also clear that almost all the sites do not comply with the licensing conditions and/or Minimum Requirements for Waste Disposal by Landfill. Waste landfill information was also not readily available or updated at some of the municipalities that might have also complicated the process of accurate provision determinations. The reasons why it was important to obtain, analyse and compare this information for the research refer to the fact that the provision calculators needed to take cognisance and include the status quo and resource needs (financial, human, asset needs, vehicles and equipment) in their quantum calculation models.

No landfill can obtain a closure licence if not operated and rehabilitated according to the required standards or in an environmentally friendly manner. The literature reviews performed, together with the interviews and questionnaires (Par. 4.4) elaborated on the bases and criteria that were used to calculate the financial provisions at year end (30 June 2014).

4.3 Site visits

The reason for the waste landfill site visits was merely to determine the status quo, operations and needs for rehabilitation and closure. This should have a definite bearing on the financial implications and needs to be considered for the ultimate provision amounts determined for rehabilitation and closure. This part of the research (site visits, interviews and questionnaires to follow), analysed the information and data reviewed and summarised the results and findings thereof.

4.3.1 Background of waste landfill sites in the North West Province

According to the National Waste Information Baseline Report (DEA, 2012a:iv) South Africa generated around 108 million tonnes of waste with more than 97 million tonnes of waste disposed of on South African landfills in 2011, which included around 59 million tonnes of general waste and 49 million tonnes of hazardous or unclassified waste. From the landfilling, only around 10% of the waste generated in South Africa was recycled. The North West Province contributed the least (only 1%) of the total waste generated in South Africa. The Status Quo Report (DACE, 2008:111-132) predicted the total waste generation within the four districts of the North West Province for 2015 at 778,242 tonnes per annum. The types and volumes of waste disposed on the landfills were a major consideration or driver in the closure cost determinations. There are also limited formalised recycling initiatives and processes implemented on the waste landfills in the Province, with most sites swooped on by informal recyclers and the associated concerns that also need to be considered, budgeted and provided for.

According to information obtained and visits to the nineteen local municipalities (2014 and 2015) it was established that the North West Province had 66 landfill sites that included operational sites, sites closed, some illegal landfills (not licensed) and new sites, licensed but not yet in operation. Tables 6 (a) & (b) of this research summarise the licensing status, some detail and challenges of each waste landfill site in the North West Province.

The waste landfill sites can be divided into three G:L:B sites, seven G:M:B sites, sixteen G:S:B- sites whilst the rest consisted of 40 smaller G:C:B- communal waste

landfill sites. There is no hazardous (municipal) waste landfill site operated in the Province to accept extreme or high hazard disposals. Some of the G:L:B landfills include hazardous cells (included in the permit conditions) that can receive moderate or low hazard rated items (separated from the other general waste). The classification of the waste landfills was included and interpreted in Table 12.

Table 12: Waste classification interpretations (landfills) (DWAF, 1998)

Legend	Interpretation
G:	General waste
C:	Communal waste landfill receiving up to 25 tonnes of waste per day
S:	Small waste landfill receiving between 25 and 150 tonnes of waste per day
M:	Medium waste landfill receiving between 150 and 500 tonnes of waste per day
L:	Large waste landfill receiving more than 500 tonnes per day
B-	No significant leachate generation
B+	Significant leachate generation
H:H	Landfill that can accept all hazard ratings of waste
H:h	Landfill that can only accept hazard ratings 3 and 4
Hazard rating 1	Extreme hazard
Hazard rating 2	High hazard
Hazard rating 3	Moderate hazard
Hazard rating 4	Low hazard

The waste landfill site classifications were also a major consideration in the provision calculations as the size, types, volumes disposed and leachate generated will also have a major bearing on the financial considerations and inputs required.

4.3.2 Municipal waste landfill site visits performed

All the waste landfill sites in the North West Province were visited and revisited over a two-year period. Table 13 refers to the sites visited during 2013 and 2014. As already indicated, some of the sites were already closed or in the process of rehabilitation and closure, whilst others (not licensed or illegally operated) had applied for licensing. There have been, however, major developments and improvements in the licensing status from 2013 to 2015 that were included and reflected in Table 13.

All the sites were visited to evaluate the operational activities on and around the sites, the site needs and specifics towards operational and closure requirements as well as other environmental and social impacts that need to be provided for. Considering the research topic, it was important during the visits to establish:

- The landfill site conditions (and operational activities);
- Licensing of the site, requirements and compliance with the licensing conditions;
- Conformance to the Minimum Requirements, 1998;
- Needs (and resources) for rehabilitation and closure;
- Post-closure needs, maintenance and monitoring.

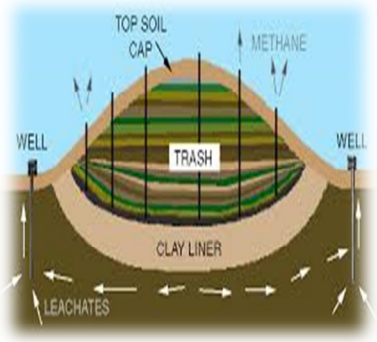
The site conditions, needs, impacts on immediate and adjacent site surroundings could only be established through site visits to determine the effect thereof on the quantum calculations towards the rehabilitation and closure provision determination.

The Minimum Requirements for Waste Landfill Operations (Figure 9) and waste landfill licensing conditions were useful in comparing the current status quo of the sites (visits) against the requirements to rehabilitate and license for closure. The focus was, however, more on the visual or aesthetic and not all the technical requirements. Some of the sites were difficult to access, resulting in illegal dumping areas becoming “informal and illegal landfills” putting further strain on the municipal waste management financial resources. There are not enough alternatives (transfers, skips etc.) ensuring an increased trend in illegal dumping. The location of the landfill sites, site conditions as well as health and safety concerns also resulted in hap-hazard waste dumping on the roads or close proximity of the waste landfill sites. Waste landfill rehabilitation and closure provision calculations will not be reliable without proper physical site visits to establish the current status quo on site (operations and continuous rehabilitation) as well as the needs for rehabilitation, repair, closure and after-closure. Annual reviews of the valuation of the rehabilitation and closure costs are required that should include all changes effected on site to be reflective of the current liability and financial resource needs.

Table 13: Municipal waste landfill sites visited per local municipality 2013 & 2014

A: Dr Kenneth Kaunda District		North West Province of South Africa
Local Municipalities	**Actual visit dates 2013 and 2014**	**Waste Landfill Sites**
Tlokwe Local Municipality	*26/09/2013 & 26/08/2014*	Felophepha Landfill Site, Old Potchefstroom
Matlotsana City Council	*04/08/2013 & 27 & 28/08/2014*	Klerksdorp Regional (and old), Stilfontein, Orkney/Kanana, Hartbeesfontein Landfill Sites
Ventersdorp Local Municipality	*27/09/2013 & 03/09/2014*	Ventersdorp Landfill Site
Maquassi Hills Local Municipality	*03 & 04/09/2013 & 20/08/2014*	Tswelelang, Makwassie, Leeudoringstad, Witpoort Landfill Sites
B: Dr Ruth Segomotsi Mompati District		
Naledi Local Municipality	*09/10/2013 & 01 & 03/10/2014*	Naledi (closed), Naledi (new), Stella Landfill Sites
Greater Taung Local Municipality	*30/10/2013 & 10/09/2014*	Taung, Reivilo, Pudimoe (new), Pudimoe (closed) Landfill Sites
Lekwa-Teemane Local Municipality	*29/10/2013 & 23/09 & 29/10/2014*	Christiana old and new, Bloemhof old and new and Utlwanang Landfill Sites
Kagisano-Molopo Local Municipality	*16/10/2013 & 06/11/2014*	Ganyesa, Bray, Tosca, Piet Plessis, Pomfret, Morokweng Landfill (Dumping) Sites
Mamusa Local Municipality	*31/10/2013 & 02/10/2014*	Schweizer-Reneke, Ipelegeng (old), Amalia (Transfer), Migdol and Glaudina Landfills
C: Ngaka Modiri Molema District		
Mahikeng Local Municipality	*17/09/2013 & 25/09/2014*	Danville Landfill Site
Ditsobotla Local Municipality	*18/09/2013 & 05/09/2014*	Lichtenburg, Coligny, Biesiesvlei, Itsotseng Landfill (Dumping) Sites
Tswaing Local Municipality	*28/10/2013 & 08/09/2014*	Delareyville, Ottosdal, Sannieshof, Atamaleng Landfill Sites
Ramotshere-Moila Local Municipality	*24/10/2013 & 17/09/2014*	Zeerust, Groot Marico, Lehurutshe Landfill Sites
Ratlou Local Municipality	*19/09/2013 & 04/11/2014*	Thultwane (south) and Ratlou (north) Dumping Sites
D: Bojanala District		
Rustenburg Local Municipality	*02/10/2013 & 28/08/2014*	Lethabong, Bethanie, Marikana, Phatsima, Rustenburg (Townlands and new Waterfall Landfill Sites
Madibeng Local Municipality	*06/11/2013 & 14/10/2014*	Hartbeesfontein Landfill Site
Kgetlengrivier Local Municipality	*23/10/2013 & 18/09/2014*	Koster, Swartruggens, Derby Landfill Sites
Moses Kotane Local Municipality	*22/10/2013 & 17 & 26/09/2014*	Mogwase (old) , Mogwase (new), Madikwe Landfill Sites
Moretele Local Municipality	*07/11/2013 & 13/10/2014*	Bosplaase East, Bosplaas West, Makapanstad Dumping Sites

The waste landfill site visits or onsite information-gathering approach followed by the consultants or provision calculators go a bit further to include a proper site orientation and needs analysis. This includes issues such as site surveys, site topographical surveys, site designs, stability assessments, storm water-, effluent-, drainage-, gas management-, geology and soils as well as impacts to adjacent catchments and receiving environment, with some examples included in Figure 8.



Inactive Landfill – picture 1 Landfills from above - picture 2 Landfill Problems – picture 3

Figure 8: Minimum Requirements towards closure of landfills (google pictures: 1/2/3)

Figure 9 summarises the operational requirements included in the Minimum Requirements for Waste Disposal by Landfill. The obvious neglect of waste landfill operations and management in the North West Province is not only causing environmental risks, but also impacting on the growth potential for municipal revenue income from solid waste services and disposal. The site visits indicated that landfilling is the main waste management disposal option in the Province and with the rural demography of the North West Province, creating serious access, management and disposal challenges to be considered with the findings indicated for closure cost determination.

The fact that mining forms the backbone of the provincial economy and is the biggest generator of waste in the North West Province, it is the responsibility of licence-holders under the MPRDA that have the effect that the municipal waste landfills mostly receive general municipal and agricultural waste, with a lesser detrimental impact on the environment, if properly managed.

The overall findings and impressions of the waste landfill sites visited at all nineteen local municipalities of the North West Province of South Africa were included in paragraph 4.3.3 of this research.

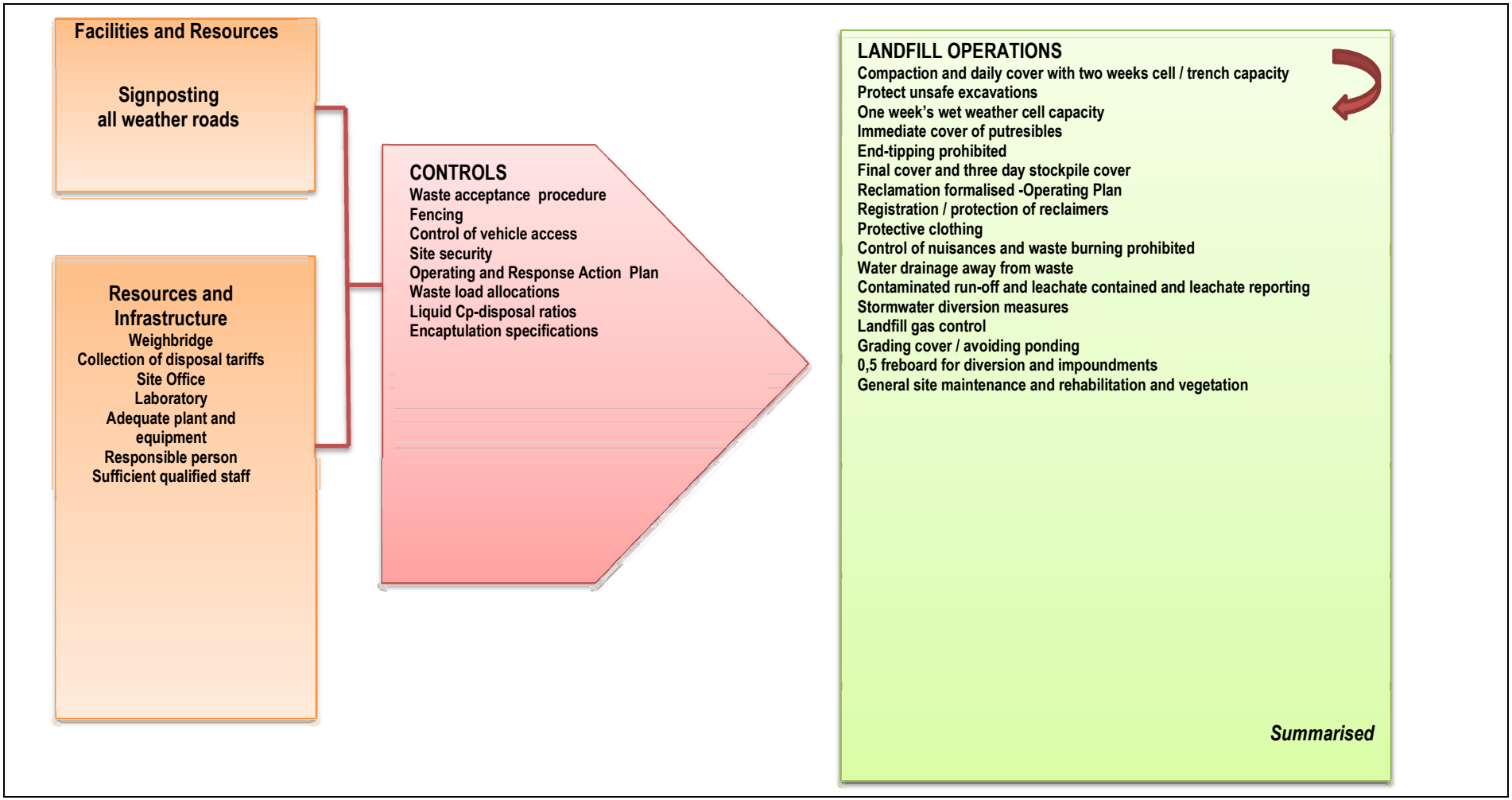


Figure 9: Minimum Requirements for Waste Disposal by Landfill Operations - Table 10 (DWAF, 1998: 16-18)

4.3.3 Site findings and needs for rehabilitation, repair and closure

Historic and current site operations discrepancies, site infrastructure and dismantling needs, impact on the receiving environment and communities in close proximity to such sites and are just some of the observations made during the visits performed and for consideration against the quantum calculation basis or criteria (Figure 10 refers).

Figure 10: Visual examples of waste landfill site visits undertaken (Table 13 refers)

The Minimum Requirements Section 12 is specific in repairing or rectifying a waste landfill site in accordance with the licensing conditions prior to closure and therefore the historical operations, current condition and needs to repair and rehabilitate to an environmentally and socially acceptable level should be considered for the provision determination (DWAF, 1998:4). During site visits (2013 and 2014) the most pertinent non-compliances or non–conformances with the Minimum Requirements, Section 10 (DWAF, 1998:1-14) and licensing conditions included the following:

a) Non-conformance to the Minimum Requirements for Waste Disposal by Landfill, Section 10 on Landfill Operations included (examples):

- The site is not fenced with no or limited access control or security;
- No or improper signposting and road access;
- Waste acceptance and disposal not monitored;
- The site is located directly next to formal and informal settlements (no proper buffer zones);
- Serious scavenging or uncontrolled recycling activities noted on and around the site;
- Improper compaction (daily or final cover) and or treatment processes;
- Illegal and continuous burning of waste, causing other nuisances;
- There were not enough resources infrastructure (plant and equipment, staff) and covering material noted on site to ensure compaction/closure;
- Odour and other nuisances emanate from improper disposal and or treatment of the waste,
- Improper drainage, effluent or water management and monitoring;
- Improper or no leachate and gas management;

b) Non-compliances with permit conditions (examples):

- Construction – construction and further development were not done according to approved plans;
- Notices for further development not done or inspected;
- There is no proper buffer-zone (of at least 800 m) between the terrain and adjacent housing developments. Furthermore, there were no written agreements with owners (housing/dwellings) surrounding the site;
- Run-off water was not managed as required;
- The developments on terrain did not comply with civil engineering requirements to ensure stability;
- The maximum height of the terrain may not exceed 2.5 m from ground-level;
- The slope of the terrain must be developed to ensure that there is no erosion;
- Considering the activities on site (not enough sanitation facilities);
- Access control: The required notices not erected at site entrance;

- The site is not fenced (at least 1.8 m fence) to prevent unauthorised access;
- Access points are not manned/closed after hours;
- Proper access control is not exercised;
- Improper control over waste types received / dumped;
- The terrain is not managed according to the Report and Plan;
- Waste received is not compacted daily as required;
- The permit holder did not ensure all measures and means to ensure the terrain is operated and managed to prevent nuisances or health risks;
- The permit holder did not use movable fences to curb windblown-litter;
- Dust control prevention measures/requirements not always adhered to;
- Informal recycling activities on site impede daily operational activities;
- Monitoring not performed as required;
- Final rehabilitation and closure of the terrain not done according to specifications

During the visits performed, the conditions of the waste landfill sites and immediate surroundings were properly assessed with the aim to note the immediate operational, repair, rehabilitation and closure needs. The current condition of the site and needs for closure should be included in the Quantum Calculations to ensure an accurate provision determination for current and future purposes. Most waste landfill sites in the North West Province were not properly operated, managed and monitored, causing serious degradation, impacts and nuisances to the immediate environment. Pollution to surface and groundwater might be the biggest risk and together with noxious gas emissions not only threatening the environment, but also the health and safety of all in close proximity. The landfills also have little or ineffective infrastructure for waste recording purposes, recycling, administrative and ablution facilities, water containment and monitoring, gas emissions and control, windblown litter, storage of vehicles and equipment. Together with the lack of resources for daily topsoil, capping and compaction, the rehabilitation, repair and closure costs will be much inflated compared to a well-kept and managed landfill site.

The waste landfill site visit findings at the nineteen local municipalities of the North West Province of South Africa were included in the AGSA General Report on the

audit outcomes of the North West for 2013/14 - Figure 11 (AGSA, 2015:39-42). This AGSA Report referred to environmental management and particularly the permitting and operation of the landfill sites and it was reported that all local municipalities had some material findings with limited progress in waste landfill site licensing and closure at some municipalities (AGSA, 2015:39-42).

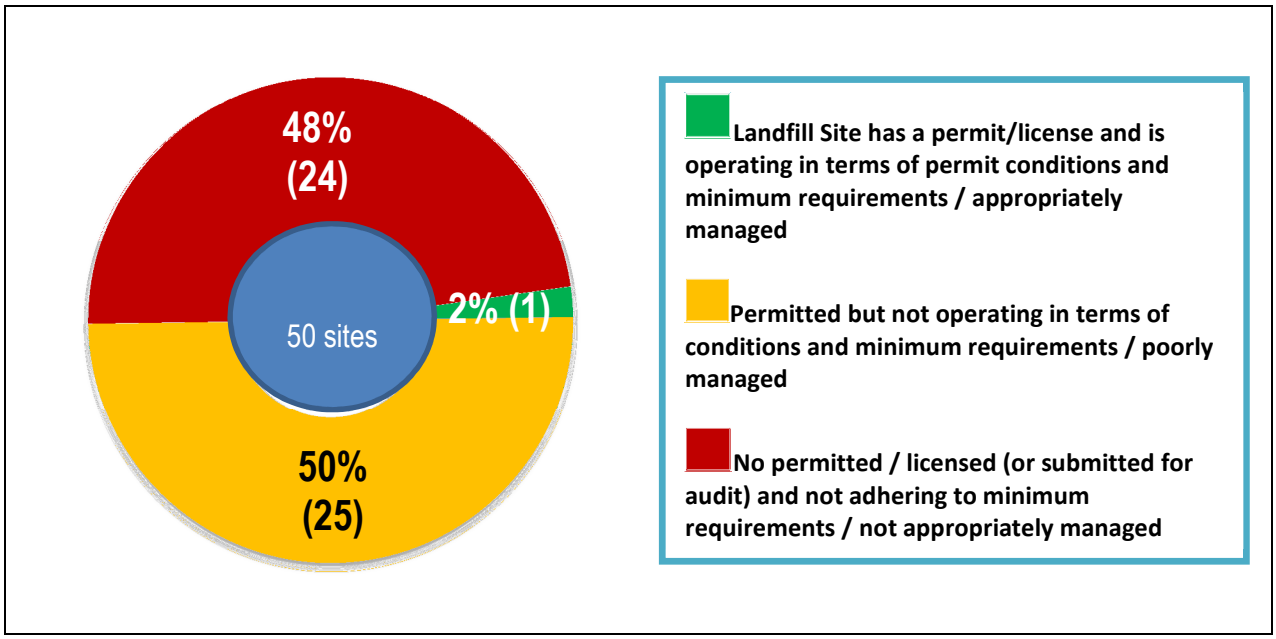


Figure 11: AGSA North West Province: MFMA: General Report findings (AGSA, 2015: 39-43)

The figure and visit findings clearly indicated that proper waste landfill operational management in the Province is lacking and basically half of the sites are not licensed. With the exception of two landfill sites, all other site operations did not conform to the Minimum Requirements, Section 10 (DWAF, 1998:1-14) or where applicable, the licensing conditions.

The overall summary of findings on the municipal waste landfills of the North West Province refers to operational activities that contravened or failed to comply with the requirements of a waste management licensing or permits and the norms and standards in terms of Section 67(1)(f) and (h) of the NEMWA and Section 29(4) of the ECA. Furthermore, most Minimum Requirements for Waste Disposal by Landfill, with specific reference to Sections 10 – 12, which include landfill operation, landfill operation monitoring and rehabilitation, closure and end-use, are not adhered to. The

municipality's waste management and disposal activities also contravened or failed to comply with the requirements of Section 28(1) of the NEMWA, Section 19 of the NWA and Sections 16(1)(c)&(d) and 26(1)(b) of the NEMWA.

It must, however, be said that most of the waste landfill sites in the North West Province are manageable due to their size, volumes and waste types received, but the lack of resources most certainly impacts on current operational discrepancies and these need to be repaired and rehabilitated. During the past three years there has been some progress at the local municipalities of the North West Province to upgrade, license or submit licensing applications for their operational and closed landfill sites. Ensuring the licensing of the sites and operational activities are acceptable according to the standards for closure but will need careful financial planning and consideration when provisions are determined.

To comprehend and summarise the main needs for improving waste landfill operational, closure and post-closure management of local municipalities in the North West Province of South Africa, the Municipal Waste Management – Good Practices (CSIR, 2011:30-37) referred to general problems experienced with landfill sites and the solutions thereto. These problems were similar to the findings on the North West landfill sites and suggestions to ascertain good practice include:

- Monitoring and enforcement of Minimum Requirements and Licensing conditions (prepare and implement compliance checklists);
- Improved housekeeping at landfills (small manageable working space, daily covering and compaction, nuisance management);
- Phase out uncontrolled salvaging or litter-picking through a properly managed recycling plan and process;
- Limited or no airspace can be managed through better management of recyclables and disposal (also exploring alternative treatment technologies);
- Better and continuous waste landfill rehabilitation to limit the impacts of pollution;
- Encroachment into landfill buffer zones can be managed through better spatial and EIA management;

- Vandalism and theft can be managed through better or improved security measures;
- Gas and water management should be monitored and managed according to permit conditions;
- Improved roads and access to landfill sites and disposal areas must be provided.

The Waste Hierarchy (Figure 12), included in the NEMWA, 2008 and subsequent National Waste Management Strategy, 2010 is also pertinent that disposal and landfilling should be a last resort and should only be used if no other option, proper care, remediation and rehabilitation should be possible. Figure 12 includes the NEMWA, 2008 approach with waste and its ultimate aim to protect health and the environment.

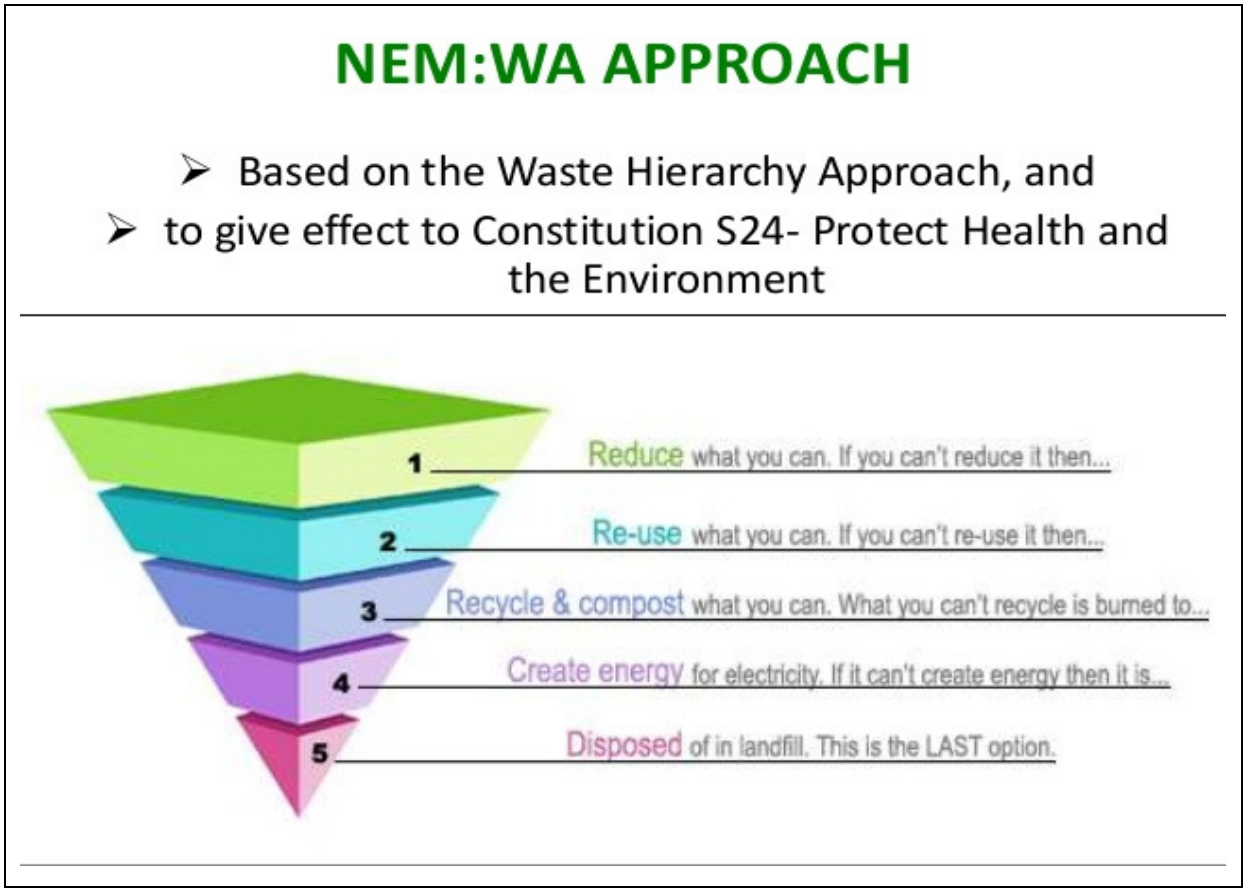


Figure 12: Waste Management: Overview (Slidesharenet, 2015)

The findings of the site visits of the landfill sites in the North West Province also compare to most landfill sites visited in other provinces in South Africa such as the

Eastern Cape, Limpopo and Gauteng. Significant financial resources need to be provided to address these findings, risks and sollutions.

4.3.4 Conclusion

From the waste landfill site visits performed at all the local municipalities in the North West Province of South Africa in 2013 and 2014, it was clear that the conditions of the sites (historical to current operations and needs) will have to be considered for rehabilitation, repair and closure. The financial provision determination for the rehabilitation and closure of better managed waste landfill sites should be less for sites with current and historical management discrepancies. No site will be able to obtain a closure licence where the site, operations, rehabilitation and repair do not conform to the legislative and other environmental sustainable development requirements.

Most waste landfill sites in the North West Province are located in close proximity to communities with informal recycling and scavenging activities creating some social concerns. It was also found that most sites do not have access control or municipal officials to manage and direct disposal. Haphazard dumping, improper disposal and operations, no or improper topsoil allocation and compacting, are some of the major aesthetic findings of the landfill visits. In the North West Province, most waste landfill sites need extensive repair and rehabilitation prior to closure, which should also need to be considered and provided for in the AFS (for current and future purposes).

4.4 Interviews and questionnaires

Although this research included some focus on both the 2012/13 and 2013/14 financial periods, the scope was directed at the quantum calculation models and means used to determine the waste landfill rehabilitation and closure provisions as at year end, 30 June 2014 (2013/14 financial period).

It was established that ten different consultants or external specialists determined or calculated the provision amounts for the rehabilitation and closure of the waste landfill sites of seventeen local municipalities in the North West Province of South Africa as at 30 June 2014 (2013/14 financial period). Two of the municipalities

determined their own provision amounts, but it was based on previous quantum calculation models or determinations from external specialists.

The scope and subsequent aims and objectives of the research were not intended to evaluate or determine the correctness (and over- and understatement) of these provision amounts, but rather on the basis used and process followed in their quantum calculation methods. The interviews and questionnaires gave some perspective or clarity to the details, methods and means followed in the Quantum Calculation Models referred to in par. 4.2.5 of this research.

4.4.1 Information acquired through interviews and questionnaires

All nine Consultants or external specialists who performed the provision calculations for the period ending 30 June 2014 were targeted in a process of interviews (telephonic and physical) and questionnaires forwarded with the explicit aim of determining what basis or guidance they used in determining these waste landfill rehabilitation and closure provision costs. Two of the consultants or specialists could not be located, whilst the two municipalities that determined their own costs (based and determined on previous external calculation models), were not included in the interviews and questionnaires forwarded. The quantum calculations and/or models used to determine the provision disclosures were requested in the informal interviews and questionnaires.

The interviews and questionnaires both focused on the bases (criteria) and processes that were used in determining the waste landfill rehabilitation and closure provisions and in the absence of a standardized framework or criteria for determination, the why a particular basis or criteria were used, also explored. Emphasis was only on what the valuations and calculations was based on, and although the absence of a standardized guideline was already established did this method also want to confirm why a particular basis or guidance was preferred over other possibilities available.

The questionnaire used in the telephonic and physical interviews with the consultants or external specialists comprised the following (Table 14).

Table 14: Questionnaire and basis for interviews (discussed and received from consultants)

Main question: Bases (criteria) used for waste landfill site rehabilitation and closure determinations **Please indicate or attach the main basis / criteria used in the determination and calculation for the rehabilitation and closure of waste landfill sites (Provision Amounts – AFS 2013/14) performed by you at local municipalities in the North West Province.** *Basis / Criteria: ……*
Sub-questions: (1) Describe the process used for the determination and calculation of waste landfill rehabilitation and closure costs. (2) Why do you use the selected basis or criteria for the determination and calculation of the rehabilitation and closure costs of waste landfill sites at local municipalities?

From the questionnaires forwarded seven consultants who in total performed the provision calculations at thirteen of the nineteen local municipalities in the North West Province of South Africa for the period ending 30 June 2014 replied (in writing) after physical and telephonic interviews conducted, as indicated in Table 15. Two consultants used during 2013/14 could not be located, but for one a quantum calculation model was obtained from the three municipalities where this consultant performed. The two local municipalities who conducted their own calculations based it on a previous year's quantum models and means and only submitted their calculations.

Table 15: Interviews and questionnaires from provision determiners (30/06/2014)

Consultants	Date	Interviewed		Physical Telephonic	Questionnaire	
		Yes	No		Yes	No
1	18/6/2015	X		Telephonic	X	
2	18/6/2015 1 & 7/7/2015	X		Telephonic and physical	X	
3	12/8/2015	X		Telephonic	X	
4	18/6/2015	X		Telephonic and physical	X	
5	18/6/2015	X		Telephonic	X	
6	18/6/2015	X		Telephonic	X	
7	18/6/2015 & 2/7/2015	X		Telephonic	X	
8	Cannot locate		X	Not applicable		X
9	Cannot locate		X	Not applicable		X

2 Local Municipalities determined / calculated own calculations

After accumulation of the information (based on the research aim and question), it was analysed and compared to ascertain what (and why) they considered and used as a basis in their quantum calculation process. Details of the findings and the analysis as well as the main drivers of landfill closure costs are included in paragraphs 4.4.2 and 4.4.3 of this research.

4.4.2 Comparative analysis of inputs and feedback from interviews and questionnaires

Scrutiny of the feedback on the questionnaires revealed that most of the approaches followed included determination of the required pre-closure, rehabilitation as well as post-closure and maintenance costs. During the WasteCon (Godschalk *et al*., 2014:1-3) 22nd conference and exhibition reference was made to the "valuation of closure costs of landfills as a tool for improving landfill management practices" and reference was also made to the long-term cost saving benefits of financial provision for final rehabilitation and closure costs and the legal and accounting requirements thereof as well as the Minimum Requirements for Waste Disposal by Landfill (1998). The authors highlight what a municipal landfill closure costing model should consider and include (Figure 13) and it was clear that it should be a comprehensive cradle to grave approach. Any flaws in the location, design and initial processes might, for example, lead to additional expenses to obtain a closure permit.

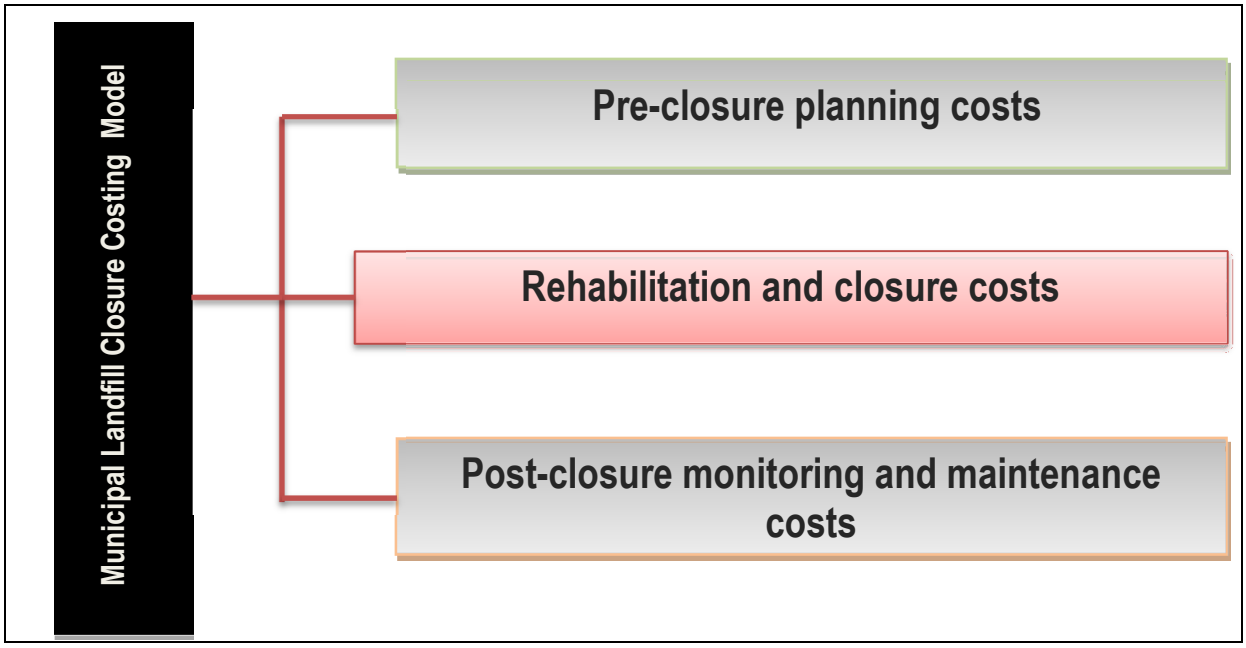


Figure 13: Municipal Landfill Closure Costing Model (Godschalk *et al.*, 2014:4)

Feedback on the interviews and questionnaires linked to the quantum models, IWMPs, waste landfill licences and licensing conditions clearly indicate similarities in approach, methods and means and that these processes were also based on the same imperatives for disclosure of the waste landfill rehabilitation and closure provisions.

Although the methodology used in determining these future cost estimates for waste landfill sites differed between some quantum models, the approach in South Africa is very similar, using the legislation, financial standards, Minimum Requirements, engineering indices and the comparative mining guidelines mostly as a basis for determination. Determining the rehabilitation costs and estimating the total lifespan of a landfill site is not always easy, due to some external factors that the landfill owner (municipalities) have little or no control over. Changes in waste behavioural disposal, characteristics and regulatory restrictions are examples and proof of what provision calculators should consider and include in their determinations.

The landfill rehabilitation and closure costing methodologies used mostly include or allude to the following five components:

- Elements for the final rehabilitation and closure calculations;
- Determination of basic unit costs for the cost element (pre- to post-closure);

- Variables that may have an impact on the cost elements and ultimately the basic unit costs;
- Rules to be followed in calculations of the amounts of each cost element, considering basic unit costs and impacts of the variables on the costs; and
- The final component is the discounting of the rehabilitation and closure costs.

The presentation of Godschalk *et al*. (2014:18) concluded with emphasizing the fact that the determination and valuation of waste landfill rehabilitation and closure costs should not only be considered as a financial calculation and disclosure, but can also assist in determining and implementing improvements to the landfill operations. Godschalk (2013:23) gave more detail on this comprehensive approach for waste landfill rehabilitation and closure cost determination included in Table 16.

Table 16: Comprehensive approach of landfill rehabilitation and closure cost (Godschalk, 2013:23)

Component	Detail
1: Pre-closure planning costs	**May include:** • Cost for applying for a landfill closure licence • The basic assessment with accompanying public participation process • Finalising end-use plans and closure designs *Cost determination may vary depending on the technical information requirements and potential environmental impacts to consider. The use of technical experts and specialists may ensure inflated expenses.*
2: Rehabilitation and closure costs	**Cost to be expended in year of closure and subsequent to closure to ensure effective closure, which may include:** • Landfill final shaping and compacting to manage and contain rainwater and prevent groundwater pollution • Capping of the landfill with the most suitable capping material to further prevent water ingression • Topsoil is added on top of the capping layer which is vegetated to ensure stability of the landfill • A storm water control system needs to be installed for further landfill stability • Where high rainfalls occur, leachate seepage control systems need to be installed • In larger landfills, where the risk of gas formations is higher, gas control systems need to be considered/added • Cost for fencing needs to be considered • Decommissioning of any site structures • Erection of end-use related infrastructure
3: Post-closure and maintenance costs	**Costs may include:** • Expenses or costs associated with post-closure environmental monitoring • Continuous on-going maintenance and management • Where the landfill subsides over time, it needs to be rectified to prevent water accumulation • Vegetation needs to be managed and fires controlled for continuous stability and to prevent erosion • Leachate and gas that may emanate from the landfill need to be managed • Water and gas monitoring needs to be performed *Post-closure monitoring and maintenance need to be performed for at least 30 years after closure (Minimum Requirements)* *(Summarised)*

Although the main research question and information acquired only related to the bases or criteria used for determining waste landfill rehabilitation and closure costs it was also interpreted to provide for or indicate the cost elements or variables that might play a role in or influence these costs.

A summary of the various methodologies used in the calculation of current and future costs for municipal waste landfills in the North West Province of South Africa (current situation till the end of its lifespan) is summarised and included in Figure 14.

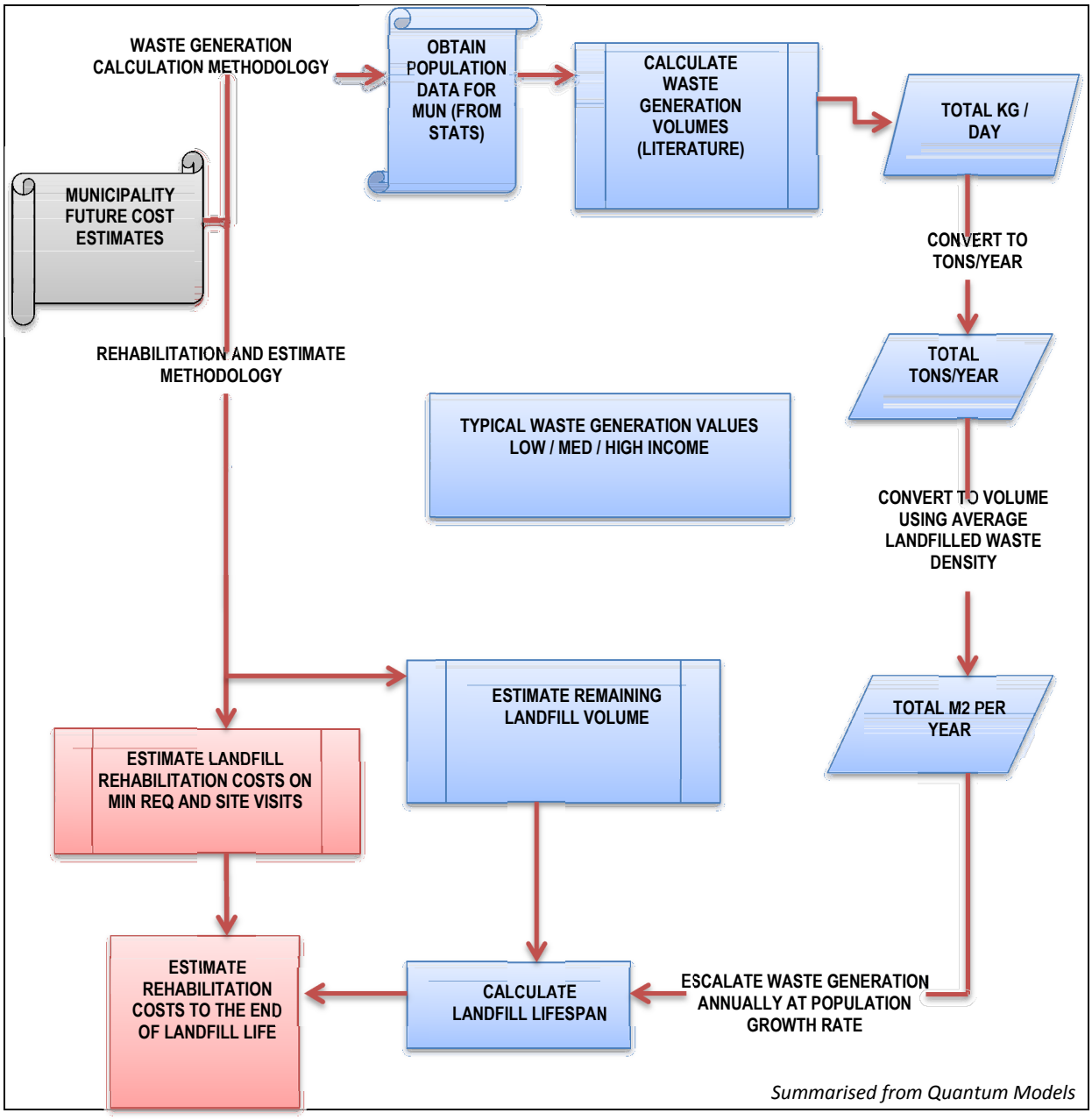


Figure 14: Methodology used for calculation of future cost estimates for landfill sites

The overall approach or process that most consultants used from appointment to submitting their financial model for substantiating the provision amounts calculated mostly included:

- Negotiations with the client (municipalities) regarding expectations and objectives;
- Information-gathering at the auditee (desktop accumulation) and on-site;
- Description of site details (topography and drainage);
- Establishment of design criteria;
- Establishment of rehabilitation measures;
- Financial model (to consider operational cost; where applicable permit application cost, rehabilitation and after-care cost.

Table 17 includes an example of the most popular estimate calculation used for a municipal waste landfill site in the North West Province of South Africa. The process of reviewing or auditing (financial audit) the provision amounts calculated and disclosed for waste landfill rehabilitation and closure mostly involve the following steps related to the process:

Step 1: Obtain the basis used to calculate the provision through inquiry from management, accounting standards and practice (GRAP) and also scrutinising the expert (consultant) valuations to evaluate the suitability thereof;

Step 2: Compare the basis used for the current year's valuation to the basis used in previous years, and where applicable discuss and follow-up any differences with management (compare valuations where different experts (consultants) were used);

Step 3: Ensure through enquiry and inspection that all the conditions (legislation and standards) were met to raise a provision (present legal or constructive obligation resulting from a past event, probable that an outflow of resources embodying economic benefits or service potential will be required to settle the obligation and reliable estimate can be made of the amount of the obligation);

Step 4: Evaluate the data used and upon which the calculation is based to ascertain the appropriateness thereof (from details of the landfill site, data on rates used to calculate the provision, key findings of the risk assessments performed on the site/s);

Step 5: Confirm and discuss the assumptions made and used for the provision determination. This includes the estimates made on the site life, airspace availability, capping and top-soil needs, final layers and vegetation, maximum rates of deposition. Evaluate the reasonableness of the significant assumptions made against the measurement objectives included in the Financial Reporting Framework;

Step 6: Evaluate the reasonableness of the rates used (discount rate and rate of return). The rates used in the calculations include discount and inflation/growth rates and the factors that apply to it, and these should be judged separately. These rates are also determined with consideration of the Minimum Requirements where closure involve, inter alia, application of final cover, top soiling, vegetation, drainage maintenance and leachate management;

Step 7: Compare current provision disclosures with the previous year's (liability amounts per reports, liability amounts per General Ledger and Statement of Financial Position, Movements per Reports, Final costs / expenses recognised as per General Ledger and Statement of Financial Position, differences found;

Step 8: Do a re-calculation of the amounts provided for (and calculation detail/process used) to ensure the mathematical accuracy thereof;

Step 9: Consider and confirm management's review and the approval processes that were followed.

Rehabilitation of the landfill sites does not incur within a single phase, but is mostly performed concurrently with the operational process (continuous process of rehabilitation and repair of filled or used airspace). It was, however, noted that some models and financial disclosures at local municipalities of the North West Province include current operational and/or maintenance requirements that should have been provided for in the expenditure budget and not disclosed or regarded as a provision.

Table17: Example: Accounting Estimates calculations *North West Province of South Africa*

			A	B	C	D	E	*DME*
No Req	**Description**	**Unit**	**Quantity**	**Master rate**	**Multiplication Factor**	**Weighing Factor 1**	**E=A*B*C*D Amount -R**	**Confirmation of Master Rates**
3	Rehabilitation of access roads	sq.m	3000	32	1	1	R 96 000.00	32
6	Opencast rehabilitation and final voids	ha	4	189071	1	1	R 756 284.00	189071
8A	Rehabilitation of overburden and spoils	ha	4	126047	1	1	R 504 188.00	126047
9	Rehabilitation of subsided areas	ha	9	105545	1	1	R 949 905.00	105545
10	General surface rehabilitation	ha	9	99851	1	1	R 898 659.00	99851
12	Fencing	m	1200	114	1	1	R 136 800.00	114
13	Water management	ha	9	37966	1	1	R 341 694.00	37966
14	2-3 years' maintenance and after-care	sum	9	13288	1	1	R 119 592.00	13288
							R 3 803 122.00	

Preliminary: 0.06 IF SUBTOTAL 1 > 100000000 *Weighing Factor 2*

: 0.12 IF SUBTOTAL 1 < 100000000 **2** R 912 749.28

Contingency: 0.1 of Subtotal 1 R 380 312.20

Sub Total 2 **R 5 096 183.48**

Add 14% VAT R 713 465.69

Sub Total 3 **R 5 809 649.17**

OTHER FINANCIAL COSTS TO INCLUDE:

Survey (Land Surveyor) / Specialist Studies (EIA & Soil Remediation) / Travel / Fees (Valuer & Geohydrology) / Civil Engineer / Other R 1 611 367.63 *Total other costs*

R 7 421 016.80 *Grand total*

Inflation rate: 6% / Discount rate: 4.6%

R 1 882 014.61

R 9 303 031.41 *Net Present Value*

PV	**R 7 421 016.80**
I	6%
N	17
FV	R -19 983 112.08
FV	R -19 983 112.08
I	4.60%
N	17
PV	**R 9 303 031.41**

PV = Present Value / **I** = Interest / **N** = lifespan (period) / **FV** = Future Value

The inputs and feedback from the (external service providers) consultants mostly followed or referred to these typical approaches and costing methodologies stated above.

Chapter 4.4.3 further expands on or summarises the main drivers and key factors used for the waste landfill closure cost determinations, whilst chapter 4.4.5 is specific on the overall basis or criteria used by the consultants or external service providers in their methods and means towards these calculations.

4.4.3 Main drivers of waste landfill closure costs in the North West Province

Comparing the Quantum Models and Questionnaires (and information obtained through interviews) revealed major similarities or trends between the main drivers of the waste landfill closure costs. During the WasteCon Conference, Godschalk *et al.* (2014:18) indicated the main drivers of landfill closure costs (Figure 15) and concluded that the valuation of closure costs is a "further tool to drive operational improvements of landfills". These drivers or variables have an impact on the waste landfill rehabilitation and closure costs through increasing or decreasing the basic unit costs.

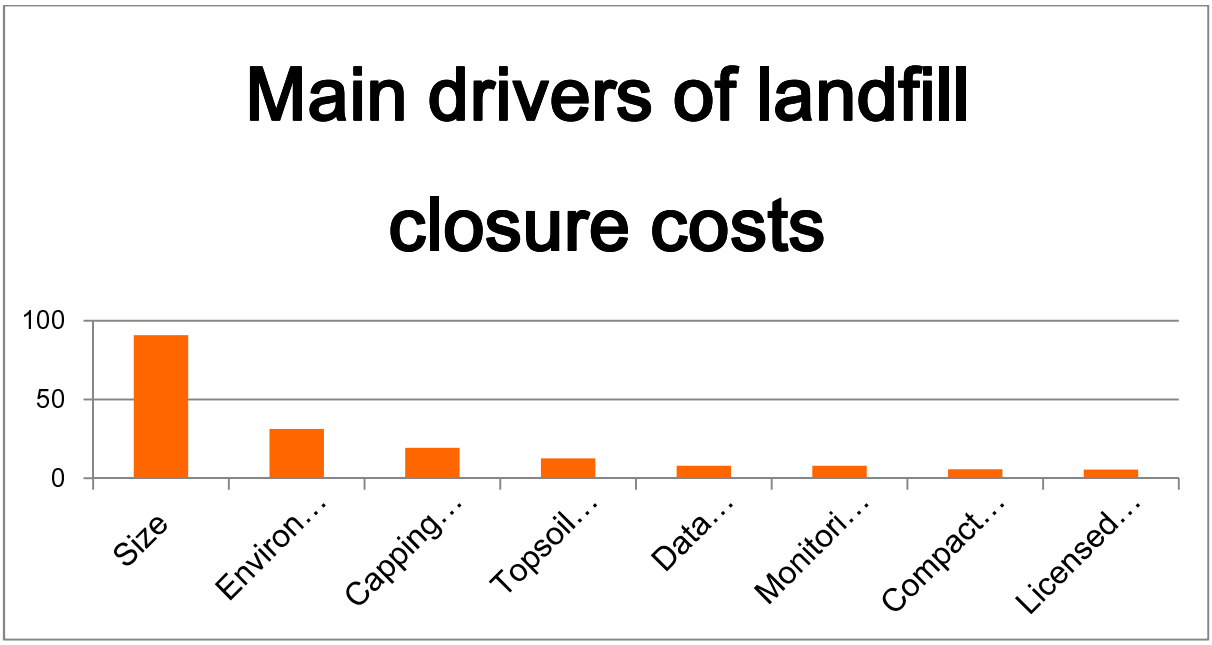


Figure 15: Main drivers and their average % towards the landfill closure costs determination (Godschalk *et al.*, 2014:6)

Other drivers or issues to consider when determining the landfill rehabilitation and closure costs include location and geology of the site (example how far from topsoil and capping material, is it in a water deficit or water surplus area), is there a proper Closure Design and End-use Plan, should a gas control system be designed and implemented, the condition of current infrastructure or infrastructure that needs to be erected or dismantled, current operations and enough and sufficient operational equipment, waste body management, enough data, records and record-keeping and what the remaining lifespan of the site is. The data analysed in this research also indicated that the main drivers or criteria stipulated should be annually reviewed, adapted and updated to be in line with the latest trends of an ever-changing waste industry, legal and financial requirements and prescribed norms and standards. Information and detail accumulated and compared through the research methodologies selected included the main drivers referred to (Figure 15), but also led to a more comprehensive list of drivers and variables as summarised in Table 19 and detailed in Annexure 1.

Most of the calculators or determiners of the waste landfill rehabilitation and closure provisions at local municipalities in the North West Province of South Africa for the financial periods reviewed followed an approach to include costs for pre-planning, rehabilitation and closure and post-closure. The accounting treatment is based on the imperatives for disclosure of financial provision as required and stipulated in the IAS 37, GRAP 19 and 17 Standards, legislation (financial and environmental), waste landfill licences and licensing conditions, Minimum Requirements and Mining Guidelines. The quantum calculations, interviews and questionnaires analysed to ascertain the most significant cost implication for the waste landfill rehabilitation and closure cost determination for all nineteen local municipalities in the North West Province indicated that the size of the landfill site used (and particularly variables for capping, top-soiling, cell construction and linings) requires most of the total costs provided for. The most significant costs noted in the planning for closure includes the Basic Assessment (when required), and closure design. For after closure, water monitoring, maintenance of cover and drainage are the main drivers in the cost determinations.

The interviews, questionnaires and quantum models further distinguished between variables over which the municipality have little or no control, variables that can be managed and also variables that relate to the availability (or non-availability) of information, summarised in Table 18. Where proper records and information are not available, assumptions or estimates were used and based on appropriate and current trends.

Table18: Variables for waste landfill rehabilitation and closure provisions

Variables (normally out of the control of the municipality) 	• Size of the landfill already used and currently in use • Length of perimeter of the landfill • Location of the landfill in water-deficit or water-surplus area • Availability of suitable capping material on-site or in the vicinity • Availability of top-soiling and vegetation material on site • Requirement for a gas control system
Variables that relate to availability of information 	• Availability and quality of technical reports, including End-use Plan and Closure Design • Occurrence of environmental impacts of landfill (confirmed by monitoring) • Occurrence of significant leachate problems (confirmed by monitoring)
Variables that relate to management practices 	• Whether the landfill is permitted or not • Existence and functioning of monitoring committee for landfill, including stakeholders • Quality of on-going operation of landfill in respect of compacting and trimming of areas already used • Whether available top-soiling material is actively managed to retain quality characteristics • Existence and condition of fence • The remaining lifespan of the landfill *Summary from Quantum Calculation Models received*

The limited information or detail included in some of the quantum calculations and substantiation thereof as well as the difference in variables used or referred to made

it difficult to reliably determine and compare all the variables and cost drivers. Table 19 and Annexure 1 only include the drivers and variables specifically indicated and may not be inclusive of all the considerations and criteria used in the cost valuations.

Table19: Comparative drivers for landfill rehabilitation and closure provisions (summarised from the quantum calculations and questionnaires)

Not included or referred to
Quantum Model information used only
Both Questionnaire & Quantum Model information used
No Model or Questionnaire / municipal calculation

DRIVERS / VARIABLES	1	2	3	4	5	6	7	8	9	10 & 11
Size of landfill and max allowable height	X	X	X	M	X	X	X	X	N	O
Length of perimeter	X	X	X	I	X	X	X	X	O	W
Fencing (or condition of fence) / access	X	X	X	N	X	X	X	X		N
Location and topography of landfill	X	X	X	I	X	X	X	X	I	
Licence status & conditions	X	X	X	M	X	X	X	X	N	C
Type of waste received	X	X	X	U	X	X	X	X	F	A
Waste generation and disposal totals	X	X	X	M	X	X	X	X	O	L
Availability of reports / records / data	X	X	X			X				C
Landfill Monitoring Committee	X			R		X			H	U
Existence and quality of End-Use Plan	X	X		E		X	X		O	L
Existence and quality of Closure Design	X	X		Q		X	X		W	A
Covering, compacting and trimming	X	X	X	U	X	X		X		T
Impact on water resources	X	X	X	I	X	X		X	D	I
Storm water and drainage / Leachate control	X	X	X	R	X	X	X	X	E	O
Surface water monitoring	X	X	X	E	X	X		X	T	N
Groundwater monitoring	X	X	X	M	X	X		X	E	S
Gas / extraction / monitoring	X	X	X	E	X	X		X	R	
Topsoil and vegetative material available	X	X	X	N	X	X	X	X	M	
Capping material available	X	X	X	T	X	X		X	I	
Remaining life of the site (or estimated)	X	X	X	S	X	X	X	X	N	
Landfill and infrastructure condition	X	X	X		X	X		X	E	
Vegetation and land-use							X			
Stability and method of construction							X			

Although this section focused on the variables and main drivers to determine the waste landfill rehabilitation and closure costs at local municipalities in the North West Province of South Africa, the aim of the research was only to critically analyse what imperatives it was based on.

4.4.4 Conclusion

The interviews and questionnaires provided clarity on some of the ambiguities and uncertainties noted in the Quantum Calculation Models and related methodologies used for the waste landfill rehabilitation and closure provision determination. Although these questionnaires completed and received were more specific to the cost elements and variables considered for provision determination they did assist in establishing the main basis from which the calculation developed.

Summarizing and comparing the various basis or frameworks used by calculators of the waste landfill rehabilitation and closure provision amounts clearly indicated that the Minimum Requirements for Waste Disposal by Landfill and Landfill Licences and licensing conditions were the most common guiding basis used. Although national legislation and standards were also included and referred to in the response, the use and impact thereof were not always specific on the provision determination. Some responses also included guidelines used (and available) for rehabilitation and closure of mines in South Africa, including civil engineering indices and requirements.

The lack of detail included in some Quantum Models was, however, a limiting factor in performing a proper comparative analysis and determining all cost elements and variables used in the valuations.

4.5 Summary of data analysed and results thereof

The most important analysis of this research relates to determining the overall basis used by the calculators of the waste landfill rehabilitation and closure provisions. It was already established that South Africa has no clear guidelines or standardised frameworks or processes to follow in determining or calculating these costs and the research wanted to prove and exploit this discrepancy of different guidelines and determinates used. The quantum calculations obtained and scrutinised included the

bases, criteria and processes followed; however, not always substantively, by the calculators of the waste landfill rehabilitation and closure financial provisions. Information from the questionnaires and quantum models provided more clarity on the approach, basis and costing methodology followed.

From the literature reviews, data acquired (analysed and compared), site visits and questionnaires to consultants returned, it was determined that the main basis or criteria (imperatives) used to calculate and disclose waste landfill rehabilitation and closure financial provisions are (also included in Table 20):

- The Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998, 2nd edition) and subsequent Waste Classification and Management Regulations (gazetted in August 2013);
- Waste landfill licences and licensing conditions (including ROD requirements);
- Legal Requirements (environmental and financial). The financial requirements include the required accounting, reporting and auditing standards and practices applicable to such a provision; South African National Standards and Codes;
- Mining Guidelines - for the closure of mines in South Africa (with reference to Civil Engineering Practices for earthworks and geo-synthetic developments stipulated in the relevant SANS).

The main guiding bases or imperatives used by the consultants or calculators of the waste landfill rehabilitation and closure provisions for the nineteen local municipalities of the North West Province of South Africa were very similar, with the above-mentioned overall guidance or framework used being the most prominent. The interpretation and use of the variables, cost elements, calculation methods and means, however, differ per quantum calculations (or models) where some variables or cost elements were considered more or less important or even excluded from the final calculations made.

The different interpretations, calculation methods and means in determining the waste landfill rehabilitation and closure amounts were notable in the AFS disclosures for 2013/14 and 2014/15 respectively. It was further noted that these calculations sometimes differ when determined or calculated by different consultants or service providers (for the same local municipalities and relevant waste landfill sites).

Table 20: Rehabilitation and closure cost basis for provision determination

	Consultants / External service providers									
Cost elements for final rehabilitation and closure of landfills - as detailed in quantum models and questionnaire (criteria used)	1	2	3	4	5	6	7	8	9	10 & 11
MAIN CRITERIA / GUIDANCE										
Waste Landfill Licence and Licensing Conditions	X	X	X	X	X	X	X		N	O
License conditions - rehabilitation & closure = Min Requirement									O	W
Waste / License conditions authorises decommissioning of a landfill										N
Min Requirements for Waste Disposal by Landfill, 1998	X	X	X	X	X	X	X		I	
Legal requirements									N	C
Particular legislative reference:									F	A
NEMA (including Section 24 G)	X	X	X			X	X	X	O	L
NEMWA	X	X		X						C
PFMA	X							X	A	U
MFMA	X								V	L
Accounting requirements		X		X			X		A	A
GRAP 19	X	X		X			X		I	T
IAS 37	X	X		X			X		L	I
IFRIC	X	X		X		X			A	O
OTHER									B	N
Department of Water and Sanitation Chief Directorate: Engineering Services: Best Practices (SANS 1200/ 1526 / 10409)							X		L	S
MPRDA: Guideline Doc for Evaluation of the Quantum Closure: Regulation 54 (1) / Rev 1.5					X				E	

Questionnaires and Quantum Calculation Models used

Only quantum model used (no questionnaire forwarded or received)

No quantum model or questionnaire available or received / municipal calculations

CHAPTER 5

OVERALL CONCLUSION, RECOMMENDATIONS AND FURTHER RESEARCH

The research is finalized with an overall conclusion (5.1), recommendations, suggestions or solutions in addressing the discrepancies and concerns with the current basis or guidance used in the waste landfill provision cost determinations (5.2) and the need for further research particular to the elements used and quantitative impact thereof on the waste landfill rehabilitation and closure provision amounts (5.3).

5.1 Overall conclusion

The research established and answered the research question on the basis used to determine or calculate the waste landfill rehabilitation, repair and closure provision costs disclosed in the AFS (30 June 2014) of local municipalities in the North West Province of South Africa. The results clearly emphasized the (why) fact that there is currently no standardized basis, mandatory regulations or methodology in South Africa to follow for calculating these costs and subsequent disclosures. This is considered the main reason for the different or inconsistent bases and criteria used in the calculations. Another contributing factor to the lack of a standardized basis methodology and criteria used relates to a rehabilitation and closure process that is often very technical (and difficult), expensive and prone to substantive periods (years) prior to closure.

The aim of the research was also addressed where an analysis of the current quantum models and calculation methods revealed different overall guiding bases used in calculating the waste landfill rehabilitation and closure provision amounts disclosed in the AFS of local municipalities in the North West Province of South Africa. This included (a) waste landfill licences and licensing conditions (b) Minimum Requirements for Waste Disposal by Landfill – 1998 (c) legal and financial or accounting and subsequent reporting requirements (d) National Standards and

Codes (e) available mining guidelines for evaluation of the quantum closure in South Africa (f) engineering indices and best practices as detailed in Table 19.

Legislation as well as financial standards and accounting practices clearly established the financial liability for municipalities regarding waste landfill rehabilitation and closure and the need to make a financial provision to settle this obligation. It further particularly recognizes such an obligating event (rehabilitation and closure) that will require financial resources that can be reliably estimated. Although the legislation and other literature used in the research are clear on the need to financially provide for waste landfill rehabilitation and closure, is it not always specific on the basis or methodology upon which the calculations should be determined. The legislation and subsequent requirements only highlight what to consider and how to disclose a provision and the needs for proper waste management, disposal and remedying the impacts on and from landfills to ascertain licensing for closure. It does not go further in guiding the calculation methods and means to ascertain a standardized and consistent process thereto.

During the process of having the data analysed and compared it was further established that there were also some differences in the drivers of waste landfill closure costs or the variables and cost elements used in the determination thereof. Although approaches, processes and means followed to determine or calculate these costs differ, did all closure costing included pre-closure, rehabilitation and closure as well as post-closure monitoring and maintenance costs?

The research results clearly emphasized the need and benefits for government and municipalities in South Africa to consider and implement a standardised methodology in determining the financial provision for final closure and rehabilitation of waste landfill sites.

5.2 Recommendations

Considering best practices and first world trends, the financial constraints and challenges experienced by local municipalities in the Province (and country) and the importance of ascertaining reliable cost estimates for immediate or future rehabilitation and closure of waste landfill sites, it is imperative to develop and

implement a uniformed and standardized framework or guideline on exactly what needs to be considered and included in the cost calculations. Without such a guidance or framework it will be difficult to determine or review the accuracy of the waste landfill rehabilitation and closure amounts provided for, with possible qualifications of the AFS as well as a lack of funding to affect the ultimate closure and licensing thereof.

The 66 waste landfill sites (in operation, closed, rehabilitated, illegal) in the North West Province alone emphasized the importance and need for the rehabilitation and closure provision calculations in South Africa to be based on similar imperatives, assumptions, unit costs, variables, parameters and other cost elements. The South African government needs to regulate the method for determining or calculating waste landfill rehabilitation and closure provisions, similar as provided for the mining sector.

In the current absence of a standardized basis framework or guideline to determine the waste landfill rehabilitation and closure provisions, can generic costing models for similar types of facilities and operations be considered and implemented as an interim measure to ascertain a more reliable, comparable and consistent valuation? The literature noted that the required annual valuations of waste landfill rehabilitation and closure costs can also contribute or add value to landfill management improvement as well as compliance with legislative- and related requirements. Through these valuations, municipalities can identify and comprehend the main drivers or impacts on their waste landfill rehabilitation and closure costs and steer their efforts towards better management or minimizing of the impacts and costs.

5.3 Further research

The focus of this research was directed on the overall bases or imperatives used in guiding the variables and cost elements included in the quantum calculations of the waste landfill rehabilitation and closure provision amounts.

This research can, however, be further extended or elaborated on to be more specific in terms of the elements used and quantification thereof in calculating the waste landfill rehabilitation and closure provision amounts. Quantification of the

impacts that the variables have or most influential variables on the percentage of the total closure costs will establish the main drivers of these costs.

Further research is proposed on the actual calculations (methods and means) of these provision amounts at present-day and at full capacity (end of life-span). This can also cover the actual amounts provided for (in the AFS) and compared to similar waste landfill site specifics and needs. Municipalities' influences over these costs as well as external influences may be explored to ascertain opportunities for improved management and determination of future rehabilitation and closure costs.

A critical analysis of the elements used and quantitative impact thereof on the waste landfill rehabilitation and closure provision amounts disclosed

The assessment of the methods and means used to determine and calculate waste landfill site rehabilitation and closure provision amounts at present day and at the end of its lifespan.

The absence of a framework or standardized guiding basis in municipal waste landfill closure cost determination in South Africa prompted various questions and uncertainties that can be explored and refined through further or more extensive research.

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ANNEXURE 1

Cost Elements: Final Rehabilitation and Closure Costs (Questionnaire & Quantum Models used)

As detailed in Quantum Models and Questionnaire (criteria used)		OWN								OWN	
PLANNING FOR CLOSURE	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
1: Classification of the landfill	X	X				X				X	**N**
2: Size of the landfill (area already used for dumping - footprint) - not yet rehabilitated (capacity/volume)	X	X				X				X	**O**
3: Landfill location		X								X	
4: Length of perimeter	X									X	**S**
5: Licence / Legal Status (application for operation to closure) - Legislation & authorisation	X	X	X			X					**U**
6: Permit conditions						X					**B**
7: Climatic Water Balance		X									**S**
8: Landfill Closure Report	X										**T**
9: Basic assessment (Consolidation of various environmental authorisation processes)	X		X								**A**
10: Specialist study: EIA / ROD					X	X		X	X	X	**N**
11: Specialist studies: Soil remediation					X			X			**T**
12: Finalise end-use plan (Existence and quality of end-use plan)	X										**I**
13: Closure design (Existence and quality of closure design)	X		X			X					**V**
14: Existence and functioning of Landfill Monitoring Committee	X										**E**
15: Availability of identified technical reports (to be required during closure process)	X										
16: Is the landfill situated in a water deficit or water surplus area	X										**D**
17: Estimated remaining life	X										**O**
18: Survey: Land surveyor					X						**C**
19: Compare current site conditions vs required conditions						X					**U**
20: Groundwater studies										X	**M**
REHABILITATION AND CLOSURE											**N**
20: Site preparation			X								**A**
21: Preliminary and general items (rehabilitation construction)			X		X		X				**T**
22: Engineering design			X								**I**
23: Base liner		X									**O**
24: Cleaning, shaping and compacting (quality of on-going covering, compacting, trimming)	X										**N**
25: Capping / cover (including availability of capping material for closure)	X		X			X					
25: Average depth of cover material										X	
26: Supply and operation of machinery to relocate and spread existing refuse (earthworks, excavations, import materials)							X		X		
27: Total earthworks										X	
27: Import suitable material with machinery for rehabilitation purposes									X		
28: Spreading and sloping of imported material									X		
29: Top-soiling and vegetation (availability and management thereof for closure)	X										
30: Soil hauled										X	
30: Storm water control system & drains (management) - earthworks / excavations / backfill / concrete	X	X				X	X				
31: Leachate seepage control system (existence of leachate problems) - management	X	X								X	

32: Gas control system	X										
33: Landfill and infrastructure condition / infrastructure and components on site	X	X	X			X					
34: Fencing (including the condition of the fence) - access control (gate)	X	X			X	X	X	X		X	
35: Decommissioning or demolition of Infrastructure / Dismantling plant structures and buildings, steel buildings (& other)	X				X			X			
Can include overland conveyers, power lines, non-electric railway lines, houses and admin facilities											
36: End-use related Infrastructure	X										
37: Rehabilitation of access roads	X				X	X		X			
38: Opencast rehabilitation and final voids					X			X			
39: Sealing of shafts, audits and inclines					X			X			
40: Rehabilitation of overburden and spoils					X			X			
41: Rehabilitation of processing waste deposits and evaporation ponds (basic salt-producing waste)					X			X			
42: Rehabilitation of processing waste deposits & evaporation ponds (acidic, metal-rich waste)					X			X			
43: Rehabilitation of subsided areas					X			X			
44: General surface rehabilitation					X			X			
45: River diversions					X			X			
46: Water management					X			X			
47: In-situ soil conditions						X					
48: Hydro seed entire area							X				
49: If applicable (removal and transport to new site)							X				
POST-CLOSURE MONITORING & MAINTENANCE											
50: Current impact of site / closure on water resources	X										
51: Water monitoring (surface- and groundwater) - and location of monitoring boreholes (on or near the site)	X					X					
52: Gas / air quality monitoring (including existence of gas problems)	X										
53: Rehabilitation monitoring	X										
54: Maintenance of cover, subsidence and drainage	X										
55: Fire control and vegetation maintenance	X										
56: Ongoing leachate management	X										
57: Ongoing gas management	X										
58: Contingencies			X		X			X			
59: 2 - 3 years' maintenance and after-care					X			X			
PROJECT FEES											
* Civil CPA indices (subject to escalation) - commencement / project / final - will influence costs			X								
* Contracted cost to rehabilitate (to pay contractor)									X		
OTHER											
* Travel					X						
* Other disbursements (unknown)					X						
* Fees: Normal valuer					X						
* Fees: Additional: Geohydrology					X						
* Fees: Civil Engineer (ESCA rates)					X						
* Safety Officer / Engineering Supervision and Approval							X				
* Engineering costs										X	

Nine consultants (two consultants not located / For one consultant the quantum model for calculations received / Other consultant – no substantive documentation received)

Two local municipalities performed own calculations – considered the bases / criteria for calculation