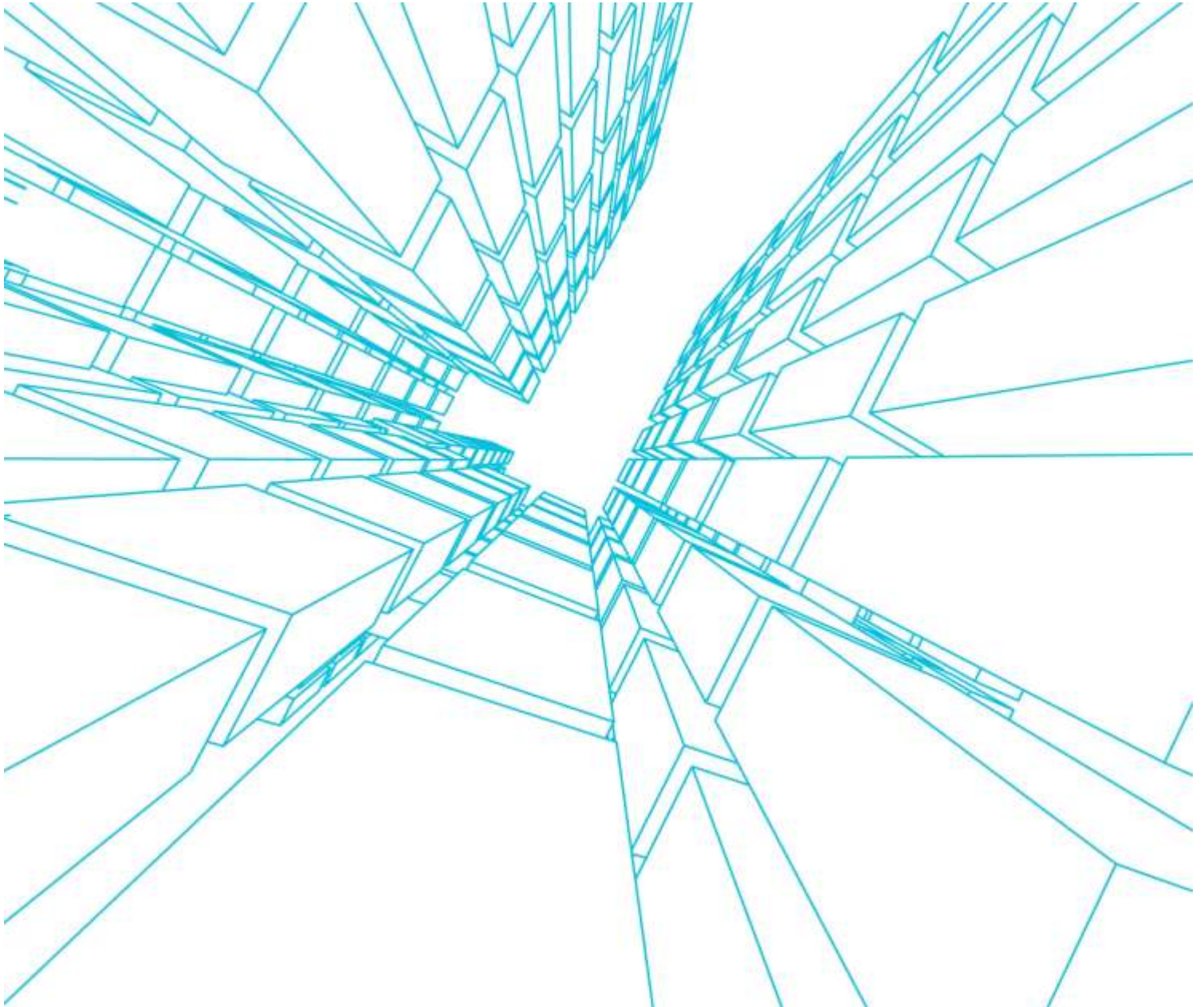


# Environmental Management Programme – Closure of Landfill Site – Violsdrift









## Contents

<b>1.</b>	<b>PURPOSE AND SCOPE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE .....</b>	<b>13</b>
1.1	Introduction.....	13
1.2	Details of the Authors .....	13
1.3	Project Description.....	14
	Closure Authorisation Process .....	15
<b>2.</b>	<b>BACKGROUND TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE .....</b>	<b>15</b>
2.1	Purpose of this EMPr .....	15
2.2	Nature of the EMPr .....	16
2.3	The Continuous Improvement Approach .....	16
2.3.1	Plan .....	16
2.3.2	Do.....	16
2.3.3	Check.....	17
2.3.4	Act.....	17
<b>3.</b>	<b>LEGAL REQUIREMENTS.....</b>	<b>18</b>
<b>4.</b>	<b>EMPR ORGANISATION, RESPONSIBILITY AND AUTHORITY .....</b>	<b>21</b>
4.1	Roles and responsibilities .....	21
4.1.1	Duties and Powers of the Municipal Manager .....	21
4.1.2	Duties and Powers of the Landfill Supervisor.....	21
4.1.3	Duties and Powers of the Environmental Control Officer .....	21
4.1.4	Duties of the Contractor .....	22
<b>5.</b>	<b>SUMMARY OF IMPACTS / ASPECTS .....</b>	<b>22</b>
<b>6.</b>	<b>ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE .....</b>	<b>25</b>
6.1	Documentation .....	25
6.2	Responsibility Matrix and Organogram.....	25
6.3	Environmental Inspections and Audits .....	25
6.4	Non-Conformance Report.....	25
6.5	Environmental Emergency Response .....	25
6.6	Communications Register .....	26
6.7	Good Housekeeping.....	26
6.8	Management of Environmental Requirements.....	26
6.9	Management and Control.....	26
6.10	Recording and reporting.....	27
6.11	Monitoring.....	27
<b>7.</b>	<b>TRAINING AND INDUCTION OF EMPLOYEES.....</b>	<b>27</b>
<b>8.</b>	<b>ASPECT AND ACTIVITIES MATRIX .....</b>	<b>28</b>
<b>9.</b>	<b>ENGINEERING CLOSURE METHODS FOR THE VIOLSDRIFT LANDFILL .....</b>	<b>34</b>
9.1	Aim and Objectives .....	34

9.2	Identification of End Land Use .....	34
9.3	Conceptual Closure Design and Proposals for Rehabilitation .....	35
9.4	Requirements for Closure Design.....	35
10.	TIMEFRAMES FOR REHABILITATION .....	36
11.	POST CLOSURE AND CONVERSION MONITORING, INSPECTIONS AND MAINTENANCE .....	36
12.	CONCLUSION.....	37
13.	REFERENCES .....	39

## List of Tables

Table 1: Terminology .....	7
Table 2: Acronyms .....	11
Table 3: Authors' Details .....	14
Table 4: Legislation Applicable to Waste Management .....	18
Table 5: Summary of Impacts .....	22
Table 6: Environmental Specifications – Closure .....	28
Table 7: Environmental Specification – Rehabilitation.....	32
Table 8: Engineering Specifications – Post Closure and Conversion Monitoring .....	37

## List of Figures

Figure 1: The Continual Improvement Cycle .....	17
Figure 2: Appropriate rehabilitation flow diagram .....	35

Table 1: Terminology

Terminology	Explanation
<b>Activity</b>	Any action needed for the design, physical investigations and rehabilitation associated with the landfill site.
<b>Alien species</b>	A species occurring in an area outside of its historically known natural range as a result of intentional or accidental dispersal by human activities.
<b>Builder's rubble</b>	Includes pieces of masonry, bricks, concrete, etc. resulting from construction, repair and demolition operations, without reinforcing steel, uncontaminated with general waste and with a maximum particle size of 300-mm.
<b>Bulky Waste</b>	Includes items, such as large tree trunks, large concrete blocks, etc., for which the large size precludes or complicates their handling by normal collection, processing or disposal methods.
<b>Cell</b>	A cell which is designed and engineered to contain waste. It is underlain by a liner to prevent the waste or the leachate from the waste coming into contact with the environment.
<b>Chance Find Procedure</b>	A chance find procedure is a project-specific procedure that outlines the actions to be taken if previously unidentified cultural heritage is encountered on site.
<b>Clean Garden Waste</b>	Compostable waste derived from garden waste (for instance gardens, parks and similar), which has not been mixed with other waste categories. This may include clippings, pruning and other discarded plant material.
<b>Closure</b>	The act of terminating the operation of a landfill. Closure is preceded by rehabilitation and followed by end-use and post-closure monitoring.
<b>Commercial Waste</b>	Solid waste generated by stores, offices and other activities not involved in manufacturing.
<b>Communication register</b>	A register aimed at tracking all communication activities in the project.
<b>Compaction</b>	The process whereby the volume of waste is reduced, using a purpose built compactor or other suitable machine.
<b>Compaction Density</b>	The mass of a body of solid waste divided by the volume (after compaction) occupied by that same body of waste.
<b>Compaction Ratio</b>	The ratio of the volume of loose waste to the volume of the same waste after placement and compaction.
<b>Compost</b>	Organic waste that has undergone microbial degradation, to produce a contaminant- and nuisance free product of potential value as a soil conditioner.
<b>Contaminated water</b>	Water contaminated by pollutants from on-site or off-site activities; for example, runoff from un-rehabilitated parts of the waste body or runoff from waste management vehicle or plant wash areas. Contaminated water must be treated to ensure water released into the receiving environment meets minimum standards and guidelines. Treated water should be recycled where possible.
<b>Cover Material</b>	Soil or other suitable material like builders' rubble or clinker ash that is used for enclosing a body of compacted waste.
<b>Daily Cell</b>	A body of waste which has been placed between waste berms covered with soil, soil berms or builder's rubble berms compacted and enclosed by cover material. The size being determined by the mass of waste disposed of in a single day, as well as by the number of vehicles delivering waste.
<b>Department of Water &amp; Sanitation (DWS)</b>	The authority responsible for water management.
<b>Development Plan</b>	A plan indicating the phasing of the development of a landfill from the landfill preparation, through the operation (which is usually divided into phases), to the final closure, rehabilitation and end-use. The phasing, and hence the Development Plan, forms part of the design.
<b>Domestic Waste</b>	Solid waste that originates in a residential environment.
<b>Engineer</b>	A suitably qualified duly appointed natural or juristic person or partnership or any other engineer appointed from time to time by the Owner, to act on its behalf with regards to certain aspects of the administration and execution of the work.
<b>Environment</b>	The surroundings in which humans exist and which comprise: <ul style="list-style-type: none"> <li>• the land, water and atmosphere of the earth;</li> <li>• micro-organisms and vegetation and animal life;</li> <li>• any part or combination and interrelationships; and</li> <li>• the physical, chemical, aesthetic, historical, cultural and economic properties</li> </ul>

Terminology	Explanation
	and conditions of the foregoing that can influence human health and well-being.
<b>Environmental aspect</b>	A product's or production process's environmental impact or important issues in the environment that an organisation should take into consideration.
<b>Environmental Audit</b>	Systematic, documented, regular and objective evaluation to see how well an organisation or facility is operating in terms of the Environmental Management Programme and is complying with statutory requirements and the organisation's Environmental Policy.
<b>Environmental Authorisation (EA)</b>	The authorisation by a competent environmental authority for commencement of listed activities in terms of the National Environmental Management Act and associated Specific Environmental Management Acts (SEMAs).
<b>Environmental Control Officer (ECO)</b>	An independent person, who is responsible for undertaking site inspections to audit and report on compliance with the environmental specifications contained within the Environmental Management Programme.
<b>Environmental impact</b>	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
<b>Environmental Impact Assessment (EIA)</b>	The process of collecting, organising, analysing, interpreting and communicating information in accordance with the environmental legal requirements set out in GNR. No 982, GNR. 983, GNR. 984 and GNR 985 as published on 14 December 2014, promulgated in terms of Chapter 5 of the National Environmental Management Act, for the purposes of obtaining an Environmental Authorisation in accordance with Chapter 5 of the National Environmental Management Act.
<b>Environmental Management Programme (EMPr)</b>	A tool used to prescribe management mechanisms / methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits of a development.
<b>Fauna</b>	All species of animals found in a particular region or environment.
<b>Fire Danger Index</b>	A relative number denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture and wind speed.
<b>Fire hazard</b>	The relative combination of fuel, oxygen and heat that will lead to the start and spread of a potential fire.
<b>Flood line</b>	The line or mark to which a flood could rise, every 50 (1:50 year flood line) or 100 (1:100 year flood line) years.
<b>Flora</b>	All species of vegetation found in a particular region or environment
<b>General Waste</b>	Waste that does not pose an immediate threat to man or the environment, i.e. house hold waste, builders' rubble, garden waste and certain dry industrial and commercial waste. It may, however, with decomposition, infiltration and percolation, produce leachate with an unacceptable pollution potential.
<b>Groundwater</b>	The water that fills the natural openings in below-surface rock or unconsolidated sands.
<b>Hazardous waste</b>	Waste that, because of its chemical reactivity, toxic, explosive, corrosive, radioactive or other characteristics, causes danger or is likely to cause danger to health or the environment.
<b>Heritage resources</b>	Any place or object of cultural, archaeological or paleontological significance in terms of the National Heritage Resources Act, 1999.
<b>Induction training</b>	The training provided to new / existing employees to (re)acquaint them with the company structure, their specific job requirements, practical and/or organisational issues and occupational health, safety and environmental considerations required on the project.
<b>Industrial Waste</b>	Non-toxic and non-hazardous solid waste resulting from industrial processes and manufacturing.
<b>Interested and Affected Parties (I&amp;APs)</b>	Any person, group of persons or organisation interested in or affected by such operation or activity and any organ of state that may have jurisdiction over any aspect of the operation of activity.
<b>Landfill (v)</b>	To dispose of waste on land, whether by use of waste to fill in excavations or by creation of a landform above grade, where the term "fill" is used in the engineering sense.
<b>Landfill (n)</b>	The waste body created by landfilling. This may be above or below ground level, or both.
<b>Landfill Gas</b>	Typically malodorous gases generated during the decomposition of waste.
<b>Landfill Operation</b>	The auditing and assessing of a waste disposal operation to determine whether it



<b>Terminology</b>	<b>Explanation</b>
<b>Monitoring</b>	conforms to the Landfill design and to the Minimum Requirements.
<b>Landfill Operator</b>	The person, firm or company including the Landfill Operator's heirs, executors, administrators, trustees, judicial managers or liquidators, as the case may be, responsible for maintenance and operational standards at the landfill. Depending on the circumstances, the Landfill Operator may also be the Landfill Owner.
<b>Landfill Owner</b>	The Landfill Owner will be deemed to be the local municipality.
<b>Land use</b>	Characterised by the arrangements, activities and inputs people undertake in a certain land cover type to produce, change or maintain it. The definition of land use in this way establishes a direct link between the land cover and the actions of people in their environment.
<b>Leachate</b>	An aqueous solution with a high pollution potential, arising when water is permitted to percolate through decomposing waste. It contains final and intermediate products of decomposition, various solutes and waste residues. It may also contain carcinogens and / or pathogens (Sporadic / Significant).
<b>Leachate Detection System</b>	A system for detecting leachate at landfills. It comprises rudimentary liners, sloped towards 'finger drains' at the lowest point of the landfill.
<b>Leachate Management</b>	The collection and drainage of leachate to a point where it can be extracted for treatment. This requires a system of under-drains and liners and, in certain instances, is synonymous with containment.
<b>Lift</b>	A series of adjoining cells of the same height, and at the same level, in a landfill.
<b>Mitigate</b>	The implementation of practical measures to reduce adverse impacts, or to enhance beneficial impacts, of an action.
<b>No-go area</b>	An area where physical activities are prohibited.
<b>Non-compliance</b>	Failure to comply with the requirements of the EMPr.
<b>Non-conformance Report</b>	A report outlining a deviation from process, procedure or compliance specifications.
<b>Plant</b>	The apparatus, machinery and vehicles used for the construction, operation and maintenance of the landfill.
<b>Pollution</b>	Any change in the environment caused by substances and/or noise, malodours, dust or heat emitted from any activity, including the storage or treatment of waste or substances and the provision of services, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or that will have such an effect in the future
<b>Potentially hazardous substance</b>	A substance that can have a deleterious effect on the environment. Hazardous chemical substances are defined in the Regulations for Hazardous Chemical Substances, published in terms of the Occupational Health and Safety Act, 1993 (Act 85 of 1993).
<b>Quality management system</b>	A set of interrelated or interacting elements that organisations use to direct and control how quality policies are implemented and quality objectives are achieved.
<b>Radioactive Waste</b>	Waste with a specific activity of more than 74 becquerels per gram (Bq/g) and total activity more than 3, 7 kBq (0,1uCi). Disposal of radioactive wastes in a landfill is prohibited.
<b>Red Data</b>	A program by the International Union for Conservation of Nature (IUCN) for evaluating the conservation status of plant and animal species. This is represented as the Red List of Threatened Species.
<b>Rehabilitation</b>	To reinstate or restore to capacity or state similar or better than the state prior to the commencement of construction, operation and maintenance activities.
<b>Resource recovery</b>	Recycling of waste or the recovery of energy.
<b>Response Action Plan</b>	A plan intended to counter or minimise the adverse effects of any malfunction of a landfill design element with immediate effect.
<b>Responsible Person</b>	The Permit Holder or his / her legally appointed representative who takes responsibility for ensuring that all or some of the facets of any of the following are properly directed, guided and executed, in a professionally justifiable manner: investigatory work, design, preparation (construction), operation, closure and monitoring.
<b>Safe Disposal</b>	The process whereby spoilt foodstuff or condemned products may be disposed of on the landfill under supervision of the Environmental Health Officer and/or Landfill Supervisor.

<b>Terminology</b>	<b>Explanation</b>
<b>Salvaging</b>	The controlled and/or uncontrolled process of recovering any material, gas, compost, or other matter from the waste for benefit and for personal consumption.
<b>Sanitary Landfilling</b>	A method of disposing of waste on land without causing nuisances or hazards to public health or safety. Sanitary landfilling uses the principles of engineering to confine the waste to the smallest practical area, to reduce it to the smallest practical volume, and to cover it with a layer of earth at the conclusion of each day's operations or at such less frequent intervals as may be acceptable.
<b>Sensitive receptors</b>	Locations or areas that are likely to experience an impact greater than at other locations or areas; for example, schools and residential areas.
<b>Ton</b>	1000 kg
<b>Waste</b>	Means any substance, whether or not that substance can be reduced, re-used, recycled and recovered— (a) that is surplus, unwanted, rejected, discarded, abandoned or disposed of; (b) which the generator has no further use of for the purposes of production; (c) that must be treated or disposed of; or (d) that is identified as a waste by the Minister by notice in the Gazette, and includes waste generated by the mining, medical or other sector, but— (i) a by-product is not considered waste; and (ii) any portion of waste, once re-used, recycled and recovered, ceases to be waste.
<b>Waste Body</b>	This refers to the body of waste (and cover) that is contained in the landfill. Because it is subject to decomposition, it has the potential to generate leachate and must therefore be adequately separated from the water regime.
<b>Waste minimisation</b>	A programme that is intended to promote the reduced generation and disposal of waste.
<b>Waste prevention</b>	The prevention and avoidance of the production of waste.
<b>Waste to Cover Ratio</b>	The ratio of volume of compacted waste to volume of cover material used to cover the said volume of compacted waste.
<b>Water resource</b>	Includes a watercourse, surface water, estuary or aquifer.
<b>Wetland</b>	Means land, which is transitional between terrestrial and aquatic systems where the water table is usually at or near the surface, or the land is periodically covered with shallow water and which, in normal circumstances, supports or would support vegetation typically adapted to live in saturated soil (as defined in the National Water Act).
<b>Working Face</b>	The active part of the landfill; where waste is deposited by incoming vehicles, then spread and compacted on the sloped face of the cell by a compactor. The width of the working face is determined by manoeuvring requirements of the vehicles depositing waste.

Table 2: Acronyms

Acronym	Explanation
CFPs	Chance Find Procedures
DEA	Department of Environmental Affairs
DENC	Department of Environment and Nature Conservation
DWS	Department of Water & Sanitation
EA	Environmental Authorisation
ECO	Environmental Control Officer
EIA	Environmental Impact Assessment
EMPr	Environmental Management Programme
I&APs	Interested and Affected Parties
IWM	Integrated Waste Management
IWMPs	Integrated Waste Management Plans
PPE	Personal Protective Equipment
KPI	Key Performance Indicator
MSDS	Material Safety Data Sheet
NCR	Non-Compliance Report
NEMA	The National Environmental Management Act, 1998 (Act No.107 of 1998)
NEMWA	The National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NWA	National Water Act
NWMS	National Waste Management Strategy
QMS	Quality Management System
SAHRA	South African Heritage Resources Agency
TEM	Transport, earthmoving and materials handling equipment
WTS	Waste Transfer Station



# 1. PURPOSE AND SCOPE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE

## 1.1 Introduction

The Environmental Management Programme (EMPr) for the closure of the landfill is designed as an environmental management tool used to prescribe management mechanisms / methods for the prevention of undue or reasonably avoidable adverse environmental impacts and for the enhancement of the positive environmental benefits during the closure process.

The plan has been developed to take cognisance of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) requirements for bestowing a 'Duty of Care' on those who cause, have caused or may in future cause pollution or degradation of the environment, as per Section 28 (1) of NEMA. Section 28 (1) has been amended to include significant pollution or degradation that occurred before the commencement of NEMA, that arises or is likely to arise at a different time from the actual activity that caused the contamination or that arises through an act or activity of a person that results in a change to pre-existing contamination. An EMPr is a stand-alone document that is typically used to guide and regulate environmental performance through all stages of development, including planning, design, construction, operation, closure, rehabilitation and post closure monitoring.

In furtherance to the EMPr, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA) also sets out key requirements for integrated waste management through the development of integrated waste management plans (IWMPs). The IWMPs allow waste generators and managers to implement measures to ensure waste is managed in a sustainable manner. Local and District Municipalities are required to compile and implement IWMPs to allow for effective sector planning, thereby ensuring waste management is undertaken in a sustainable and well planned manner. The outcomes of which, allow for improved planning and budgeting at municipal level.

The objectives (Chapter 2 of NEMWA) of aforementioned outcomes are to protect health, well-being and the environment by implementing the following NEMWA measures:

- Minimising natural resource consumption;
- Minimisation and avoidance of waste generation;
- Reduction, re-use, recovery and recycling of waste;
- Treating and safely disposing of waste;
- Ecological degradation and pollution prevention;
- Securing ecologically sustainable development while promoting justifiable economic and social development;
- Ensuring the promotion of effective waste delivery services;
- To undertake remediation of land where contamination (may) present(s) a significant risk of harm to health or the environment; and,
- To achieve integrated waste management reporting and planning.

This EMPr is not intended to provide site specific management and mitigation directives.

## 1.2 Details of the Authors

As per the requirements of the NEMA, the details and expertise levels of the persons who prepared the EMPr are provided below (**Table 3**).

Table 3: Authors' Details

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<b>Expertise to carry out preparation of EMPr</b>	Vici has an MSc in Conservation Biology and a BSc degree in Zoology. She is a professional Environmental Assessment Practitioner (EAP) with over 9 years' experience in the environmental management field. She has compiled and reviewed numerous Environmental Management Programmes in support of various Environmental Authorisation application processes.

### 1.3 Project Description

The Nama Khoi Local Municipality is applying for a waste management license for the closure of the existing Violsdrift Landfill. The landfill is located about 2.54 km south east of the Violsdrift town and 0.37km east from the Violsdrift settlement, Northern Cape. Waste generated in the settlement of Violsdrift was previously collected every second week for disposal at the existing Springbok Landfill, however this service has ceased in the recent years. Presently, domestic waste is currently dumped illegally, after which it is burnt at the existing Rooiwal landfill site.

The site is not licensed but is classified as a G:C:B-, due to the waste types and volume received and the climatic conditions of the area. A general description of the landfill (following a site visit conducted on the 02/03/2016) includes the following:

- The landfill site is not enclosed by perimeter fencing and a gate, therefore, no access control is conducted;
- This facility is not lined with any impervious surfacing;
- Type of waste present includes domestic (glass, paper, tin and plastic) waste. No hazardous waste was reported to be received on site;
- Burning of waste occurs on site; and
- No record keeping of the influx (amount) of waste received was kept.

The closure and rehabilitation activities will comply with the Minimum Requirements for Waste Disposal by Landfill (Department of Water Affairs and Forestry (DWAF), 1998). Closure activities will commence within 12 months from the date of issue on the waste management license. In compliance with the requirements for a communal landfill, during closure of the existing landfill the following activities will be conducted:

- Closure:
  - Consolidation of waste on site in skips for disposal at the Springbok landfill.

- The landfill footprint area must be fenced with a locked gate to prevent unauthorised entry into the rehabilitated and closed site.
- Placement of a “no dumping” notice at the site.
- Providing a skip for the community to dump their waste in. The skip will be taken to a legal landfill site at least once a week.
- Provide environmental education and awareness with regard to the importance of utilising skips and waste containers in waste management.
- Stormwater:
  - Design of stormwater management infrastructure to comply with Government Notice 704 of the National Water Act, 1998 (Act No. 36 of 1998).
- Final Cover:
  - After the waste has been removed from site, the site will be capped with a 150mm topsoil layer.
  - The site will then, immediately following capping with topsoil, be seeded with a mixture of indigenous grasses.
  - Vegetation establishment must be monitored post decommissioning to ensure successful rehabilitation.

Upon closure, the Nama Khoi Local Municipality intends to establish a Waste Transfer Station (WTS) for the temporary storage of waste, prior to disposal at the licensed Springbok Landfill.

The GPS co-ordinates for the site are

(S) 28°46'38.00"

(E) 17°37'54.04"

Please refer to Annexure A: Locality Map.

#### Closure Authorisation Process

The application for closure required the submission of a basic assessment report to the competent authority, thereby ensuring compliance to section 24(5) of NEMA.

A pre-requisite for authorisation from the competent authority is the inclusion of a rehabilitation plan indicating best environmental management practises to be implemented during site closure.

## **2. BACKGROUND TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME FOR CLOSURE**

### **2.1 Purpose of this EMPr**

The purpose of an EMPr is to provide an acceptable environmental framework and action plan to manage and control potential environmental impacts resulting from the closure and conversion of the waste disposal facility. This EMPr is based on the principles of the NEMA, specifically the Integrated Waste Management (IWM) Hierarchy. Such principles are:

- To avoid, minimise or correct the disturbance of ecosystems and loss of biodiversity;
- To avoid or minimise or correct pollution and degradation of the environment;
- To avoid or minimise waste and re-use or re-cycle waste where possible, disposing of it in a responsible manner;
- To apply a risk-averse and cautious approach; and,
- To anticipate and to prevent negative impacts on the environment and on people's environmental rights. Where they cannot be prevented, such impacts must be minimised and remedied.

The EMPr provides guidelines and directions to ensure that the closure and conversion activities for the landfill are undertaken in such a way as to avoid, where possible, impacts on the biophysical and social environment.

## 2.2 Nature of the EMPr

The EMPr is a legally required document to ensure that compliance with the requirements of reasonable protection of the environment as imposed by NEMA, in particular Section 28, which refers to duty of care. The EIA Regulations, 2014, are used as a guideline for the content of the EMPr. The mitigation measures required in terms of Section 28, subsection (1) may include measures to –

- Inform and educate employees about the environmental risks of their work and the manner in which their tasks must be performed to avoid causing significant pollution or degradation of the environment;
- Cease, modify or control any act, activity or process causing the pollution or degradation;
- Contain or prevent the movement of pollutants or the cause of degradation;
- Eliminate any source of the pollution or degradation; or
- Remedy the effects of the pollution or degradation.

This EMPr, as a standalone document, shall be used to guide and regulate environmental performance during the closure of the waste disposal facility. It contains the following elements:

- Goal setting and performance measurement;
- Compliance management;
- An assessment and management system;
- Community relations;
- Roles, responsibilities and accountabilities;
- Risk management;
- Emergency preparedness and response; and,
- Incident reporting and investigation.

To achieve these environmental management requirements, a defined and implementable system must be in place. This system comprises the “what” and the “how”.

- The “what”: The EMPr indicates to the Landfill Supervisor what is required by setting objectives with measurable targets in place for the successful management of the scheme.
- The “how”: The Landfill Supervisor is required to formulate procedures and/or guideline documents in compliance with its Quality Management System (QMS) on how the objectives will be met.

## 2.3 The Continuous Improvement Approach

The approach adopted for this EMPr is derived from the Deming Cycle, a cycle of continuous improvement that entails the reiterative actions of plan, do, check and act.

### 2.3.1 Plan

Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.

### 2.3.2 Do

Throughout the life cycle of the waste disposal site, the Landfill Supervisor will be required implement management practices to ensure implementation of this EMPr. Such practices should include and evaluate at least the following for the project:

- Location and extent of associated infrastructure;
- Associated activities, such as the transportation of people and equipment;
- Materials and equipment to be used;
- Management actions;
- Human resources used;



- Monitoring activities;
- Emergency / disaster incident and reaction procedures; and
- Rehabilitation procedures for the impacted environment.

Including these information topics into procedures and/or guideline documents will ensure that aspect-specific environmental management (based on this EMPr) forms an integral part of the closure of the site. It is, therefore, important to integrate the environmental management requirements into the day-to-day activities by way of set procedures that are set out in its QMS.

The incorporation of the “how” and “what” will ensure that the Landfill Supervisor understands what is required of it and that it allows systems to be put in place to ensure that the execution of the requirements is monitored. The Landfill Supervisor should also develop a programme for monitoring aspect-specific indicators in terms of the targets provided in the EMPr. **Figure 1** illustrates the effect that a programme for monitoring can have as an ongoing effort to improve the EMPr process.



**Figure 1: The Continual Improvement Cycle**

### 2.3.3 Check

A system of assessing monitoring results has been developed (**Table 8**) to check environmental management performance. Continuous assessment facilitates proactive management of environmental issues. Mitigation measures can then be successfully implemented on an on-going basis to keep environmental indicators within their target thresholds. Moreover, the assessment system also enables the assessment of the efficacy of the EMPr. Regular auditing of environmental performance is prescribed to prove and preserve accountability in a legislative context.

### 2.3.4 Act

The assessments and monitoring of the results and findings of the regular audits must be documented within a reporting system. Precautionary mitigation measures and corrective actions will be prescribed and instructions will be given in order to implement these in the field. The Landfill Supervisor shall in terms of the requirements of the QMS comply with the timeframes for dealing with implementing corrective actions:

- Acknowledge the finding – within 1 day of being informed of the finding.

- Rectify/mitigate finding – within 3 days of finding being raised.
- Respond in writing on “close out” of finding – within 5 days of finding being raised.

The findings of monitoring and auditing programmes can also be used to update the EMP. Although the EMP is a specific document, it is dynamic and should be updated regularly to address changing requirements, legislation, technologies, etc.

### 3. LEGAL REQUIREMENTS

The site closure and conversion must be implemented within the framework of NEMA and other relevant environmentally related legislation as well as the project specific conditions of the EA. Please refer to **Table 4** below.

**Table 4: Legislation Applicable to Waste Management**

Legislation	Sections	Relates to
<b>The Constitution, 1996 (Act No. 108 of 1996)</b>	Chapter 2	Bill of Rights
	Section 24	Environmental rights
	Section 25	Rights in property
	Section 32	Administrative justice
	Section 33	Access to information
<b>National Environmental Management Act, 1998 (Act No. 107 of 1998) as amended<sup>1</sup></b>	Section 2	Defines the strategic environmental management goals, principles and objectives of the government. Applies throughout the country to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	Duty of care and remediation of environmental damage. The scheme owner has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care. The duty of care has been amended to include significant pollution or degradation that occurred before the commencement of the NEMA that arises or is likely to arise at a different time from the actual activity that caused the contamination or that arises through an act or activity of a person that results in a change to pre-existing contamination.
	Section 30	Control of emergency incidents. Responsible person's duties relating to reporting and remediation actions regarding emergency incidents. A criminal sanction may be imposed on the responsible person for failure to comply with the reporting requirements and obligations to address any emergency incidents.
<b>Environment Conservation Act, 1989 (Act No. 73 of 1989) and regulations</b>	The Act has been substantially repealed by the NEMA. However, there are certain regulations under the Act which are still in operation, such as the National Noise Control Regulations.	
<b>National Environmental Management: Waste Act, 2008 (Act No. 59)</b>	Section 16	General duty in terms of waste management
	Section 17	Reduction, re-use, recycling and recovery of waste

<sup>1</sup> The NEMA 2014 EIA regulations may be relevant for certain construction and maintenance such as those that may need to take place in or close to water resources.

Legislation	Sections	Relates to
of 2008) (NEMWA) <sup>2</sup>	Section 26	Prohibition of unauthorised disposal of waste
	Section 27	Littering
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEMBA)	Sections 65-69	These sections deal with restricted activities involving alien species, restricted activities involving certain alien species totally prohibited, and duty of care relating to alien species.
	Sections 71 and 73	These sections deal with restricted activities involving listed invasive species and duty of care relating to listed invasive species.
National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) <sup>3</sup>	Section 32	Control of dust
	Section 34	Control of noise
	Section 35	Control of offensive odours
	Schedule 2	Ambient air quality standards
Fertilisers, Farm Feeds, Agricultural Remedies and Stock Remedies Act, 1947 (Act No. 36 of 1947) and regulations	Sections 3 to 10	Control of the use of registered pesticides, herbicides (weed killers) and fertilisers. Special precautions must be taken to prevent workers from being exposed to chemical substances in this regard. Workers handling these remedies must also be registered in terms of the Act.
Conservation of Agricultural Resources Act, 1983 (Act No. 43 of 1983) and regulations	Section 5, 6	Implementation of control measures for alien and invasive plant species
National Heritage Resources Act, 1999 (Act No. 25 of 1999)	Section 35	No person may, without a permit issued by the responsible heritage resources authority, destroy, damage, excavate, alter, deface or otherwise disturb any archaeological or paleontological site.
	Section 36	No person may, without a permit issued by the South African Heritage Resource Agency (SAHRA) or a provincial heritage resources authority, destroy, damage, alter, exhume, remove from its original position or otherwise disturb any grave or burial ground older than 60 years which is situated outside a formal cemetery administered by a local authority. "Grave" is widely defined in the Act to include the contents, headstone or other marker of such a place, and any other structure on or associated with such place.
	Section 38	This section provides for Heritage Impact Assessments (HIA), which are not covered under the NEMA. The HIA will be approved by the authorising body of the provincial directorate of environmental affairs, which is required to take the provincial heritage resources authorities' comments into account prior to making a decision on the HIA.
Occupational Health and Safety Act, 1993 (Act No. 85 of 1993) and regulations	General Administration Regulations GN R1449 (Section 7)	Material Safety Data Sheets must be made available at the request of any interested or affected party.
	Section 8	General duties of employers to their employees

<sup>2</sup> The Listed Activities in terms of the Waste Act should be included as R718 of GG32368 of 3 July 2009 as, depending on throughput, the effluent treatment plants may require waste licenses.

<sup>3</sup> The National Ambient Air Quality Standards have been published and replace the SANS codes, R1210, GG 32816 of 24 December 2009.

Legislation	Sections	Relates to
	Section 9	General duties of employers and self-employed persons to persons other than their employees
<b>National Water Act, 1998 (Act No. 36 of 1998) and regulations</b>	Section 19	Prevention of and remedying the effects of pollution of a water body
	Section 20	Control of emergency incidents
	Chapter 4	Use of water and licensing
<b>Hazardous Substances Act, 1973 (Act No. 15 of 1973) and regulations</b>	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.	
<b>Minimum requirements for storage, handling and disposal of hazardous waste, DWAF guidelines, 1998</b>	Section 10	Temporary hazardous waste storage: time, volume and other requirements
<b>National Road Traffic Act, Act 1996 (Act No. 93 of 1996) and regulations</b>	Section 54	Transportation of dangerous goods
<b>Fencing Act, 1963 (Act No. 31 of 1963)</b>	Section 17	Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 metres on each side thereof and remove any tree standing in the immediate line of the fence. However, this provision must be read in conjunction with the environmental legal provisions relevant to the protection of flora.
<b>National Veld and Forest Fires Act, 1998 (Act No. 101 of 1998)</b>	Chapter 2	Promotes and regulates the formation of fire protection associations which aim to manage and coordinate fire protection and fire services in an area.
	Chapter 4, 5	Organisations are required to make and maintain firebreaks and fire-fighting equipment and personnel should there be a risk that a fire may start or spread from the premises.
<b>DEA Integrated Environmental Management</b>	DEA Integrated Environmental Management Information Series (2004): Environmental Management Plans: DEA Guideline on compiling EMPs.	
<b>SANS 1929</b>	Ambient air quality – limits for common pollutants <sup>4</sup>	
<b>SANS 10103</b>	The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication.	
<b>National Waste Policy</b>	Provides for the identification of and governance arrangements for priority initiatives and measures for performance assessment. The National Waste Management Strategy (NWMS) seeks to systematically improve waste management in South Africa. Therefore, as a legislative requirement of the NEMWA, the NWMS seeks to ensure sustainable design, resource efficiency and waste prevention practices are implemented (DEA, NWMS Draft, 2010).	

<sup>4</sup> Replaced by R1210

## 4. EMPr ORGANISATION, RESPONSIBILITY AND AUTHORITY

### 4.1 Roles and responsibilities

This section describes the key functionaries in the planning, implementation and monitoring of the EMPr.

#### 4.1.1 Duties and Powers of the Municipal Manager

The Municipal Manager is ultimately responsible for:

- Ensuring compliance with all the environmental requirements of the EMPr;
- Ensuring that the EMPr has been made available to the staff, suppliers as well as subcontractors;
- Reviewing all reports by the Landfill Supervisor; and,
- Ensuring rectification on non-compliance issues raised by the Landfill Supervisor.

#### 4.1.2 Duties and Powers of the Landfill Supervisor

The Landfill Supervisor is ultimately responsible for:

- Ensuring that the EMPr has been made available to appointed Contractors, for review and distribution to its suppliers as well as subcontractors, and that the Contractor acknowledges and accepts the contents therein, also on behalf of any parties reporting to the Contractor;
- Ensuring compliance with all the environmental requirements of the EMPr;
- Assessing the Contractor's environmental performance during project life-cycle in consultation with the ECO, to whom a brief monthly statement of environmental performance will be submitted;
- Maintaining a register of complaints and queries made by members of the public; and,
- Oversee response(s) by the task specific contractor to any project-related complaints from the public.

#### 4.1.3 Duties and Powers of the Environmental Control Officer

The closure related activities must be monitored by an independent Environmental Control Officer (ECO). The ECO must be well versed in environmental matters and have a minimum of two years of relevant on-site construction related experience. The ECO should have a relevant environmental degree or other relevant tertiary qualification. The ECO's responsibilities include:

- Report on compliance with all the environmental requirements set in the EMPr (photographs will be taken of any transgressions and will be presented to the Landfill Supervisor, who will be responsible for ensuring rectification of non-compliance issues);
- Be familiar with relevant legislation and regulations;
- Brief the various Landfill Supervisor's / Contractor's foremen about the requirements of the EMPr for at least one hour (where after environmental training will be provided by the Environmental Officer to the workforce);
- Undertaking weekly site visits;
- Advise the Landfill Supervisor about the interpretation, implementation and enforcement of the EMPr;
- Attend site meetings, as and when required;
- Oversee implementation of corrective action with regard to the EMPr;
- Issue a list of transgressions/ non-conformance reports to the Landfill Supervisor at monthly intervals for dissemination to the various responsible parties; and,
- Undertake monthly audits of adherence to the EMPr.

The ECO is responsible for providing an independent evaluation of compliance with the EMPr and not for enforcement of conditions of the EMPr. The Applicant is responsible for enforcement of the conditions of the EMPr. The ECO provides feedback to the Landfill Supervisor who, in turn, reports to the Municipal Manager, as required. Issues of non-compliance raised by the ECO must be taken up by the Landfill Supervisor and resolved with the construction teams in a timely manner.

The ECO will remain employed for the full duration of the closure phase.

#### 4.1.4 Duties of the Contractor

All Contractors (including staff, suppliers, sub-contractors and casual labour) are ultimately responsible for:

- Task specific activities for the duration of their appointment (so will Sub-Contractors and contract workers);
- Ensuring work conducted is done within the framework of the EA, EMPr and applicable legislation;
- Ensure that all suppliers and Sub-Contractors have a copy of and are fully conversant with the contents of the EMPr;
- Providing Method Statements setting out, in detail, how management actions contained in the EMPr will be implemented;
- Monitoring task specific impacts upon the surrounding environment as per the Environmental Monitoring Method Statement; and,
- Submitting environmental monitoring data to the Landfill Supervisor on a monthly basis.

The Contractor(s) must arrange for all his/her employees and those of his/her sub-contractors to be made aware of the requirements of the EMPr to ensure:

- A basic understanding of the key environmental features of the work site and environments; and,
- Familiarity with the requirements of this EMPr.

Suppliers, sub-contractors with their employees and casual labour must comply with all the requirements of this EMPr and supporting documents in terms of NEMA Section 28 Duty of Care. The absence of specific reference to the supplier, the sub-contractor or casual labour in any specification does not imply that the supplier, sub-contractor, casual labour is not bound by this EMPr.

The Contractor shall clearly describe the overall methodology proposed for the task specific related activities in particular method statements. All method statements must take environmental requirements into account.

## 5. SUMMARY OF IMPACTS / ASPECTS

All closure activities will be limited to the landfill site, lay-down areas and site office / yard. All activities outside these areas need to be approved by the landfill Supervisor prior to the commencement of works.

All interactions between the Landfill Supervisor and Interested and Affected Parties (I&APs) will be via the Municipal Manager. The Landfill Supervisor may not enter into agreements with I&APs or undertake work on private property in lieu of favours, payment or any other means where either party may benefit from the activities / permissions of the other party.

The identification and summarisation of impacts and risks associated with decommissioning related activities (**Table 5**) are set out in this section.

**Table 5: Summary of Impacts**

Impact	Nature of Impact	Mitigation
<b>Cultural-historical aspects</b>	Disturbance or damage to heritage and/or fossil resources uncovered during the re-contouring phase of the project	<ul style="list-style-type: none"> <li>• Chance Find Procedures (CFPs) must be developed for the project to ensure that standard protocols and steps are followed should any heritage and/or fossil resources be uncovered during the re-contouring phase of the project.</li> <li>• These procedures should outline the steps and reporting structure to be followed in the instance that heritage resources are found.</li> <li>• Should heritage resources be uncovered during the</li> </ul>

Impact	Nature of Impact	Mitigation
		<p>construction phase of the project, all work in the area must cease immediately and be reported to SAHRA.</p>
<b>Noise generation</b>	<p>Noise generated as a result of machinery used and personnel required to implement the closure/ decommissioning activities on site.</p>	<ul style="list-style-type: none"> <li>• Servicing of all vehicles and machinery to ensure good working order; and,</li> <li>• Use of silencers and mufflers on potentially noisy equipment.</li> </ul>
<b>Air Emissions</b>	<p>Emissions from vehicles transporting the remaining waste from the site to the Kakamas Landfill, as well as other vehicles and equipment on site fitted with exhausts may cause a temporary decrease in air quality within the immediate surroundings.</p> <p>Similarly, dust generated during closure and rehabilitation activities may negatively impact on the surrounding areas ambient air quality.</p>	<ul style="list-style-type: none"> <li>• All reasonable measures should be taken to minimise air emissions in the form of smoke, dust and gases from vehicles/ equipment used on site.</li> <li>• No fires are allowed.</li> <li>• The Landfill Supervisor shall implement measures to restrict the generation of dust during rehabilitation activities.</li> <li>• The Landfill Supervisor shall control dust from spoil dumps or stockpiles by ensuring that they are kept covered or must have a suitable dust palliative applied (such as water or commercial dust suppressants) to prevent windborne dust pollution.</li> </ul>
<b>Health and Safety</b>	<p>Health and safety incidents to workers during closure and rehabilitation activities.</p>	<ul style="list-style-type: none"> <li>• Safety training of staff is required to minimize accidents.</li> <li>• All staff is required to wear the required Personal Protective Equipment (PPE) at all times.</li> </ul>
<b>Health and Safety</b>	<p>Movement of operational vehicles and equipment or danger associated with open areas (trenches, unstable ground etc.) may lead to potential safety impacts to the public if not demarcated as no go zones.</p>	<ul style="list-style-type: none"> <li>• The site must have access control. The public will not be allowed near the working areas.</li> <li>• On site vehicles will be fitted with reversing horn.</li> <li>• Staff on site will wear PPE and reflective clothing.</li> <li>• Open excavations will be marked with danger tape.</li> </ul>
<b>Water and Soil Pollution</b>	<p>Contamination of soils and surface water due to hydrocarbon spills from vehicles/ equipment used during rehabilitation.</p>	<ul style="list-style-type: none"> <li>• Precautionary measures must be taken to prevent any form of pollution.</li> <li>• Accidental pollution incidents shall be reported to the Municipal Manager immediately after they occur and shall be cleaned up (to the satisfaction of the ECO) by the Landfill Supervisor or a nominated clean-up organisation.</li> <li>• Vehicle and plant maintenance shall be confined to the areas demarcated for this purpose. Should any amount of fuel, oil, transmission or hydraulic fluids be spilled onto the soils, the Municipal Manager or ECO shall be informed immediately. Tests must be conducted to determine the extent of soil contamination as soon as a spillage occurs. The polluted soil shall be rehabilitated or remediated to the satisfaction of the ECO.</li> <li>• On-site stormwater management shall be to the satisfaction of the ECO.</li> <li>• Any spillage of waste, caused by any party during the closure activities, shall be cleaned up immediately and appropriately disposed of.</li> </ul>

Impact	Nature of Impact	Mitigation
<b>Illegal Dumping</b>	<p>Night-time and / or weekend fly tipping (illegal dumping) may result in dumping of unacceptable waste streams increasing environmental, health and safety impacts and risks including:</p> <ul style="list-style-type: none"> <li>• Changes in the expected composition of leachate from the waste disposal facility resulting in the pollution of soil and water resources.</li> <li>• Changes in expected landfill gas emissions resulting in flammability, toxicity, asphyxiation and other hazards as well as objectionable odour negatively impacting on on-site personnel (and other on-site persons) health and safety.</li> <li>• The increase for the landfill footprint in instances of uncontrolled dumping of wastes.</li> </ul>	<ul style="list-style-type: none"> <li>• The closed landfill site is to be fenced with a locked gate. Fencing is to be maintained to prevent access for illegal dumping.</li> <li>• The local community shall be informed of the site closure and made aware of alternatives through public meetings, the placement of notices in local newspapers, etc.</li> <li>• The Municipal Manager shall ensure placement of signage close to the road informing the public of site closure and providing details on alternative disposal sites or facilities.</li> <li>• Maintain security at the site for a short period after closure to prevent potential illegal dumping and / or vandalism.</li> <li>• Placement of skips near the community residential areas / notices informing community members of the waste transfer station for use to safely dispose of their waste.</li> </ul>
<b>Surface and groundwater pollution</b>	<p>Surface and groundwater water pollution may occur after closure if the engineering design/ instructions are not correctly implemented on site.</p>	<ul style="list-style-type: none"> <li>• A professional engineer must provide detailed closure drawings and oversee as well as sign off on the closure of the landfill.</li> <li>• Maintenance of the site is ongoing until vegetation establishment has been completed.</li> <li>• The installation of stormwater management measures, such as intercept drains and conservancy tanks, must be regular checked for damage and proper functioning.</li> <li>• Water collected in the conservancy tank (if applicable) must be analyzed for potential contamination.</li> </ul>
<b>Alien vegetation</b>	<p>Alien plant species may establish on site post closure/ decommissioning of the landfill site. This may interfere with the capping layer making it less able to control the ingress of water, resulting in leachate.</p>	<ul style="list-style-type: none"> <li>• Maintenance of the site is ongoing until indigenous vegetation has successfully established on site.</li> <li>• Any alien plants identified must be removed from site and destroyed.</li> </ul>
<b>Loss of habitat and indigenous vegetation</b>	<p>Activities conducted for the closure of the landfill may lead to the loss of natural habitats and indigenous species.</p>	<ul style="list-style-type: none"> <li>• Clean up the surrounding areas and move the litter into an approved landfill area.</li> <li>• Vehicle movement must be restricted to the fenced area and the road to the landfill and should not disturb additional vegetation and habitat.</li> <li>• Rehabilitation activities should focus on clearing the litter from the area outside the landfill and establishing a soil cover over the litter on site.</li> </ul>



## 6. ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE

### 6.1 Documentation

The following documentation must be kept on the project site for the full duration of closure and conversion:

- Environmental Management Programme;
- Environmental Authorisation/s (e.g. Waste Management License);
- Environmental monitoring reports;
- Environmental incident book;
- Communications Register;
- Register of audits; and,
- Non-conformance reports.

### 6.2 Responsibility Matrix and Organogram

The Landfill Supervisor has in terms of its environmental management system, a Responsibility Matrix and Organogram. This shall be displayed in an appropriate location. This identifies responsible parties, their contact details, and highlights their roles and responsibilities. This document must be updated on a regular basis to ensure that information is correct.

### 6.3 Environmental Inspections and Audits

Audits will be conducted to monitor compliance with the EMPr. Photographic records will support the visual assessment. External auditing may take place at unspecified times.

### 6.4 Non-Conformance Report

The Non-Conformance Report (NCR) process shall be in terms of the Landfill Site's environmental management system.

The following information is typically recorded in the NCR:

- Details of non-conformance;
- Any plant or equipment involved;
- Any chemicals or hazardous substances involved;
- Work procedures not followed;
- Any other physical aspects;
- Nature of the risk;
- Actions agreed to by all parties following consultation that should adequately address the identified non-conformance. This may take the form of specific control measures and should take the hierarchy of controls into account. This must accompany the NCR for filing purposes;
- The agreed timeframe by which corrective actions should be completed;
- The Landfill Site representative should verify that the agreed actions have been taken on or soon after the agreed completion date. Where the actions are complete, the Landfill Site representative should sign the Close-Out portion of the Non-Conformance Form and file it; and,
- The measures put in place to prevent any future reoccurrence of the problem.

### 6.5 Environmental Emergency Response

The Landfill Site environmental emergency procedures must ensure that there will be an appropriate response to unexpected or accidental actions or incidents that could cause environmental impacts. Such incidents may include:

- Accidental discharges to water (i.e. into a water resource) and land;
- Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- Accidental toxic emissions into the air; and,
- Specific environmental and ecosystem effects from accidental releases or incidents.

The Environmental Emergency Response Plan is separate to the Health and Safety Plan as it is aimed at responding to environmental incidents and must ensure to include the following:

- All employees shall be adequately trained in terms of incidents and emergency situations;
- Details of the organisation (manpower) and responsibilities, accountability and liability of personnel;
- A list of key personnel and contact numbers;
- Details of emergency services (e.g. the fire department, spill clean-up services) shall be listed;
- Internal and external communication plans, including prescribed reporting procedures;
- Actions to be taken in the event of different types of emergencies;
- Incident recording, progress reporting and remediation measures to be implemented;
- Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release; and,
- Preventative measures to be taken in future.

## **6.6 Communications Register**

All complaints or communications that are received from I&APs or any other stakeholder must be recorded in a Communications Register. These complaints and communications will be investigated and a response to the complainant, I&APs or stakeholder will be given within 10 days. The Communications Register shall include the following information:

- Record the time and date of the complaint/communication;
- A detailed description of the complaint/communication;
- Findings from investigation into the cause of the problem;
- Action and resources used to correct the problem;
- Action taken to prevent a reoccurrence of the problem;
- Photographic evidence of the problem (where possible);
- A written response to the Complainant indicating rectification of the problem; and,
- Information regarding the relevant authority that was contacted or notified in writing (person, time and date).

## **6.7 Good Housekeeping**

The Landfill Site is to practice good housekeeping throughout the closure and conversion life-cycle. This should eliminate disputes about responsibility and facilitate efficiency. Records of such actions taken to ensure the maintenance and management of housekeeping must be recorded.

## **6.8 Management of Environmental Requirements**

The Landfill Supervisor shall record and report upon environmental management measures undertaken to mitigate assessed impacts upon the environment.

## **6.9 Management and Control**

The Landfill Supervisor is to implement environmental management in terms of its environmental management system.

Appropriate measures shall include:

- Appointment of necessary resources to monitor and manage environmental requirements;

- Implement aspect specific method statements to deal with emergency situations;
- Provision of adequate emergency response equipment to mitigate and manage an incident or emergency; and,
- Provision of specific training related to implementation of environmental management requirements.

#### **6.10 Recording and reporting**

The Landfill Supervisor shall maintain detailed records of parameters monitored. These detailed records shall demonstrate the effectiveness of the management actions implemented to mitigate potential impacts.

The Landfill Supervisor shall compile a database/report of management works implemented in terms of and at the frequencies stipulated by the environmental management system requirements.

#### **6.11 Monitoring**

The Landfill Supervisor shall compile an Environmental Monitoring procedure which details the scope, nature, process, schedule and templates for environmental monitoring. The procedure shall in be in line with the environmental management system requirements.

The monitoring results shall be used to determine the effectiveness of the management programme.

All complaints, compliments or other comments relating to environmental management parameters are to be recorded in the site issues register for inclusion in the project issues register held by the Landfill Supervisor.

Monitoring results and the associated required management and mitigation actions for the coming monitoring period are to be presented in the monitoring section of the Monthly Report. The Landfill Supervisor shall monitor and maintain the following on an on-going basis, if applicable:

- Re-growth of alien invasive vegetation;
- Storm water systems;
- Topsoil and backfill volumes;
- Access road condition;
- Noise;
- Erosion prevention;
- Landscaping requirements;
- Spoil management; and,
- KPI monitoring schedule.

## **7. TRAINING AND INDUCTION OF EMPLOYEES**

The Landfill Supervisor is to take responsibility for the management of staff on the Landfill Site during operations and supervise them closely at all times. The onus is on him to make sure that all staff and Sub-Contractors fully comprehend the contents of the EMP. The environmental awareness training programmes should, therefore, be targeted at the two levels of employment: management and labour. Environmental awareness training programmes need to be formulated for these levels and must comprise:

- A record of all names, positions and duties of staff to be trained;
- A framework for the training programmes;
- A summarised version of the training course(s); and
- An agenda for the delivery of the training courses.

Such programmes will set out the training requirements, which need to be conducted prior to any construction works occurring and will include:

- Acceptable behaviour with regard to flora and fauna;

- Maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, lubricants, cement, mortar and other chemicals;
- Responsible handling of chemicals and spills;
- Environmental emergency procedures and incident reporting; and,
- General code of conduct towards I&APs.

## 8. ASPECT AND ACTIVITIES MATRIX

Environmental aspects identified, as well as aspects generally associated with landfill closure activities have been identified and listed in the following table. The Landfill Supervisor will be required to check which aspects may be affected and to put measures in place to mitigate or reduce the impacts on each aspect.

**Table 6: Environmental Specifications – Closure**

Activity /Issue	Action required
<b>Closure</b>	
<b>Site Offices</b>	<p>Fires will not be allowed on the site.</p> <p>The site will be kept clean, neat and tidy at all times and all materials are to be stored in a neat and organised manner. Should existing buildings be used, these should be maintained at all times.</p> <p>The Municipal Manager will supply at the very least chemical toilets. These shall be secured to prevent them from being knocked or blown over. The use of the natural bush for ablution purposes is strictly prohibited.</p> <p>Should water and electricity supply not be available on site, the Landfill Supervisor is to supply generators and water tanks. Water from mains supply must be agreed to with the Municipal Manager.</p> <p>Deviation from the existing access roads must be planned to limit disturbance of the environment (maximum 3m in width and following the contours), including birds, animals, reptiles and their habitat as much as possible, and must have the approval of the ECO and the landowner.</p> <p>All route deviations must be approved by the Municipal Manager and ECO.</p>
<b>Safety and Security at the Sites</b>	<p>Access to the site must be restricted and guarded.</p> <p>The site must be secured to reduce opportunities for criminal activity.</p> <p>Trenches and potential hazardous areas must be demarcated and clearly marked.</p> <p>No firearms (except security personnel), alcohol or drugs are allowed on site.</p> <p>Trespassing on private properties that adjoin the site is forbidden.</p>
<b>Training and Induction</b>	<p>The Landfill Supervisor must ensure that all people involved in the closure (including sub-contractors and casual labour) are aware of and familiar with the environmental requirements. The Landfill Supervisor is responsible for providing the site foreman with at least one hour of environmental training and for ensuring that the foreman will be able to adequately pass the information on to staff. Topics of this training must include:</p> <ul style="list-style-type: none"> <li>• The meaning of environment;</li> <li>• Acceptable behaviour with regard to flora and fauna;</li> <li>• Management and minimisation of waste;</li> <li>• Maintenance of equipment to prevent the accidental discharge or spill of fuel, oil, lubricants and other chemicals;</li> <li>• Responsible handling of chemicals and spills; and,</li> <li>• Emergency procedures and incident reporting.</li> </ul> <p>The Landfill Supervisor must monitor the performance of the workers to ensure that the topics that were covered during their training and induction have been understood and are</p>

Activity /Issue	Action required
<b>Closure</b>	<p>being followed.</p> <p>Environmental awareness posters should be used on site.</p> <p>If required, the ECO and/or a translator may be requested to explain aspects of environmental or social behaviour that are unclear on site.</p> <p>The Landfill Supervisor must ensure that all staff on site has undergone basic fire-fighting and spill management training prior to arrival on site.</p>
<b>Complaints Register</b>	<p>Any complaints received will be investigated and a response will be given to the complainant within 7 days. Complaints received from the community must be recorded in the Complaints Register. The complaint will be brought to the attention of the Municipal Manager, who will respond accordingly. Detailed information has to be recorded, including:</p> <ul style="list-style-type: none"> <li>• The name and contact details of the complainant (if not anonymous);</li> <li>• The date, time and nature of the complaint;</li> <li>• The response and investigation undertaken; and,</li> <li>• Which actions were taken and who the name of the person responsible for the action.</li> </ul> <p>The Landfill Supervisor shall assist the Municipal Manager in responding to queries and complaints from the public pertaining to site establishment and activities by:</p> <ul style="list-style-type: none"> <li>• Documenting the details of such communications and submitting the information to the Municipal Manager for inclusion in the complaints register;</li> <li>• Bringing any such matters to the attention of the Municipal Manager as soon they arise;</li> <li>• Taking any remedial action as instructed by the Municipal Manager or the ECO; and discussing such matters at the site meetings.</li> </ul> <p>The Landfill Supervisor shall make selected staff available for any formal consultation with affected parties for explaining the process and answering such parties' questions.</p>
<b>Emergency Response</b>	<p>An emergency response and contingency plan must be in place to limit the extent of any actions that may result in significant environmental damage. Such actions include:</p> <ul style="list-style-type: none"> <li>• Establishment of procedures and policies to ensure that an incident does not recur;</li> <li>• Development, review and testing of an emergency and contingency plan;</li> <li>• Emergency organisation (manpower) and responsibilities, accountability and liability;</li> <li>• A list of key personnel;</li> <li>• Details of emergency services applicable (e.g. the fire department and spill clean-up services);</li> <li>• Internal and external communication plans, including prescribed reporting procedures where required by legislation;</li> <li>• Actions to be taken in the event of different types of emergencies;</li> <li>• Appropriate training of all staff will with regard to emergency responses;</li> <li>• Incidents will be reported immediately to the responsible person;</li> <li>• Documentation of all incidents in the environmental incident register; and</li> <li>• Recording of detailed information, including: <ul style="list-style-type: none"> <li>○ The name and contact details of the complainant (if not anonymous).</li> <li>○ The date, time, location and nature of the complaint.</li> <li>○ The response and investigation undertaken.</li> <li>○ Which actions were taken and who was responsible for the action.</li> <li>○ Information regarding the relevant authority that was contacted or notified in writing (person, time and date).</li> </ul> </li> </ul>

Activity /Issue	Action required
<b>Closure</b>	
<b>Demarcated Areas</b>	Routes for temporary access shall be located within the approved demarcated areas and vehicle movement shall be confined to these roads. Movement of vehicles outside the designated working areas shall not be permitted without authorisation from the ECO.
<b>Storage of Fuel and other Materials</b>	<p>Once the Landfill Supervisor has been appointed, the following actions will be undertaken:</p> <ul style="list-style-type: none"> <li>• An emergency response plan will be prepared.</li> <li>• Fuel, lubricants, transmission, and hydraulic fluids shall only be stored in designated areas.</li> <li>• Areas made available for fuelling or greasing equipment and vehicles must be clearly demarcated. A drip tray must be used to prevent soil pollution. No fuelling, greasing or filling of oils may take place outside these demarcated areas.</li> <li>• The Landfill Supervisor must provide adequate and approved facilities for the storage and recycling of used oil and contaminated hydrocarbons. Such facilities must be designed and sited with the intention of preventing the pollution of the surrounding area and environment.</li> <li>• The Landfill Supervisor shall provide spill response kits and enough of the correct type of drip trays to prevent, contain and mop up any spill envisaged on site.</li> </ul>
<b>Control of Damage to Plants and Animals</b>	<p>In principle, the ideal is to minimise damage to natural habitats within the designated area. In practice, however, it is sometimes unavoidable, in which case the aim is to rehabilitate the disturbed land according to the EMPr and the ECO's instructions.</p> <p><b>Destruction and Removal of Plants:</b></p> <p>No indigenous shrubs and/or trees shall be cut down by the Landfill Supervisor, unless authorised by the ECO in consultation with the specialist ecologist. Removal, damage, or disturbance of any plant outside the designated area is not permitted. Special care shall be taken not to disturb or destroy riverine vegetation.</p> <p>Gathering of firewood shall not be permitted.</p> <p><b>Disturbance of Animals:</b></p> <p>No animals (birds, reptiles, amphibians, insects or mammals) that reside within or adjacent to the site shall be killed or unnecessarily disturbed.</p>
<b>Control of Pollution</b>	<p>As a minimum requirement, all waste emissions (hazardous, airborne, liquid and solid) from the site shall be kept within the limits of standards set in terms of relevant national and local pollution legislation and regulations.</p> <p><b>General</b></p> <p>No waste of a solid, liquid or gaseous nature shall be emitted from the site without approval from the Municipal Manager and ECO.</p> <p>Precautionary measures must be taken to prevent any form of pollution.</p> <p>Accidental pollution incidents shall be reported to the Municipal Manager immediately after they occur and shall be cleaned up (to the satisfaction of the ECO) by the Landfill Supervisor or a nominated clean-up organisation.</p> <p><b>Soil</b></p> <p>Vehicle and plant maintenance shall be confined to the areas demarcated for this purpose. Should any amount of fuel, oil, transmission or hydraulic fluids be spilled onto the soils, the Municipal Manager or ECO shall be informed immediately. Tests must be conducted to determine the extent of soil contamination as soon as a spillage occurs. The polluted soil shall be rehabilitated or remediated to the satisfaction of the ECO.</p> <p><b>Water</b></p> <p>Water containing waste shall be prevented from entering water sources either by seepage or natural flow. On-site stormwater management shall be to the satisfaction of the Municipal Manager.</p>

Activity /Issue	Action required
<b>Closure</b>	
	<p>Air</p> <p>All reasonable measures should be taken to minimise air emissions in the form of smoke, dust and gases.</p>
<b>Management of Waste</b>	<p>In practice, all wastes arising from closure activities are to be handled, transported and disposed of in accordance with the relevant regulations. All efforts shall be made to minimise, reclaim or recycle waste and, failing that, to dispose of it in a manner that is licensed by the competent authority for that purpose.</p> <p>Sanitation</p> <p>The Landfill Supervisor shall provide adequate sanitation facilities in the form of chemical toilets at the site camp and at the site for staff and visitors.</p> <p>The use of the surrounding veld as a toilet facility is not permitted under any circumstance.</p> <p>Wastewater</p> <p>Wastewater is water that is contaminated by humans through their actions.</p> <p>All wastewater runoff from disturbed areas shall be collected in settlement ponds.</p> <p>Solid Waste</p> <p>Solid waste refers to all construction waste (such as rubble, cement bags, waste cement, timber, cans, other containers, wires and nails), household and office waste.</p> <p>Solid waste shall be collected and stored in demarcated, fenced areas in skips and/or bins. The fenced areas or containers shall be designed to be weather and rodent proof and should be strategically and conspicuously placed throughout the site.</p> <p>Wherever possible, solid waste that is recyclable shall be recycled.</p> <p>Hazardous Wastes</p> <p>Hazardous wastes are wastes that are proven to be toxic, corrosive, explosive, flammable, carcinogenic, radioactive, poisonous or as determined by the Hazardous Substances Act (Act 15 of 1973) as amended.</p> <p>The discharge of hazardous chemicals (such as hydraulic fluid, degreaser and drilling fluid), as declared under the Hazardous Substances Act as amended, on the site or into the river is prohibited.</p> <p>Potentially hazardous raw and waste materials shall be handled and stored on site in containers with tight lids that must be sealed and must be disposed of at an appropriately permitted hazardous waste disposal site. Such containers must not be used for purposes other than those they were originally designed for.</p> <p>The following hazardous waste products shall be disposed of at a waste disposal site approved by the ECO:</p> <ul style="list-style-type: none"> <li>• Diesel and petroleum; and</li> <li>• Oil and lubricants;</li> </ul> <p>The Landfill Supervisor must maintain a hazardous material register.</p>
<b>Control of Disturbance to Neighbours and/or Affected Parties</b>	<p>Noise</p> <p>All noise levels must be controlled at the source. All employees must be given the necessary ear protection.</p> <p>Noise emanating from operational and rehabilitation activities must not be "disturbing noise"; that is, the sound level from the site measured at the nearest dwelling must not exceed the ambient noise level by 7dBA or more.</p> <p>Appropriate directional and intensity settings should be maintained on hooters and sirens, if applicable.</p> <p>Silencer units on plant and vehicles shall be maintained in good working order.</p> <p>Where required, the Landfill Supervisor shall provide noise attenuation measures in the form of cladding and earth berms between sources of on-site noise and neighbours and/or</p>

Activity /Issue	Action required
<b>Closure</b>	
	<p>affected property owners.</p> <p>A speed restriction of 10km/h shall be imposed on all vehicles to limit additional noise that could be generated by these vehicles.</p> <p>Dust</p> <p>The Landfill Supervisor shall implement measures to restrict the generation of dust during operation, rehabilitation and other related activities. Roads and working areas shall be maintained regularly and this may include spraying water or the application of dust palliatives. Water used for this purpose shall be used in quantities that are small enough not to generate run-off and cause soil erosion.</p> <p>The Landfill Supervisor shall control dust from spoil dumps as specified above.</p> <p>Stockpiles of soil must be kept covered or must have a suitable dust palliative applied, such as water or commercial dust suppressants, to prevent windborne pollution.</p> <p>Social Interaction and Disruption</p> <p>The Landfill Supervisor's activities and movement of staff shall be restricted to designated areas only. The Landfill Supervisor and site staff may not interact directly with adjacent landowners but only through the Municipal Manager, who will contact property owners to obtain permission.</p> <p>The Landfill Supervisor's staff shall wear identity cards (with the employee's photograph displayed on the card) to make identification possible at all times. Any temporary staff employed by the Landfill Supervisor or sub-contractor shall also comply with this clause.</p> <p>Traffic Control</p> <p>All reasonable precautions must be taken during operational and rehabilitation activities to avoid severely interrupting the traffic flow on existing roads.</p>

Table 7: Environmental Specification – Rehabilitation

Activity /Issue	Action required
<b>Closure</b>	
<b>Environmental Acceptability</b>	The site shall be rehabilitated to ensure there are no adverse effects on the surrounding environment.
<b>Regulatory Requirements for Closure and conversion</b>	A closure application is submitted to the Northern Cape Department of Environmental and Nature Conservation in accordance to the regulatory requirements for site closure for non-permitted sites. The application covers site investigations to determine closure requirements prior to the commencement of rehabilitation.
<b>Demolition and Site Clean Up</b>	<p>The remaining waste from the site and surrounding areas shall be collected for transfer to the nearest appropriate landfill site.</p> <p>Re-contouring: The profile, soil condition and landform of the waste site shall be restored to a similar state to the surrounding landscape to provide for homogenous representivity. Areas requiring re-contouring shall be stripped of the top 150 mm of topsoil and this shall be stockpiled separately from other soil stockpiles.</p> <p>Scarification and ripping: All areas where re-contouring interventions are required shall be cross-ripped before topsoil placement. Topsoil shall be uniformly scarified to allow for vegetation growth. Ripping depths shall be determined by the depths identified for the soil profiles during the pre-construction survey.</p> <p>Topsoil placement: Topsoil shall be uniformly replaced to a depth of 150 mm within areas</p>



Activity /Issue	Action required
<b>Closure</b>	
	where previously removed for re-contouring purposes.
<b>Soil Remediation</b>	<p>Fertilising: Soil analysis tests on the top 75 mm of prepared surface shall be performed prior to revegetation/seeding to determine the required fertiliser levels for vegetative cover. These levels should be in line with the following used for dry land production of pasture grasses: Nitrogen at 70kg/ha-1, Potassium at 40kg/ha-1 and Phosphorus at 20kg/ha-1. The fertiliser application rate will be dependent on the fertiliser mix and application rates as identified during soil analysis. These requirements will be determined from findings following tests done on adjacent lands or prior to decommissioning and rehabilitation activities commencing. Fertilisers shall contain both macro and micro elements.</p>
<b>Hydro seeding</b>	<p>Seed acquisition: Seed shall be purchased from a South African National Seed Organization (SANSOR) accredited dealer. Seed used for rehabilitation shall not be older than one season. Purchased seed must be of the correct species and of known origin, dried and packed, conforming to all legal requirements for seed. Proof of compliance must be provided to the Municipal Manager prior to commencement of works.</p> <p>Hydro seeding/Conventional Seeding: The Municipal Manager shall appoint a reputable hydro seeding/conventional seeding company to undertake the hydro seeding/conventional seeding. The appointed contractor shall ensure that an approved hydro seeding machine is used capable of dispensing a uniform solution of seed, anti-erosion compound, fertiliser and water.</p> <p>The seed mix required for re-vegetation will be dispensed at a rate of not less than 20 kilolitres of water per hectare. This mixture will comprise a selection of species that are indigenous and locally occurring, and capable of growing under natural conditions.</p> <p>Hydro seeding/conventional seeding shall only be carried out after the first good rains (minimum of 5 mm) have fallen during the summer rainfall period. All hydro seeding/conventional seeding activities shall be completed one month before the end of the growing season.</p> <p>The grass cover requirements at the end of the growing seasons following the rehabilitation work and hydro seeding are:</p> <ul style="list-style-type: none"> <li>• 60% cover of the approved seed mix species diversity after the first growing season.</li> <li>• 80% cover of the approved seed mix species diversity after the second growing season.</li> </ul> <p>The appointed contractor shall be held liable during the Defects Notification Period applicable to rehabilitation will commence when the 60% grass cover is achieved and end when 80% grass cover is achieved.</p>
<b>Alien Vegetation Control</b>	<p>The rehabilitated areas shall be maintained weed and invader plant free. An active programme must be implemented to ensure no further spread of these plants in adjacent areas occurs. Control of weeds and invader plants must be done in accordance with accepted control measures implementable for each species.</p> <p>All weeds and invader plants shall be controlled before the setting of seeds. All such material must be removed to a registered landfill site. The transportation of such material must not result in the spread of weeds and invader plant species along public or private roads.</p>
<b>Reinstatement</b>	The site must be fenced with a locked gate in order to restrict access and prevent illegal

Activity /Issue	Action required
<b>Closure</b>	
<b>of Infrastructure</b>	dumping.
<b>Prevention of Further Illegal Dumping</b>	<p>Fencing: Fencing must be maintained once installed.</p> <p>Signage: The Municipal Manager shall ensure placement of signage close to the road informing the public of site closure and conversion and providing details on alternative transfer sites.</p> <p>Security: Maintain security at the site for a short period after closure to prevent potential illegal dumping and / or vandalism.</p> <p>Education and awareness: Provide environmental education and awareness with regard to the importance of utilising skips and waste containers in waste management.</p>

## 9. Engineering Closure Methods for the Vioolsdrift Landfill

### 9.1 Aim and Objectives

The aim is to provide guidelines for closure of the existing communal landfill site. The Vioolsdrift landfill site is unlicensed and pre-date the according to DWAF (1998). Consequently compliant planning, engineering and operations were not implemented at the sites.

All waste disposal facilities need to be closed and rehabilitated after their intended design life. Closure plans are best developed before a landfill is put into service, but in this case, no proposed closure plan was ever prepared. Thus, a rehabilitation plan is required to close the site and to monitor the effectiveness of the closure into the future.

According to DWAF (1998) the requirements for the closure of a landfill site are summarized below. In terms of the Minimum Requirements, the closure and end use plan must include the following:

- Evaluation of the current status of the landfill;
- Comparison of the current status of the landfill with the closure design including end use requirements;
- Recommendations for upgrading the existing condition of the landfill to that desired; and
- Detailed plans for management, monitoring, inspection and maintenance of the site once it has been closed.

The current status of the landfill is detailed in the main Basic Assessment Report, of which this is an Appendix. This report is structured as follows:

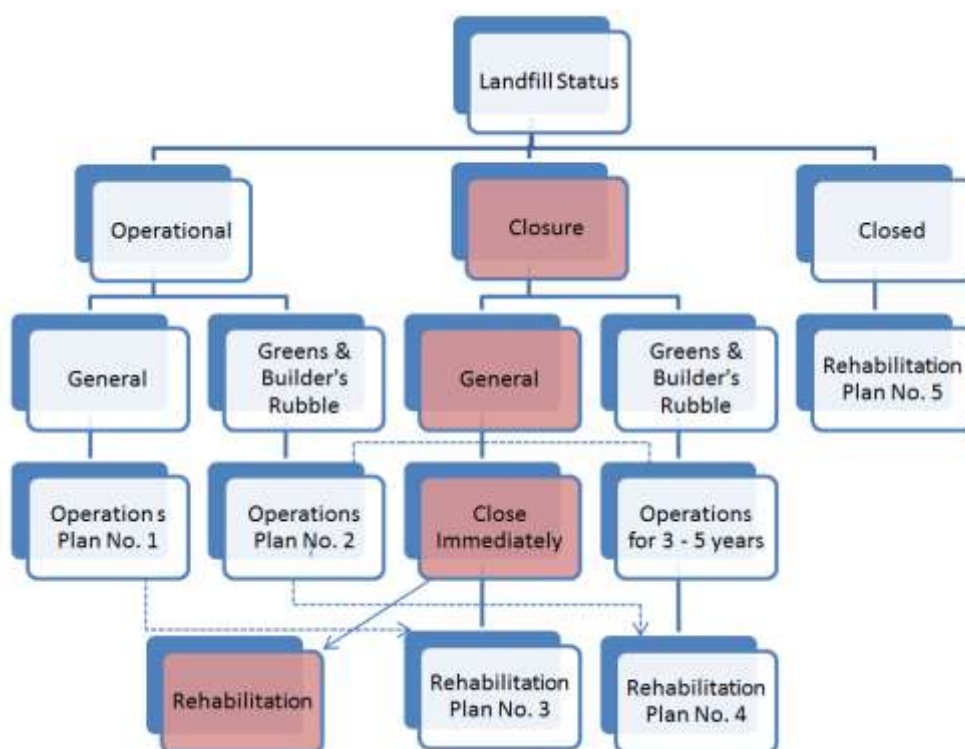
- Identification of end land use;
- Conceptual closure design and proposals for rehabilitation;
- Closure design; and
- Monitoring and auditing.

### 9.2 Identification of End Land Use

There are many different options and alternatives for end use of landfills including agricultural use, ecological uses, recreational and amenity uses, etc. The choice of the desired end use is typically influenced by a number of factors including:

- Type of waste and associated operational constraints;
- Size, location and access;
- The development plan or framework;
- The aspirations of local residents, interest groups, etc;
- Scheme economics; and
- Long-term management requirements.

The site in question needs to be closed and rehabilitated to prevent any further disposal of waste and contamination of land. The closure will entail earthworks and capping as described hereafter. Final end use of the site will then be open field where natural vegetation will be re-introduced and the site could be used for grazing or other agricultural uses at a later stage. The appropriate route for rehabilitation of the landfill will be as shown in **Figure 2** below.



**Figure 2: Appropriate rehabilitation flow diagram**

### 9.3 Conceptual Closure Design and Proposals for Rehabilitation

The Closure design and proposals for rehabilitation made under this section of the Report address the requirements as per DWAF (1998). The following recommendations are made in order to prevent or reduce the impact of the landfill on the geohydrology by:

- Removing the waste from the site and rehabilitating the area.
- It is recommended that the existing fence be maintained to ensure that no further development or dumping of additional waste of any kind be carried out.

### 9.4 Requirements for Closure Design

The final closure design:

- Ensures that any identified pollution risk is mitigated and managed. Pollution control is the primary function of the closure design; and

- Separates the waste in the landfill from its surrounding environment.

**Table 10: Engineering Specifications – Closure Design**

Activity /Issue	Action required
<b>Closure</b>	
<b>Closure Methodology</b>	<p>The following steps are envisaged in the closure design:</p> <ul style="list-style-type: none"> <li>• Consolidate the waste on the site in skips and take to a legal landfill. Ensure that all the waste on site has been removed by digging test holes to determine if waste was buried in the past.</li> <li>• Repair the erosion gullies and depressions in the ground by filling them up and stabilising them.</li> <li>• Place a “no dumping” notice at the site.</li> <li>• Fence the site so that no illegal dumping can take place.</li> <li>• Place a skip either near the gate or near the town of Violsdrift for the community to dispose their waste.</li> </ul>
<b>Stormwater Management System</b>	<p>Storm water management and drainage planning are critical components on waste management sites during operations and after closure of the site. Therefore the storm water management infrastructure should be designed to comply with Government Notice 704 of the National Water Act (NWA) of 1998.</p> <p>By consolidating all the waste that was disposed of at the Violsdrift landfill site and closing the site to ensure that no more waste is disposed of in the future, potential water contamination will be mitigated.</p> <p>Intercept drains and a conservancy tank will be constructed to confirm there is no residual waste that can generate leachate.</p>
<b>Final cover</b>	<p>After the waste has been removed from site, 150mm topsoil must be placed on the area where the waste was. The site must then be seeded a mixture of indigenous grasses, and allowed to propagate to form a health grass community on the site. The grassing and vegetation must commence immediately after final capping in order to prevent soil erosion.</p>

## 10. TIMEFRAMES FOR REHABILITATION

Rehabilitation works shall proceed after the first good rains (minimum of 5 mm) have fallen during the rainfall period. All hydro seeding/conventional seeding activities shall be completed one month before the end of the growing season.

## 11. POST CLOSURE AND CONVERSION MONITORING, INSPECTIONS AND MAINTENANCE

The appointed contractor will be responsible for environmental control on site during rehabilitation and the maintenance period. During rehabilitation, activities will be monitored and recorded by an ECO and audited against the EMP. Photographic records of the site will support the visual assessment. Monitoring and incident information will be communicated to the Municipal Manager. Any complaints will be recorded and investigated. After rehabilitation, the site needs to be inspected and monitored to ensure that the rehabilitation activities have been successful and maintained. The monitoring actions are:

- Inspection of all erosion and sediment control devices on a regular basis, particularly after heavy rains; and,
- Ongoing assessment of unsuccessful areas and erosion, stability and drainage re-establishment.

Incident reports will be checked to ensure that appropriate follow-up actions were taken. The specifications made under this section address the requirements as per the Minimum Requirements for Waste Disposal by Landfill (DWAF, 1998).

**Table 8: Engineering Specifications – Post Closure and Conversion Monitoring**

Activity /Issue	Action required
<b>Closure and conversion</b>	
<b>On-going Monitoring</b>	<p>Site Inspections, maintenance and management</p> <p>The following specifications are important in order to meet the requirements on-going site inspections, maintenance and management.</p> <ul style="list-style-type: none"> <li>• The fence must be regularly inspected so that no further development or dumping of additional waste of any kind can be carried out after the closure of the site.</li> <li>• Ongoing monitoring of the water (if any) in the conservancy tank to determine if any residual waste is generating leachate.</li> <li>• The site must be inspected at 3 monthly intervals. Once the stability of the site has been established, the inspection interval can be extended in consultation with the Department.</li> <li>• Any areas of subsidence must be filled.</li> <li>• The vegetation that has been established on the landfill needs to be maintained in order to prevent erosion.</li> <li>• Alien vegetation must be removed.</li> </ul>

## 12. CONCLUSION

The activities set out in this EMPr will effectively manage any current and residual impacts on the closure of Violsdrift landfill. It must be further noted that:

- A professional engineer must sign off on the construction works to confirm that it complied with the engineering design requirements;
- The design and placement of the Waste Transfer Facility must be undertaken by a professional engineer appointed directly by the Nama Khoi Local Municipality;
- Closure should commence during the 2017 / 2018 financial year, to allow the Municipality time to allocate budget;
- Ongoing management on site must be maintained and waste must be immediately diverted from site to the nearest licenced landfill; and
- On-site monitoring must continue until the Department of Environment and Nature Conservation (DENC) and the Municipality are satisfied that no further potential environmental impacts are identified.



## 13. REFERENCES

- AECOM, (2015). *Basic Assessment Report. Closure License Application for the Vioolsdrift Landfill Facility*, Pretoria, South Africa.
- Zenande Leadership and Linkd Environmental Services, (2013). *Nama Khoi Local Municipality Draft Integrated Waste Management Plan*, Northern Cape, South Africa.
- Department of Water Affairs and Forestry, (1998). *Minimum Requirements for Waste Disposal by Landfill*, Pretoria, South Africa.