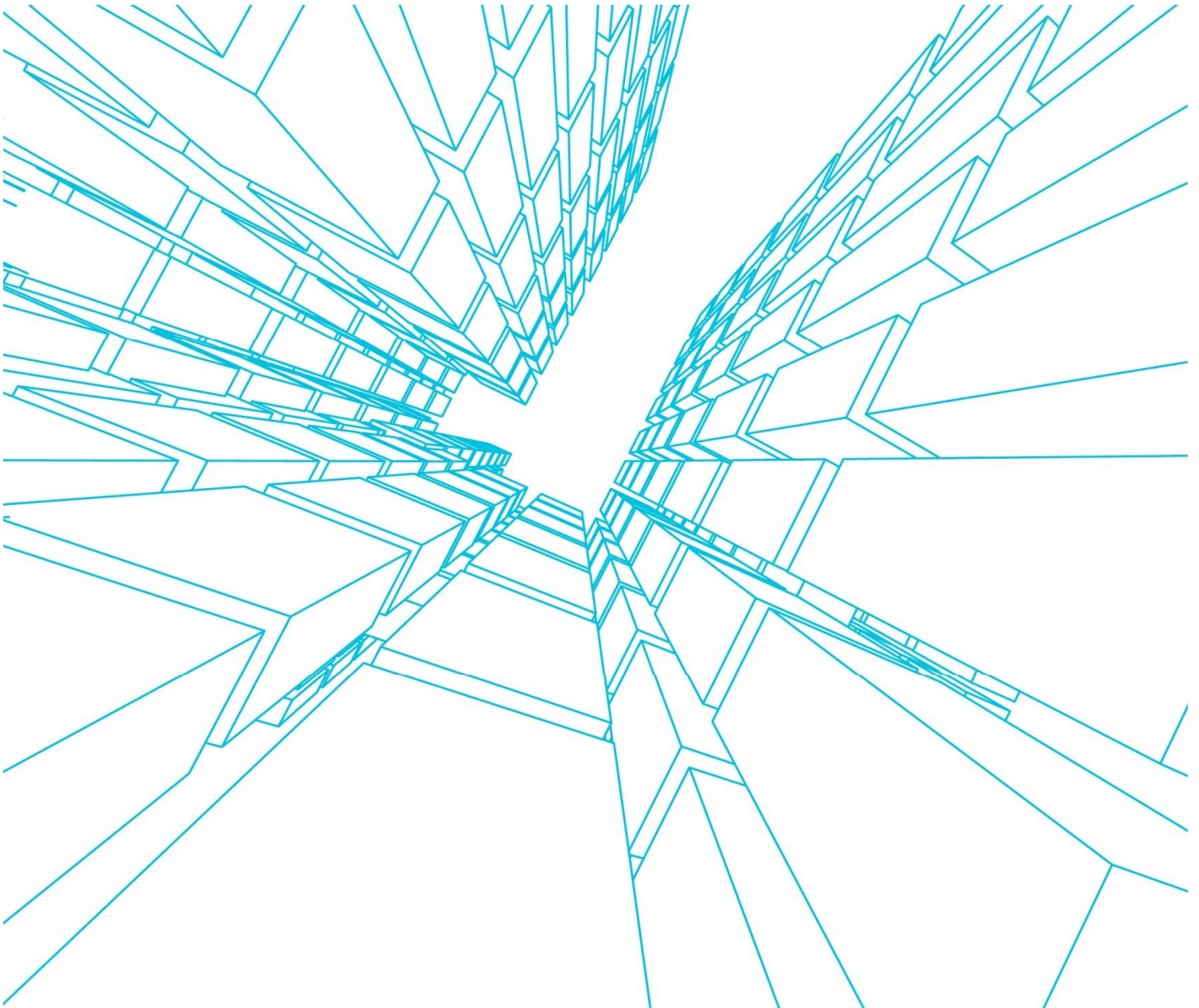


Environmental Management Programme – Operation of Landfill Site: Nondweni



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Contents

1.	PURPOSE AND SCOPE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME	9
1.1	Introduction	9
1.2	Details of the Authors	10
1.3	Project Description	10
1.3.1	Operation Authorisation Process	11
2.	BACKGROUND TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME	12
2.1	Purpose of this EMPr	12
2.2	Nature of the EMPr	12
2.3	The Continuous Improvement Approach	13
2.3.1	Plan	13
2.3.2	Do	13
2.3.3	Check	14
2.3.4	Act	14
3.	LEGAL REQUIREMENTS	14
4.	EMPR ORGANISATION, RESPONSIBILITY AND AUTHORITY	17
4.1	Roles and responsibilities	17
4.1.1	Duties and Powers of the Municipal Manager	17
4.1.2	Duties and Powers of the Landfill Supervisor	17
4.1.3	Duties and Powers of the Environmental Control Officer	18
4.1.4	Duties of the Contractor	18
5.	SUMMARY OF IMPACTS / ASPECTS	19
6.	ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE	20
6.1	Documentation	20
6.2	Responsibility Matrix and Organogram	20
6.3	Environmental Inspections and Audits	21
6.4	Non-Conformance Report	21
6.5	Environmental Emergency Response	21
6.6	Communications Register	22
6.7	Good Housekeeping	22
6.8	Management of Environmental Requirements	22
6.9	Management and Control	22
6.10	Recording and reporting	22
6.11	Monitoring	22
7.	TRAINING AND INDUCTION OF EMPLOYEES	23
8.	ASPECT AND ACTIVITIES MATRIX	23

9.	TIMEFRAMES.....	41
10.	CONCLUSION	41
11.	REFERENCES.....	41

List of Tables

Table 1-1: Terminology	4
Table 1-2: Acronyms	8
Table 1-1: Authors' Details.....	10
Table 3-1: Legislation applicable to waste management.....	14
Table 5-1: Summary of impacts which can be expected during operations	19
Table 8-1: Operation and Maintenance Specifications	25
Table 8-2: Elements of the storm water management system.....	38

List of Figures

Figure 2-1: The Continual Improvement Cycle	14
Figure 8-1: Proposed capping for the Nondweni landfill site	31
Figure 8-2: Waste disposal profile on a sloped terrain.....	32
Figure 8-3: Requirements for Class B Liner	33
Figure 8-4: Leachate cut-off trench.....	35

Table 1-1: Terminology

Terminology	Explanation
Activity	Any action needed for the design, physical investigations and rehabilitation associated with the landfill site.
Alien species	A species occurring in an area outside of its historically known natural range as a result of intentional or accidental dispersal by human activities.
Builder's rubble	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.
Bulky Waste	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.
Cell	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.
Clean Garden Waste	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.
Closure	The act of terminating the operation of a landfill. Closure is preceded by rehabilitation and followed by end-use and post-closure monitoring.
Commercial Waste	Solid waste generated by stores, offices and other activities not involved in manufacturing.
Communication register	A register aimed at tracking all communication activities in the project.
Compaction	The process whereby the volume of waste is reduced, using a purpose built compactor or other suitable machine.
Compaction Density	The mass of a body of solid waste divided by the volume (after compaction) occupied by that same body of waste.
Compaction Ratio	The ratio of the volume of loose waste to the volume of the same waste after placement and compaction.
Compost	Organic waste that has undergone microbial degradation, to produce a contaminant- and nuisance free product of potential value as a soil conditioner.
Contaminated water	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.
Cover Material	Soil or other suitable material like builders' rubble or clinker ash that is used for enclosing a body of compacted waste.
Daily Cell	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.
Department of Water & Sanitation (DWS)	The authority responsible for water management.
Development Plan	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.
Domestic Waste	Solid waste that originates in a residential environment.
Engineer	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.
Environment	The surroundings in which humans exist and which comprise: <ul style="list-style-type: none"> • the land, water and atmosphere of the earth; • micro-organisms and vegetation and animal life; • any part or combination and interrelationships; and

Terminology	Explanation
	<ul style="list-style-type: none"> the physical, chemical, aesthetic, historical, cultural and economic properties and conditions of the foregoing that can influence human health and well-being.
Environmental aspect	A product's or production process's environmental impact or important issues in the environment that an organisation should take into consideration.
Environmental Audit	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.
Environmental Authorisation (EA)	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 (SEMA's).
Environmental Control Officer (ECO)	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.
Environmental impact	Any change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation's environmental aspects.
Environmental Impact Assessment (EIA)	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.
Environmental Management Programme (EMPr)	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.
Fauna	All species of animals found in a particular region or environment.
Fire Danger Index	A relative number denoting an evaluation of rate of spread, or suppression difficulty for specific combinations of fuel, fuel moisture and wind speed.
Fire hazard	The relative combination of fuel, oxygen and heat that will lead to the start and spread of a potential fire.
Flood line	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.
Flora	All species of vegetation found in a particular region or environment
General Waste	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.
Groundwater	The water that fills the natural openings in below-surface rock or unconsolidated sands.
Hazardous waste	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.
Heritage resources	Any place or object of cultural, archaeological or paleontological significance in terms of the National Heritage Resources Act, 1999.
Induction training	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.
Industrial Waste	Non-toxic and non-hazardous solid waste resulting from industrial processes and manufacturing.
Interested and Affected Parties (I&APs)	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.
Landfill (v)	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.

Terminology	Explanation
Landfill (n)	The waste body created by landfilling. This may be above or below ground level, or both.
Landfill Gas	Typically malodorous gases generated during the decomposition of waste.
Landfill Operation Monitoring	The auditing and assessing of a waste disposal operation to determine whether it conforms to the Landfill design and to the Minimum Requirements.
Landfill Operator	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.
Landfill Owner	The Landfill Owner will be deemed to be the local municipality.
Land use	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.
Leachate	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).
Leachate Detection System	A system for detecting leachate at landfills. It comprises rudimentary liners, sloped towards 'finger drains' at the lowest point of the landfill.
Leachate Management	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.
Lift	A series of adjoining cells of the same height, and at the same level, in a landfill.
Mitigate	The implementation of practical measures to reduce adverse impacts, or to enhance beneficial impacts, of an action.
No-go area	An area where physical activities are prohibited.
Non-compliance	Failure to comply with the requirements of the EMPr.
Non-conformance Report	A report outlining a deviation from process, procedure or compliance specifications.
Plant	The apparatus, machinery and vehicles used for the construction, operation and maintenance of the landfill.
Pollution	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
Potentially hazardous substance	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).
Quality management system	A set of interrelated or interacting elements that organisations use to direct and control how quality policies are implemented and quality objectives are achieved.
Radioactive Waste	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.
Red Data	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.
Rehabilitation	To reinstate or restore to capacity or state similar or better than the state prior to the commencement of construction, operation and maintenance activities.
Resource recovery	Recycling of waste or the recovery of energy.
Response Action Plan	A plan intended to counter or minimise the adverse effects of any malfunction of a landfill design element with immediate effect.
Responsible Person	The Permit Holder or his / her legally appointed representative who takes

Terminology	Explanation
	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.
Safe Disposal	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.
Salvaging	The controlled and/or uncontrolled process of recovering any material, gas, compost, or other matter from the waste for benefit and for personal consumption.
Sanitary Landfilling	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.
Sensitive receptors	Locations or areas that are likely to experience an impact greater than at other locations or areas; for example, schools and residential areas.
Ton	1000 kg
Waste	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.
Waste Body	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.
Waste minimisation	A programme that is intended to promote the reduced generation and disposal of waste.
Waste prevention	The prevention and avoidance of the production of waste.
Waste to Cover Ratio	The ratio of volume of compacted waste to volume of cover material used to cover the said volume of compacted waste.
Water resource	Includes a watercourse, surface water, estuary or aquifer.
Wetland	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).
Working Face	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 1-2: Acronyms

Acronym	Explanation
DEA	Department of Environmental Affairs
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
IWMPs	Integrated Waste Management Plans
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)
NWMS	National Waste Management Strategy
QMS	Quality Management System
SAHRA	South African Heritage Resources Agency
TEM	Transport, earthmoving and materials handling equipment

1. PURPOSE AND SCOPE OF THE ENVIRONMENTAL MANAGEMENT PROGRAMME

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.

An EMPr describes the measures that need to be taken to ensure the Duty of Care is bestowed upon 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. Non-compliance to Section 28 (Duty of Care) is a criminal offence and may lead to criminal prosecution.

An EMPr is 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 (IWMP). The IWMP's 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 IWMP's 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 afore-mentioned 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 1-1: Authors' Details

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1.3 Project Description

The existing unlicensed Nondweni landfill is both owned and operated by the Nquthu LM, the Applicant for the proposed WML. Although no record keeping of the influx of waste is being done, the LM estimates that the site receives 3 m³ of plastic waste, which is sold to a private recycling company, 3 m³ of paper/cardboard waste (which is also recycled), and 5 m³ of general waste per day. The sources of waste are private households, local businesses, and the hospital in Nquthu. During the site visit, medical pharmaceutical waste was observed on site, specifically, numerous used phials of oxytocin, a substance typically used to induce labour.

The expanded operation of the landfill will involve the following major functions, which will be undertaken in accordance with the Minimum Requirements for Waste Disposal by Landfill, 1998, as well as the Environmental Management Programme (EMPr). Detailed design for the rehabilitation activities as laid out in the EMPr must commence immediately upon receipt of the WML, including.

- Maintenance of access roads to the Landfill;
- Access control;
- Maintenance of Site roads and controlling of traffic within the Site;
- Control of nuisances;
- Construction and maintenance of Site drainage, including storm water-, contaminated runoff- and leachate control;

- Construction and maintenance of capping and liners; and
- Record keeping.

The following is proposed for the once-off rehabilitation of the landfill:

- Repair and maintain fencing
- Repair and maintain infrastructure
- Rehabilitation of site
 - Dig test pits to determine the waste volumes and locations;
 - Identify a temporary storage area on site during rehabilitation;
 - Possible moving of waste before the final capping.
 - Consolidate waste on site.
 - Spread the waste material into the trench in 300mm layers and compact the waste.
 - Cover the waste with 150mm of clean excavated soil or builder's rubble for every 1m of waste and compact. Continue with this process until all the waste on site is in the pit or the pit is filled up to an acceptable height above ground level (normally between 3m and 10m depending on the size of the pit). The last waste layer in the cell should have at least 300mm ground cover with slopes of 1:3 down to natural ground level;
 - Cap the trench with 300mm compacted clay and 200mm topsoil;
 - The capping layer should include a gas venting system if the waste is more than 2m deep;
 - Install leachate cut-off trench and conservancy tank downstream of the capped areas
 - Construct a stormwater diversion berm upstream of the capped cell (north, east and west) to divert any stormwater from the waste mass;
 - Provide boreholes for groundwater quality monitoring;
 - Control the encroaching soil erosion;
 - The capping design must be designed by and signed off by a Professional Engineer.
 - A new engineered cell has to be constructed for future disposal. The size of the new cell will depend on the disposal rate. Design the cell to have capacity for at least 5 years, with a maximum depth of 2 to 3m below natural ground, a maximum height of 5m and a cover to waste ratio of 1:4.
 - Geotechnical and geohydrological studies must be performed;
 - Compile site operational and management manuals before construction of the new cell.
- Litter picking
- Maintain signage

The following Engineering and operational Works will be required:

- Leachate collection system
- Installation of monitoring boreholes downstream of the landfill site and adherence to the monitoring protocol.
- Implement waste classification at gate
- Daily compaction of waste
- Daily cover application
- Adhere to cell system specified by engineer
- Surface water management
- Erosion control works

The GPS coordinates for the site are:

- 28°12' 7.887"S
- 30°48' 20.658"E

1.3.1 Operation Authorisation Process

The application for operation 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 operation and closure.

2. BACKGROUND TO THE ENVIRONMENTAL MANAGEMENT PROGRAMME

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 operation of the waste disposal facility.

This EMPr is based on the principles of the NEMA. 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 operation 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 operation 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) requirements 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 specific indicators in terms of the targets provided aspect- in the EMPr.

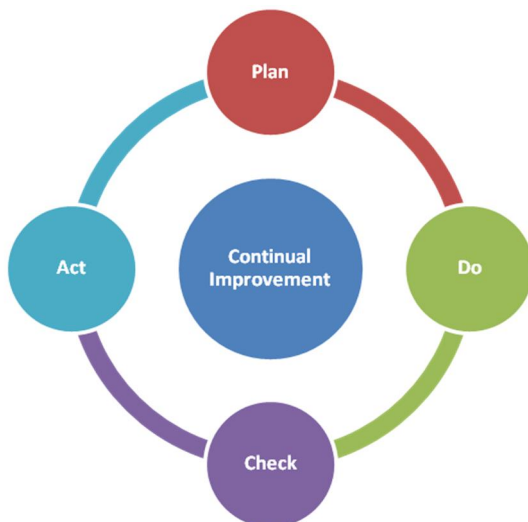


Figure 2-1: The Continual Improvement Cycle

2.3.3 Check

A system of assessing monitoring results has been developed (Section 4.2) 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 EMPr. Although the EMPr is a specific document, it is dynamic and should be updated regularly to address changing requirements, legislation, technologies, etc.

3. LEGAL REQUIREMENTS

The site operation and eventual decommissioning 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 3-1 below.

Table 3-1: Legislation applicable to waste management

Legislation	Sections	Relates to
The Constitution, 1996 (Act No. 108 of 1996)	Chapter 2	Bill of Rights
	Section 24	Environmental rights
	Section 25	Rights in property
	Section 32	Administrative justice
	Section 33	Access to information
National Environmental Management Act, 1998	Section 2	Defines the strategic environmental management goals, principles and objectives of the government. Applies throughout the country to the

Legislation	Sections	Relates to
(Act No. 107 of 1998) as amended¹		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
Environment Conservation Act, 1989 (Act No. 73 of 1989) and regulations	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	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEMWA)²	Section 16	General duty in terms of waste management
	Section 17	Reduction, re-use, recycling and recovery of waste
	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)³	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	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

¹ 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.

² 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.

³ 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
1947) and regulations		
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
	Section 9	General duties of employers and self-employed persons to persons other than their employees
National Water Act, 1998 (Act No. 36 of 1998) and regulations	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
Hazardous Substances Act, 1973 (Act No. 15 of 1973) and regulations	Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances	
Minimum requirements for storage, handling and disposal of hazardous waste, DWAF guidelines, 1998	Section 10	Temporary hazardous waste storage: time, volume and other requirements
National Road Traffic Act, Act 1996 (Act No. 93 of 1996) and regulations	Section 54	Transportation of dangerous goods
Fencing Act, 1963 (Act	Section 17	Any person erecting a boundary fence may clean any bush along the line

Legislation	Sections	Relates to
No. 31 of 1963)		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
National Veld and Forest Fires Act, 1998 (Act No. 101 of 1998)	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
DEA Integrated Environmental Management	DEA Integrated Environmental Management Information Series (2004): Environmental Management Plans: DEA Guideline on compiling EMPs	
SANS 1929	Ambient air quality – limits for common pollutants ⁴	
SANS 10103	The measurement and rating of environmental noise with respect to land use, health, annoyance and to speech communication	
National Waste Policy	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)	

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;

⁴ Replaced by R1210

- Maintaining a register of complaints and queries made by members of the public; and,
- Oversee response 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 where 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 operation activities will be limited to the landfill area, 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 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 are set out in this section.

Table 5-1: Summary of impacts which can be expected during operations

System Element	Aspect	Operations
Aesthetics	Landscape quality	Change in visual landscape due to infrastructure development and associated activities
Air Quality	Dust generation and related maintenance of ancillary infrastructure	Dust generation
	Development of landfill cells	Gaseous emissions from active landfill cells (odour, health impacting substances);
	Particulate matter	Particulate matter from landfill site
Ecological	Preliminary site establishment and infrastructure development	Erosion and/or siltation due to excavation, removal of vegetation
	Establishment and filling of new landfill cells	Contamination of water resources from leakage of leachate
	Closure of landfill cells and rehabilitation	Contamination of water resources from leakage of leachate
Heritage	Archaeology / Palaeontology – Loss of archaeological artefacts	Loss of artefacts due to landfill cell development and associated activities
	Heritage – Loss of heritage artefacts / landscapes	Loss of / damage to artefacts due to landfill cell development and associated activities
Hydrological	Preliminary site establishment and infrastructure development	Erosion and/or siltation due to excavation, removal of vegetation
	Establishment and filling of new landfill cells	Contamination of water resources from leakage of leachate
	Closure of landfill cells and rehabilitation	
Hydrological and Ecological	Preliminary site establishment and infrastructure development	Erosion and/or siltation due to excavation, removal of vegetation
	Establishment and filling of new landfill cells	Contamination of water resources from leakage of leachate
	Closure of landfill cells and rehabilitation	
Noise	Nuisance to nearby residents / works	Noise impacts to local receivers
Social	Population Change	Potential community impacts due to changes in the long term

System Element	Aspect	Operations
		population structure and dynamics
	Inflow of Jobseekers	The longer term impact of a possible inflow of workers and potential job seekers into the area.
	Local Economic Benefits and Local Procurement	Local economic benefit and the contribution to additional economic spinoffs during the operational phase. Enhancing the potential for further economic development.
	Safety and Security	Local economic benefit (positive). Contribution to additional economic spinoffs and economic wellbeing of the area and its residents with the potential for further economic development
	Daily Living and Moving Patterns	Negative Impact on daily living and movement patterns of residents due to worker and vehicle movement and noise and dust generated during operations phase.
	Sense of Place	Impacts on the sense of personal identity and belonging due to the operational activities.
	Impact on Infrastructure and Services	This variable refers to the impact that the project may have on the ability of local government to provide infrastructure and services during construction.
Traffic	Increased traffic in greater area (knock-on impacts)	Increased traffic on local and regional roads
Vermin and Vector	Vermin and vector impact – To nearby residents/works/agricultural infrastructure	Increased vermin and vector species in area

6. ENVIRONMENTAL DOCUMENTATION, REPORTING AND COMPLIANCE

6.1 Documentation

The following documentation must be kept on the project site for the full duration of operation and eventual decommissioning:

- Environmental Management Programme;
- Environmental Authorisation/s (e.g. Waste Management Licence);
- 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 EMP. 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.

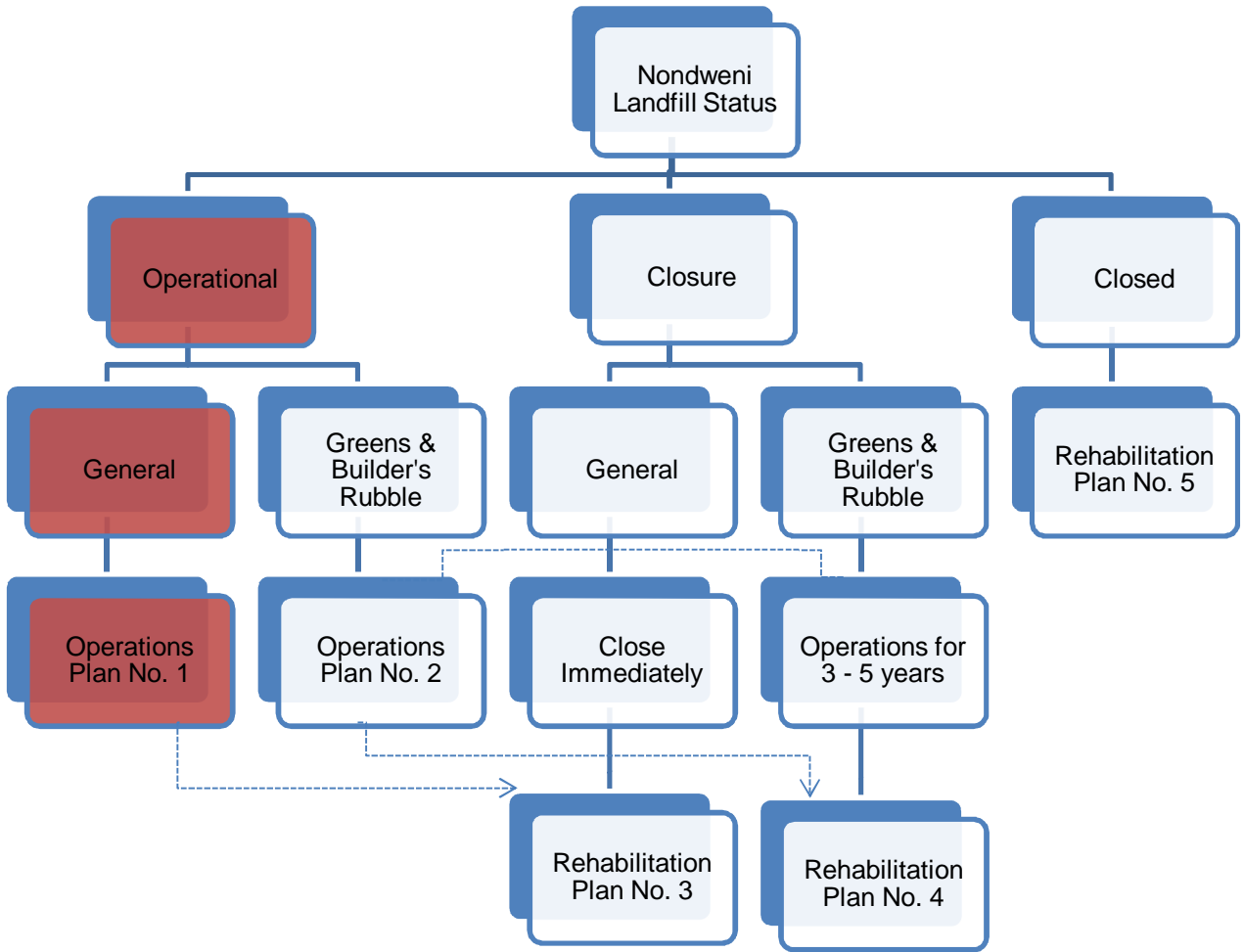
7. TRAINING AND INDUCTION OF EMPLOYEES

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 EMPr. 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);
- 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

The site will accept general waste, garden waste and building rubble, therefore to upgrade it to the relevant standards, the appropriate route for rehabilitation of the landfill will be as shown in the figure below.



Aspects and activities relating to the operation and maintenance of the landfill site are identified in the table below. The Landfill Supervisor will have to monitor, implement and demonstrate to its performance in environmental management and impact mitigation with respect to these activities.

Table 8-1: Operation and Maintenance Specifications

Activity /Issue	Action required
Operation And Maintenance	
Waste quantities	The landfill shall be limited to waste quantities as authorised by the relevant authority.
Waste types	The landfill shall only accept waste for which it is authorised to receive.
Charges for disposal	<p>It is intended by the Municipal Manager that the tariff structure for disposal of waste by outside parties be revised annually.</p> <p>Where considered justified, the Municipal Manager reserves the right to grant special disposal tariffs to any of the landfill users.</p> <p>Having revised the disposal tariffs, the tariffs will be updated and the Landfill Supervisor will adhere strictly to the prescribed schedule. A notice board with the applicable disposal tariffs, to be erected at the Landfill entrance, will be updated annually.</p>
Operating Hours	The landfill operating hours should be displayed or made available to the public and should include specific times for public holidays and closure periods.
Landfill Supervisor	<p>A full-time Landfill Supervisor will be provided to manage the Landfill. The experience and qualifications of the Landfill supervisor will comply with the Minimum Requirements for Waste Disposal by Landfill, 1998, as issued by the Department of Water Affairs and Forestry.</p> <p>The Landfill Supervisor will be contactable for 24 hours a day in the event of any emergencies or serious problems that may arise on the Landfill.</p>
Meetings and landfill inspections	<p>The Landfill Supervisor, the Municipal Manager, the Engineer as well as other Contractors that may be actively involved on the Landfill at the time, will meet at approximately monthly intervals as the Committee of Control (C.O.C.). The Engineer will make arrangements for the C.O.C meetings and will also be responsible for the minutes of the meetings.</p> <p>The C.O.C. meetings will be conducted to discuss all matters relating to the operation of the Landfill and to review and up-date the overall plan of operation. Decisions made, agreed upon and recorded in the minutes of these meetings will be binding on the parties.</p> <p>It is however to be noted that the C.O.C. does not have executive powers and that certain decisions affecting the Landfill Supervisor may need to be approved by the Municipal Manager.</p> <p>Periodic (initially six-monthly) Landfill audits will be undertaken by external auditors appointed by the Municipal Manager, in the company of the Landfill Supervisor. During this exercise a specially designed pro forma will be filled out, which will numerically assess important aspects of the operation. This, together with appropriate recommendations, will be submitted to the Municipal Manager, the Engineer and the Landfill Supervisor. These inspections may or may not be conducted in conjunction with the monthly meetings.</p> <p>The frequency of meetings and audits will be increased if operational standards are not acceptable. At the discretion of the Municipal Manager and based on the standard of operation, such periodic Landfill audits can later be reduced to annual inspections.</p> <p>Any member of the C.O.C. will have unimpeded access to the Landfill, provided that they report to security before entering the operational part of the Landfill.</p>
Salvage Rights	<p>Although certain salvage operations may be undertaken, scavenging amongst the waste at the working face will be prevented. The only exception to this rule is the compulsory removal from waste disposal area of steel objects that can cause punctures in tyres of vehicles delivering waste as well as the removal and stacking of tyres disposed of as part of the general waste stream.</p> <p>Salvaging may in future include formalised materials sorting and recovery, composting, landfill gas recovery and any other operation of a similar nature.</p>
Operation of the landfill	<p>The operation of the Landfill will involve the following major functions, which will be undertaken in accordance with the Minimum Requirements for Waste Disposal by Landfill, 1998, as well as the Environmental Management Programme.</p> <ul style="list-style-type: none"> • Maintenance of access roads to the Landfill • Access control • Maintenance of Site roads and controlling of traffic within the Site • Control of nuisances • Construction and maintenance of Site drainage, including storm water-, contaminated runoff- and leachate control • Record keeping <p>The principles regarding the above are discussed below, with a view to providing a clear concept of what is anticipated in terms of the landfill operation. In addition to the major functions dealt with below, numerous other aspects are included for information:</p>

Activity /Issue	Action required
	Operation And Maintenance
	<p>Maintenance of access roads to the Landfill The entrance to the Site will be kept in a clean and neat state. This includes removal of all mud and refuse deposited on the road in the vicinity of the Site entrance (particularly during wet weather) and the picking of all windblown or scattered refuse and litter emanating from the waste delivery and disposal operation. This activity will be performed daily.</p> <p>Access control Access control will at all times be performed in a responsible manner, thus ensuring that only vehicles with waste loads permitted for disposal on the Waste Disposal Site, in accordance with the Minimum Requirements for Waste Disposal by Landfill, 1998, will be allowed on the Landfill.</p> <p>Control of nuisances The Landfill Supervisor will take all reasonable measures to operate the Landfill so as to reduce and, where possible, prevent nuisances such as:</p> <ul style="list-style-type: none"> • odour; • dust (by means of watering Site roads), • flies and rodents (by applying sanitary landfill procedures of compaction and covering, as well as by providing fly bait and fly traps at the waste disposal working face, public disposal area, etc. Rat traps or natural rodent control measures will be implemented to prevent poisoning of birds in the area); • noise (by ensuring that all plant silencers, etc. are in good working order and by limiting the operations to the prescribed hours.); • windblown litter (by applying sanitary landfill procedures of waste compaction and daily covering, as well as using litter catch nets where required. Litter that has been scattered in the area will be collected and disposed of on a daily basis); and, • no scavenging will be allowed on the Landfill workface. The removal of sharp steel objects from the workface that could cause punctures to waste collection vehicle tyres as well as tyres disposed of with the general waste, will however be the only exceptions and removal thereof from the disposable waste stream a requirement. <p>Construction and maintenance of Site drainage, including storm water, contaminated run-off and leachate control Undue contact between waste and storm water will be prevented, so as to minimise the volume of contaminated run-off and leachate generated on the Landfill. Two drainage systems will therefore be operated on Site; one for clean storm water and uncontaminated run-off from rehabilitated parts of the Landfill, and the other for polluted runoff from the operational part of the waste body that is to be directed into a contaminated water containment pond.</p> <ul style="list-style-type: none"> • Uncontaminated storm water A system of berms and cut-off drains will be constructed around the perimeter of the Site to prevent clean water from entering the Landfill area. The object of the drainage system is to divert clean storm water, as well as unpolluted run-off from rehabilitated areas, around one or both sides of the waste body. Once portions of the landfill have been rehabilitated, such runoff will be classified as unpolluted. Continued maintenance of this system is intended to keep it free draining. As new phases of the landfill are developed, the storm water system will be extended by excavating and preparing further trenches. Erosion protection will be provided where required. Should water be accumulating in the daily cover material borrow pit, it is to be drained / pumped from the excavations as soon as possible to prevent it from hampering cover material excavations. <p>Record keeping Detailed daily records will be kept of the following operational aspects and these will be available for inspection by the Landfill Supervisor:</p> <ul style="list-style-type: none"> • mass of each waste load delivered; • category and composition of each waste load; • source of the waste; • process from which waste originated;

Activity /Issue	Action required
	<p data-bbox="228 416 552 445">Operation And Maintenance</p> <ul data-bbox="416 461 1517 887" style="list-style-type: none"> • vehicle registration number; • driver details; • time and date of delivery; • account number; • verification tests performed on incoming waste loads; • volume of cover placed per day; • complaints lodged; • incidents / accidents; • landfill protocol violations; • breakdowns and stoppages; • rainfall figures with full weather station data including minimum and maximum temperatures, rainfall, wind speed and wind direction; and, • monthly and annual reports will be prepared, highlighting the major activities, events, statistics, etc. The format of the monthly and annual reports will be discussed with the Engineer prior to finalisation of the reports. <p data-bbox="416 916 999 945">A Site Instruction Book will also be kept on the Landfill.</p> <p data-bbox="416 947 1517 999">All consumables for record keeping, invoices, associated computer equipment, peripherals and the supply of other suitable equipment will be available on the landfill site.</p>
<p data-bbox="153 1025 376 1081">Maintenance of the Landfill</p>	<p data-bbox="416 1025 1517 1081">All aspects of the Landfill will be maintained in order to ensure its smooth and efficient operation and to prevent undue deterioration of any item. Included in the maintenance of the Landfill are:</p> <p data-bbox="416 1111 600 1140">Scattered waste</p> <p data-bbox="416 1142 1517 1223">To keep the Site and its surrounds neat and clean by removing all windblown or scattered litter emanating directly or indirectly from the Landfill operation on a daily basis. As a first step, the Landfill Supervisor will take all actions required to prevent the spreading of windblown litter.</p> <p data-bbox="416 1252 528 1281">Buildings</p> <p data-bbox="416 1283 1517 1335">The buildings and structures will all be maintained on an on-going basis. This will include, but not be limited to the following:</p> <ul data-bbox="416 1337 1517 1447" style="list-style-type: none"> • General housekeeping to ensure that all buildings are maintained and kept clean inside and outside as well as all areas surrounding the buildings • Upkeep and maintenance of gardens and landscaped areas, as it may apply • Ensuring clean and hygienic conditions in all ablution facilities as well as kitchen/dining areas <p data-bbox="416 1476 560 1505">Access road</p> <p data-bbox="416 1507 1517 1559">All temporary and permanent Site roads will be maintained (i.e. those roads providing access to various waste management facilities).</p> <p data-bbox="416 1561 1517 1671">This work will include the watering of unpaved road surfaces to prevent dust nuisances; grading and filling of potholes; resurfacing of roads with selected graded material or building rubble free from reinforcing and with particle size less than 100-mm; as well as any other repair work required to ensure that all-weather access to the Landfill workface is provided in a safe and usable condition.</p> <p data-bbox="416 1700 871 1729">Berms and storm water drainage canals</p> <p data-bbox="416 1731 1517 1834">All berms and storm water canals will be maintained in good condition and free from any blockages to effectively perform its intended function. Silt accumulating in the storm water drains will be removed at regular intervals. Where required, temporary berms and storm water drainage channels will be provided to ensure the safe and sound operation of the Landfill.</p> <p data-bbox="416 1863 871 1892">Fences, gates and access control boom</p> <p data-bbox="416 1895 1517 1975">All fences, gates and locks will be kept in good order and any damage caused to it will be repaired. All alien bushes or trees growing on- or in close proximity of the line of security fences will be removed and the roots killed.</p> <p data-bbox="416 2004 823 2033">Rehabilitated and landscaped areas</p>

Activity /Issue	Action required
Operation And Maintenance	
	<p>All trees and shrubs planted onsite will be watered until such time as they are well enough established not to require further watering. Any erosion furrows and subsidence's which form on intermediate or finally rehabilitated disposal areas shall be filled and re-grassed where applicable.</p> <p>Road-markings All road markings on the paved access roads will be maintained.</p>
Notice boards	A weatherproof notice board will be erected at an approved location. All notice boards, including the tariff board, will be updated to ensure that the information displayed remains relevant. The boards will be maintained in good repair.
Violation of Site Protocol	A record and the details of the occurrence of all vehicles violating the Site protocol will be kept. Vehicles may, depending on the violation and the number of written warnings issued, be "blacklisted" from being allowed to dispose of waste at the Waste Landfill Site for a period to be determined by the Landfill Supervisor. A report of the violation will be handed to the vehicle driver and distributed to the driver's direct supervisor and the Municipal Manager. Types of incidences considered to be a violation, are in accordance with site rules, which will be displayed on site.
Procedure for rejection of waste loads	<p>Should any waste load delivered to the Landfill not meet the Landfill license conditions in terms of its waste classification, the Landfill Supervisor shall execute the following procedure:</p> <ul style="list-style-type: none"> • The driver will be informed that the waste load has failed the criteria (and may be requested to wait for further laboratory analysis that may confirm or refute the original conclusions, should the waste type be unknown). • The driver will then be advised that the waste load must be transported to the nearest hazardous waste landfill licensed for disposal of that particular waste category. • The Chemical Advisor will then inform the waste generator as well as the hazardous waste landfill of the particular waste load and fax / email a copy of the chemical analysis for the particular load. <p>If a load of waste fails the on-site indicator test and has to be redirected to an appropriately licensed hazardous waste landfill, the waste generator, who shall be responsible for costs associated with the transport and disposal thereof, shall be required to submit a copy of the safe disposal certificate obtained from the hazardous waste landfill within 7 days of rejection of the waste load at the landfill.</p>

Activity /Issue	Action required
Operation And Maintenance	
Heritage Sites	<p>Should a find of heritage importance be unearthed, construction activities will stop immediately at the site of discovery. The area will be fenced off with a radius of 20m around the unearthed item, demarcated as a no-go area and access will be prohibited. Should there a risk of the find being violated, whether intentionally or inadvertently, the Contractor shall be required to appoint a guard to enforce the no-go area policy.</p> <p>The Landfill Supervisor and Municipal Manager shall be notified immediately.</p> <p>The Landfill Supervisor will contact an archaeologist to undertake further studies and determine the importance of such a find. All related activities will be undertaken by the archaeologist, or under his/her supervision, to ensure no unnecessary damage takes place on the site.</p> <p>During this period, work will not take place in the demarcated area. Work will be continued further along the site at a distance which is clearly well out of the area that may be affected by the findings. Should the findings be clearly limited to a particular area the Landfill Supervisor and Municipal Manager, in consultation with the archaeologist, will be free to determine what can reasonably be deemed a safe no-work distance, which will be kept clear of activities.</p> <p>Work will only recommence on the written consent of the archaeologist and/or Amafa.</p> <p>Findings containing human remains shall immediately be reported by the Municipal Manager to the South African Police Services (SAPS).</p> <p>All parties concerned shall respect the potentially sensitive and confidential nature of the heritage resource, particularly human remains.</p> <p>Under no circumstances shall any artefacts be removed, destroyed or interfered with by anyone on site.</p> <p>The Contractor and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or paleontological artefacts, as set out in Section 51(1) of the NHRA.</p>
Rehabilitation of the site and immediate surrounds	<p>The following is proposed for the once-off rehabilitation of the landfill:</p> <ul style="list-style-type: none"> • Fencing <ul style="list-style-type: none"> ○ Erect a concrete palisade fence around the landfill including a lockable gate. Other types of fences are easily vandalised and stolen. Although concrete palisade fencing can also be vandalised or stolen, it has proved most effective in applications of this nature. • Infrastructure <ul style="list-style-type: none"> ○ Maintain the lockable guardhouse with a gate and access control and appoint personnel to man the facility. Access control is required to monitor the types and volumes of waste being dumped at the site and to indicate to the driver of the vehicle, where to dispose of the waste. Install ablution facilities or porta-toilet with maintenance contract. ○ Install potable water tank and replenish daily. ○ Install solar powered security light at entrance. • Rehabilitation of site <ul style="list-style-type: none"> ○ Determine the extent of previous waste disposal activities on site. Dig test pits of approximately 2m deep around the site to determine the location and extent of

Activity /Issue	Action required
	<p data-bbox="228 416 552 445">Operation And Maintenance</p> <p data-bbox="608 456 1023 486">previous waste management activities;</p> <ul style="list-style-type: none"> <li data-bbox="560 490 1517 607">○ Identify a temporary storage area on site. While the site rehabilitation is done, the incoming waste will be temporarily stored in that area. Appoint someone to oversee that waste is being dumped in the correct place. The temporary storage area should include adequate stormwater management and daily cover; <li data-bbox="560 613 1517 797">○ Consolidate all the waste material in one area (preferably the current trench) of the site using a Tractor Loader Backhoe (TLB) and a tipper/front end loader. It is strongly recommended that a TLB be purchased and dedicated to work at the landfill. Keep clean builders rubble aside as this can be used as cover material. Currently waste is dumped over the entire site. The waste footprint must be minimised with consolidation; <li data-bbox="560 804 1517 1021">○ Spread the waste material into the trench in 300mm layers and compact the waste. The bucket of the TLB could be used to compact the waste. Cover the waste with 150mm of clean excavated soil or builder's rubble for every 1m of waste and compact. Continue with this process until all the waste on site is in the pit or the pit is filled up to an acceptable height above ground level (normally between 3m and 10m depending on the size of the pit). The last waste layer in the cell should have at least 300mm ground cover with slopes of 1:3 down to natural ground level; <li data-bbox="560 1028 1294 1057">○ Cap the trench with 300mm compacted clay and 200mm topsoil; <li data-bbox="560 1064 1517 1120">○ The capping layer should include a gas venting system if the waste is more than 2m deep. <li data-bbox="560 1126 1517 1243">○ A leachate cut-off trench must be installed downstream of the capped areas in order to intercept the leachate coming from the unlined capped cells. Install a conservancy tank downstream of the trench. Treat or recycle the leachate through the lined waste cell; <li data-bbox="560 1249 1517 1305">○ Construct a stormwater diversion berm upstream of the capped cell (north, east and west) to divert any stormwater from the waste mass; <li data-bbox="560 1312 1182 1341">○ Provide boreholes for groundwater quality monitoring; <li data-bbox="560 1348 999 1377">○ Control the encroaching soil erosion; <li data-bbox="560 1384 1509 1413">○ The capping design must be designed by and signed off by a Professional Engineer. <li data-bbox="560 1420 1517 1536">○ A new engineered cell has to be constructed for future disposal. The size of the new cell will depend on the disposal rate. Design the cell to have capacity for at least 5 years, with a maximum depth of 2 to 3m below natural ground, a maximum height of 5m and a cover to waste ratio of 1:4. <li data-bbox="560 1543 1270 1572">○ Geotechnical and geohydrological studies must be performed; <li data-bbox="560 1579 1517 1632">○ Compile site operational and management manuals before construction of the new cell. <ul style="list-style-type: none"> <li data-bbox="464 1693 647 1722">● Litter picking <ul style="list-style-type: none"> <li data-bbox="560 1729 1517 1845">○ Appoint unskilled casual labour from surrounding communities to pick up the windblown litter surrounding the landfill. Provide gloves and masks. Provide a container or collection point where litter can be stored. Alternatively use Municipal workers for this task. <li data-bbox="464 1852 600 1881">● Signage <ul style="list-style-type: none"> <li data-bbox="560 1888 1517 1942">○ Erect a sign post at the gate indicating the operating times of the landfill site as well as the types of waste accepted at the landfill site.
Engineering works	<p data-bbox="413 1951 794 1980"><u>Capping of previous disposal areas</u></p> <p data-bbox="413 2009 1517 2038">The covering and capping of historically used site must be undertaken as deemed necessary by the</p>

Activity /Issue	Action required
Operation And Maintenance	

engineer.

Before final capping, the waste must be compacted and shaped in such a way as to promote run-off and to prevent any ponding of water on the landfill site.

Filling and landscaping may be necessary to achieve a dome shaped landscape. This is essential in order to prevent any pooled water from seeping through the capping layer and in to waste below.

The capping needs to be impervious in order to prevent any further contaminants leaching into the ground water.

A capping or final cover system is made up of a series of elements. The capping system is designed to maximise run-off, while minimising infiltration and preventing ponding of water on the landfill. Cover requirements, and hence the number and sequence of components, will vary with the class of landfill under consideration. For the site in question, a 300mm compacted clay layer, and a 200mm thick layer of local topsoil planted with local grasses and shrubs to be applicable as a final capping. The topsoil layer must be lightly compacted after spreading. **Figure 8-1** below shows a typical section of the conceptual capping for the landfill site.

The compacted clay layers could be replaced by a suitable Geosynthetic equivalent depending on the approval of the Engineer.

The current sand capping layer can be used as the foundation layer required in the capping design.

Allowance should be made in the capping design for gas venting if the waste is deeper than 2m.

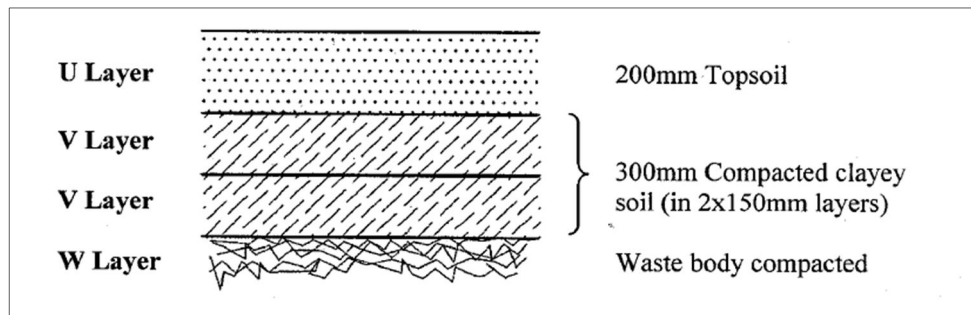


Figure 8-1: Proposed capping for the Nondweni landfill site

The capping system is subjected to a detail design by a Professional Engineer.

During the detail design of the capping system, attention should be given to the Factor of Safety against sliding of the soil cover on top of the geomembrane (the veneer system).

Vegetation cover

Once the final layer of top soil has been placed on the cap, the site must be seeded with 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, as per the seed mix detailed in the Environmental Management Programme.

In **Figure 2-1** the correct profile for a landfill on a sloped terrain can be seen.

Activity /Issue	Action required
	Operation And Maintenance

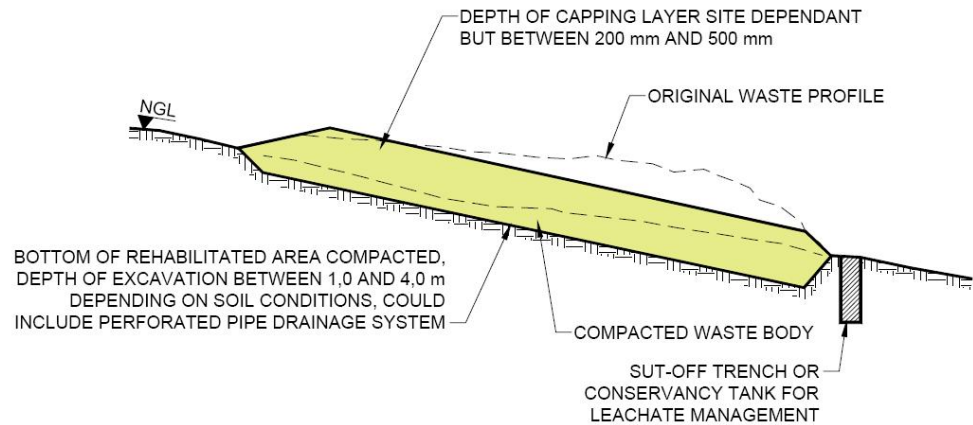


Figure 8-2: Waste disposal profile on a sloped terrain

Liners for new disposal areas

- o A composting system is advised for garden waste;
- o It is recommended that the recyclables be removed from the waste stream before the waste is landfilled;
- o Install the necessary lining and leachate collection systems.

Details Of Liner

The landfill receives general waste, so it should conform to the relevant standards and the proposed liner will therefore adhere to the Class B liner requirements set out in the Draft National Standards for Disposal of Waste to Landfill (see below) as set out in the Waste Classification and Management Regulations published in Government Gazette Notice 615 of 2012.

Construction Of Liner Works

The various layers of the proposed liner works are shown in the figure below and described in detail in this section.

Activity /Issue	Action required
	Operation And Maintenance

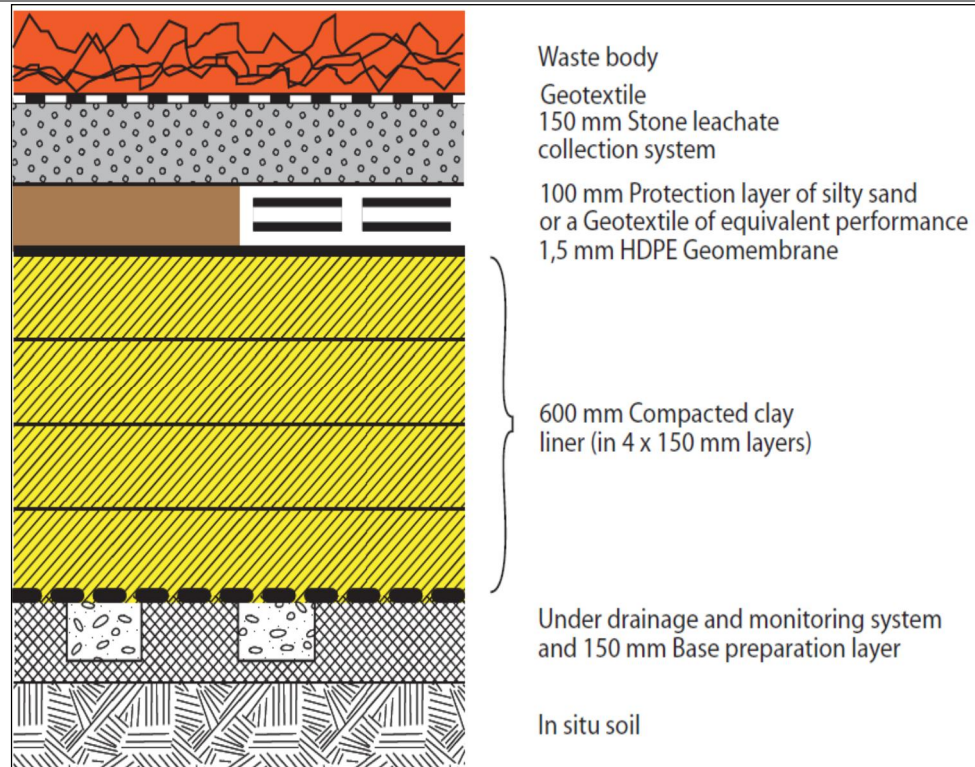


Figure 8-3: Requirements for Class B Liner

150mm Base preparation layer – The construction of the base preparation layer entails ripping to a depth of 150mm, wetting and compacting the in-situ materials to a minimum 95% Standard Proctor density with moisture contents between 0 – 2% from optimum.

Under Drainage and Monitoring System – (also called the Leakage detection system). This system is provided to detect any leachate leakage that has for some reason penetrated through all of the landfill layers above it. Should any leachate be detected in this system, it will be removed immediately. The Leakage detection system will consist of a 150mm thick layer of granular material (crushed stone) having a size of 19mm with perforated HDPE pipes installed in a herringbone formation to collect any possible leachate. This crushed stone layer can also be replaced by a geosynthetic layer that will perform the same function as the granular material.

Geotextile Filter Layer – (Represented by the dotted line in diagram) This layer protects the leakage detection layer from contamination by fine material.

600mm Compacted Clay Liner –The clay must be compacted in layers not exceeding 150mm to a minimum density of 95% Standard Proctor maximum dry density at a water content of Proctor optimum to optimum +2%. The permeability of the clay must be such that an outflow rate of 1×10^{-6} cm/s will not be exceeded. This is the considered to be the primary barrier layer.

Activity /Issue	Action required
	<p data-bbox="485 456 1517 517">If the detail design engineer and owner of the landfill so wishes, the clay layers can be replaced by a GCL.</p> <p data-bbox="485 577 1517 669">1.5mm HDPE Geomembrane – The High Density Polyethylene (HDPE) sheet needs to be in direct contact with the clay layer (or GCL) and needs to be manufactured by a reputable company and installed according to the Engineer’s specifications.</p> <p data-bbox="485 703 1517 857">Protection Layer – The protection layer is placed directly above the geomembrane to protect it from mechanical damage and can be in the form of a 100mm layer of fine to medium silty sand or a needle punched Geotextile material capable of providing the same level of protection. A geotextile is much thinner than the 100mm sand layer and can thus afford the owner more landfill airspace.</p> <p data-bbox="485 891 1517 1016">Leachate Collection System – This layer is used to remove any leachate that percolates through the waste body. It is compiled of crushed stone with a size of 38mm to 50mm and needs to be at least 200mm thick. The stone leachate collection layer can be replaced by a geosynthetic material.</p> <p data-bbox="485 1077 1517 1169">Geotextile Filter – This geotextile is installed to protect the leachate collection layer from clogging by fine material and needs to be able to withstand some force as it is the final layer before waste is deposited. For that reason a woven geotextile should be used.</p> <p data-bbox="485 1229 1517 1290">Waste Body – The main waste body is deposited on the geotextile filter by first end tipping a 1m thick waste layer and following the general landfilling.</p> <p data-bbox="485 1350 1517 1505">Great care must be taken during construction of the layerworks that comprise the landfill liner so that the inherent characteristics of the layers are not compromised. Effective engineering construction monitoring during construction of the liner system is a prerequisite. The final landfill liner to be installed will have to undergo a detail design phase before it will be approved by the regulating authorities.</p> <ul data-bbox="464 1516 1517 1917" style="list-style-type: none"> <li data-bbox="464 1516 719 1541">• Leachate collection <ul data-bbox="560 1547 1517 1917" style="list-style-type: none"> <li data-bbox="560 1547 1517 1765">○ In order to minimise the contamination of groundwater by the leachate in the waste cells, construct a drainage trench (Figure 8-4) downstream of the waste cells. The drainage channel should be deeper than the waste cells by up to 1m. Install a HDPE perforated drainage pipe in the trench and cover the pipe with a geotextile material to prevent blockage of the pipe perforations. Backfill the drainage trench with the excavated soil and compact. The pipe must have a minimum 2% slope and drain towards an underground conservancy tank. <li data-bbox="560 1771 1517 1917">○ The tank must be drained when it is 75% full. The conservancy tank has a vent open to the atmosphere that can be used to test the level of leachate in the tank. Rainwater on top of cells will seep through the waste and will drain through the leachate collection system into the conservancy tank and should not go into the environment.

Activity /Issue	Action required
	Operation And Maintenance

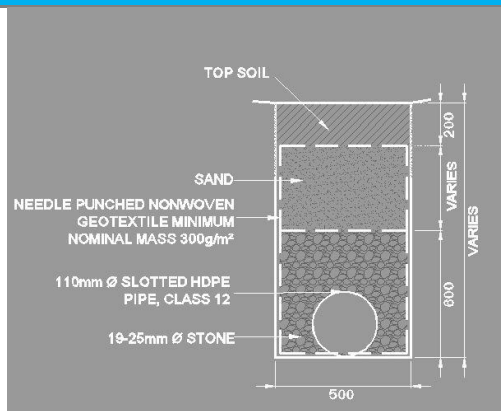


Figure 8-4: Leachate cut-off trench

- Boreholes

A monitoring borehole is required downstream of the landfill site. The monitoring protocol is as follows:

- Water Levels should be measured at least monthly and the readings recorded against time and date
- Water samples should be taken at least every 6 months, preferably in April and October (end of summer and winter) and the samples sent to a reputable lab for analysis. Field readings such as pH, temperature, EC, etc. should also be measured at the time of sampling and recorded against date and time.
- Chemical constituents to test for should include Ca, Na, Mg, Fe, K, SO₄, HCO₃, Cl, NH₄, NO₂, NO₃, F, PO₄, Si, as well as physical readings such as pH, temperature, EC, DO, Redox Potential.
- The monitoring data should be kept in a safe place and be available to the Department on request.
- A monitoring report done by a geohydrologist should be compiled at the end of the 18 months, using the monitoring data collected. This report will then be evaluated to determine whether further monitoring may be needed.
- In the event of contamination/pollution being found, the department should be notified as soon as possible and a remediation plan be provided for approval. Potential receptors are to be identified immediately and action taken to ensure that there is no health risk.
- The precautionary principle applies, as it is very difficult if not impossible to remediate groundwater once it has been polluted.

- Waste Classification at Gate

- Waste can only be accepted at the Landfill which is accordance with the Waste Licenses.
- Waste not in accordance with the license must be refused and diverted to an appropriate facility.
- Should the waste be acceptable, record keeping of the incoming waste types and quantities must be as accurate as possible.
 - According to the regulations contained in Government Gazette of 23 August 2013, the waste manager must keep record of the following:
 - Name, address and contact details.

Activity /Issue	Action required
	<p data-bbox="225 416 552 445">Operation And Maintenance</p> <ul style="list-style-type: none"> • Date of receipt. • Quantity of waste received by weight (ton) and volume (m³) if possible. • Type of waste management applied (recycled, re-use, recovery, treatment, disposal) • Any discrepancies in information between the different holders of the waste (related to the quantity of the waste, type, classification, physical and chemical properties) • Waste management reporting description and code in terms of the National Waste Information Regulations, 2012. • Details on waste diverted to another waste facility, and details of the facility. • Certification and declaration of receipt and final arrangement of the waste. <ul style="list-style-type: none"> ○ Contaminated waste (small amounts of domestic waste mixed with garden and/or builders rubble) must be separated out and placed in a skip. This should be done by the disposer, if domestic waste are not accepted at the landfill ○ A compliance check list can assist the landfill operator in complying with the permit conditions. Internal audits also assure that the operator is following the check list and that the site is meeting the permit conditions. The facility should be audited on an annual basis. <ul style="list-style-type: none"> • Compaction <ul style="list-style-type: none"> ○ Compaction must be done daily. Compaction of waste is done by passing heavy equipment over deposited waste. This reduces voids in the waste, thus reducing the chances of channelling which promotes the rapid infiltration and migration of any leachate formed. It also reduces the risk of fires, discourages vermin, controls litter, reduces the amount of cover required and increases site life. ○ For landfill sites where compaction rollers cannot be purchased, hand rollers or filled drums can be used to get some degree of compaction. ○ Should the site receive mostly garden refuse and builder's rubble, the garden waste should ideally be chipped and converted to compost. If the Municipality cannot afford a chipper for permanent use on site, the possibility of using external contractors to convert the garden waste into compost, needs to be investigated. <ul style="list-style-type: none"> • Cover application <ul style="list-style-type: none"> ○ Daily cover of the working face of the landfill is required. The application of soil or other suitable cover to compact waste reduces litter and the risk of fire, but its main purpose is to eliminate odour. It also reduces scavenging and generally improves aesthetics. The sanitary landfill definition specifies daily cover or covering after the waste has been placed (if the waste is not dumped on a daily basis). ○ A minimum thickness of 100mm of compacted soil is required after 300mm waste has been placed. This thickness will need to be increased in the case of poor quality cover. ○ The material to be used for cover may be on-site soil or builders' rubble of manageable sizes. With the approval of the Provincial Authority, ash or other artificial covering can be used. ○ Always keep an emergency stock pile for at least one week's cover. ○ When cover material is not available on site, the material needs to be obtained from external sources like construction sites, cemeteries etc. <ul style="list-style-type: none"> • Cell system <ul style="list-style-type: none"> ○ If a pit system must be used on the site due to the large volume of waste or difficult

Activity /Issue	Action required
	<p style="text-align: center;">Operation And Maintenance</p> <p>geological conditions, an Engineer should be contacted to design the cell.</p> <ul style="list-style-type: none"> ○ The site should be survey to determine the quantity of the waste to determine the size of the cell that would be required. • Surface water Management <ul style="list-style-type: none"> ○ Separation of clean and dirty water circuits requires regular maintenance ○ The storm water system installed must be inspected and cleaned weekly. ○ Ponding on the landfill must be avoided and if it occurs, the area must be re-shaped to maximise run-off • Storm water Management <ul style="list-style-type: none"> ○ Using material from the excavated cell, construct a berm upstream of the trenches to divert the stormwater from the waste. Waster should be kept out of the cells. • Erosion control works <ul style="list-style-type: none"> ○ Repair existing erosion areas by stabilising with rock and shaping to maximise run-off.
<p>Storm Water Management System</p>	<p>1. 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 of 1998.</p> <p><u>Objectives</u> The design focuses on mitigating potential adverse effects of inadequate storm water management at the site. The objectives of a Storm Water Management Plan (SWMP) can be summarised as:</p> <ul style="list-style-type: none"> • to protect water resources from pollution by separating and collecting all storm water that has a poor quality into dirty water 'storage' facilities for treatment before discharging into the environment or reuse within the site operations where applicable. • to ensure that all storm water management infrastructure is designed to handle a 1 in 50 year storm event and is not adversely affected by a 1 in 100 year storm event. • to maintain downstream water quantity and quality requirements by ensuring that the maximum volume of clean water runoff is diverted directly to the natural watercourses and the minimum amount of clean storm water is contaminated and thus enhancing the overall catchment yield. <p>All the storm water that falls on part of the landfill cell which is not operational (and probably capped) will not be allowed to get mixed with the dirty water and will be diverted to natural water courses around the site.</p> <p>In addition to meeting the fore mentioned objectives, the storm water management system will ensure that:-</p> <ul style="list-style-type: none"> • contaminated areas will be minimized and remain isolated from clean areas • clean storm water may be reused in the site operations • seepage losses from waste management facilities are minimized and overflows are prevented. <p><u>Classification of Areas according to land use</u></p> <p>Good storm water management is based on separating clean and dirty water and therefore incorporates the fundamental principle of pollution prevention. The site should be divided into dirty and clean areas. The storm water that fall on these areas shall be classified as dirty storm water and clean</p>

Activity /Issue	Action required												
	<p data-bbox="228 416 552 445">Operation And Maintenance</p> <p data-bbox="411 454 683 483">storm water respectively.</p> <p data-bbox="411 544 847 573"><u>Storm Water Management Infrastructure</u></p> <p data-bbox="411 602 1517 663">The table below shows some elements that may be incorporated into the storm water management systems on sites and the respective purposes.</p> <p data-bbox="411 808 1110 837">Table 8-2: Elements of the storm water management system.</p> <table border="1" data-bbox="416 853 1503 958"> <thead> <tr> <th data-bbox="416 853 847 882">1. Element</th> <th data-bbox="847 853 1046 882">2. Supply</th> <th data-bbox="1046 853 1257 882">3. Convey</th> <th data-bbox="1257 853 1503 882">4. Store/other</th> </tr> </thead> <tbody> <tr> <td data-bbox="416 882 847 911">5. Storm water drains</td> <td data-bbox="847 882 1046 911">6.</td> <td data-bbox="1046 882 1257 911">7. √</td> <td data-bbox="1257 882 1503 911">8.</td> </tr> <tr> <td data-bbox="416 911 847 958">9. Diversion Berms</td> <td data-bbox="847 911 1046 958">10.</td> <td data-bbox="1046 911 1257 958">11. √</td> <td data-bbox="1257 911 1503 958">12.</td> </tr> </tbody> </table> <p data-bbox="411 1003 667 1032"><u>Design of the Elements</u></p> <p data-bbox="411 1061 1513 1182">The storm water flowing towards the site will be collected away from the waste facilities in drains or will be diverted by berms to the downstream side of the facilities. After capping of the landfill all the water falling on top of the landfill is considered clean therefore it can be released directly to the water courses downstream of the landfill.</p>	1. Element	2. Supply	3. Convey	4. Store/other	5. Storm water drains	6.	7. √	8.	9. Diversion Berms	10.	11. √	12.
1. Element	2. Supply	3. Convey	4. Store/other										
5. Storm water drains	6.	7. √	8.										
9. Diversion Berms	10.	11. √	12.										
<p data-bbox="151 1218 304 1294">Landfill Management Actions</p>	<p data-bbox="411 1218 1485 1274">There are a number of Landfill Management Actions that must be implemented as part of the overall operation of the landfill.</p> <ul data-bbox="461 1308 1517 2031" style="list-style-type: none"> <li data-bbox="461 1308 759 1337">• Responsible Personnel <ul data-bbox="560 1341 1517 1559" style="list-style-type: none"> <li data-bbox="560 1341 1517 1559">○ Training must be provided to responsible personnel on the waste management and landfill operation practises, as general lack of knowledge by the employees adds to the current problems experienced. It is advised that the responsible personnel register with the Institute of Waste Management of Southern Africa (IWMSA) and use the minimum requirements document (Minimum Requirements of Water Affairs and Forestry Document) daily. Attendance of seminars and courses offered by the IWMSA or regulatory waste bodies are also strongly recommended. <li data-bbox="461 1570 692 1599">• Burning of waste <ul data-bbox="560 1603 1517 2031" style="list-style-type: none"> <li data-bbox="560 1603 1517 1749">○ Burning of waste takes place at many small landfills in South Africa, to reduce the volume of waste and its attraction to vermin and livestock. The burning of waste is considered unacceptable, however, because of the aesthetics, odours, and the potential of health dangers from air pollution. On account of these adverse impacts, therefore, the Department prohibits the burning of waste. <li data-bbox="560 1753 1517 2002">○ Possible exceptions to this Minimum requirement would be small general landfill in rural areas, provided that they are at least a 1000m downwind of residential areas. In such cases special permission to burn must be obtained. Where burning is permitted, proper procedures must be followed to protect the public health and safety, and to prevent the degradation of the environment. Efficient burning to obtain complete combustion without smouldering would therefore be a minimum requirement and all relevant occupational health and safety requirements would have to be met. <li data-bbox="560 2007 1517 2031">○ Accidental fires on landfills while burning must be extinguished immediately. 												

Activity /Issue	Action required
	<p data-bbox="225 416 552 445">Operation And Maintenance</p> <p data-bbox="608 456 1517 517">Appropriate operational procedures, involving the spreading and smouldering of burning waste, rather than the application of water must be implemented.</p> <ul data-bbox="464 524 1517 1346" style="list-style-type: none"> <li data-bbox="464 524 568 553">• Litter <ul data-bbox="560 553 1517 674" style="list-style-type: none"> <li data-bbox="560 553 1517 674">○ It is a minimum requirement that all litter be contained within the site. This may be achieved by the principals of compaction and cover. On sites characterized by high winds, however, movable litter fences are a minimum requirement. Windblown litter must be picked up and removed from fences on a daily basis. <li data-bbox="464 680 592 710">• Odours <ul data-bbox="560 710 1378 739" style="list-style-type: none"> <li data-bbox="560 710 1378 739">○ Odours must be combatted by good cover application and maintenance. <li data-bbox="464 745 568 775">• Dust <ul data-bbox="560 775 1517 869" style="list-style-type: none"> <li data-bbox="560 775 1517 869">○ Unsurfaced roads and ungrassed or unpaved areas, which give rise to dust problems, must be regularly watered to restrict duct levels which do not pose a nuisance to workers or users of the facility. <li data-bbox="464 904 711 934">• Waste reclamation <ul data-bbox="560 934 1517 1055" style="list-style-type: none"> <li data-bbox="560 934 1517 994">○ Reclamation on the landfill is not permitted. Reclamation at landfill sites can endanger the health and safety of the reclaimers. <li data-bbox="560 1001 1517 1055">○ Pickers, children and domestic animals are not be allowed onto any landfill site for safety reasons. <li data-bbox="464 1061 735 1090">• Vandalism and Theft <ul data-bbox="560 1090 1517 1189" style="list-style-type: none"> <li data-bbox="560 1090 1517 1189">○ Vandalism and theft on a landfill site is a common occurrence. Access control and proper security measures are required on landfill sites. Regular inspections of the perimeter of the landfill and immediate repairs of the fencing must be undertaken. <li data-bbox="464 1196 863 1225">• Monitoring Compliance check list <ul data-bbox="560 1225 1517 1346" style="list-style-type: none"> <li data-bbox="560 1225 1517 1346">○ A compliance check list must be drawn up and used to ensure the landfill operator is complying with the permit conditions. Quarterly Internal audits are required to ensure that the operator is following the check list and the site meeting the permit conditions. <p data-bbox="411 1382 1517 1536">The current landfill has a variety of negative impacts on the environment. Standards and requirements are in place in South Africa to limit these impacts and it is the duty of the landfill operator to implement these measures. Municipalities often have a significant challenge in this regard because of budget constraints resulting in a lack of equipment or personnel. However, these short comings do not change the duty of care requirements for the operation of landfills.</p> <p data-bbox="411 1568 1485 1688">Most of the environmental impacts are because of general waste management practices not being adhered to. The people surrounding the landfill are exposed to health hazards due to the waste not being managed properly. Uncovered waste results in windblown litter, landfill fires, ground water and air pollution, negative aesthetics etc.</p>
<p data-bbox="153 1720 296 1780">Composting Systems</p>	<p data-bbox="411 1720 1517 1780">Composting systems will reduce the amount of waste that is being landfilled and will benefit the surrounding communities through job creation and giving them the opportunity to have a product to sell</p> <p data-bbox="411 1812 1497 1841">Typical waste that can be used for composting is garden waste, food waste, manures and fruit waste.</p> <p data-bbox="411 1872 1430 1901">Below is a discussion of compost methods that can typically be used at communal landfill sites:</p> <p data-bbox="411 1928 647 1957">Minimal Technology</p> <ul data-bbox="464 1989 1517 2018" style="list-style-type: none"> <li data-bbox="464 1989 1517 2018">• Static piles require minimum technology. A compost pile is fairly simple to imagine. Starting at

Activity /Issue	Action required
	<p data-bbox="228 416 552 443">Operation And Maintenance</p> <p data-bbox="512 456 1517 577">a minimum size of about one cubic meter to generate and retain heat, compost piles have been known to become quite large. Static piles have no forces aeration. The output that one can expect from this type of composting technique is a lower grade compost or a soil conditioner.</p> <ul data-bbox="464 584 1517 705" style="list-style-type: none"> • This type of composting is inexpensive and if the piles are turned every few weeks, relatively few day of equipment is needed. • The time period for this kind if composting is 18-24 months. Less skilled labour is required as this is fairly easy to operate and manage. <p data-bbox="416 770 608 797">Low Technology</p> <ul data-bbox="464 831 1517 1048" style="list-style-type: none"> • Compost bins or barrels refer to an aerated bin containing layers of carbons, kitchen scraps and soil left to decompose. • Windrow – As the volume of materials increases it becomes prudent to make additional piles, often side by side, until you have a long row. A windrow is an elongated compost pile. Materials need to be physically turned in order to introduce air into the process • Vermicomposting refers to the controlled degradation, or composting, of organic wastes, primarily by earthworm consumption. <p data-bbox="416 1055 1517 1176">The output that can be expected from low technology composting is compost or a soil conditioner. The advantages is moderate cost, labour intensive, ability to use a front end loader and other generic types of equipment and the product is generally of a satisfactory quality. The time period for this type of composting is 9 – 12 months.</p>
<p data-bbox="153 1211 304 1301">Community involvement programmes</p>	<ul data-bbox="416 1211 1517 2029" style="list-style-type: none"> • Food for waste programme <ul data-bbox="512 1245 1517 1648" style="list-style-type: none"> ○ The municipality can encourage the community to take part in the food for waste or similar programme. ○ The Food for Waste programme is a special Public Works Programme of the Department of Public Works through which three objectives are pursued: (1) Increasing the waste collection capacity of municipalities thereby reducing the amount of un-served areas; (2) creating job localised opportunities for unemployed people from poor households; and (3) reducing poverty and hunger through providing food parcels to compensate for labour. ○ The beneficiaries of the programme should preferably be non-working individuals from the most vulnerable sections of disadvantaged communities who do not receive any social security income. ○ The food for waste programme can help in cleaning the area surrounding the landfill site from windblown litter and dumping outside the perimeters of the landfill site. • Material recycling facility <ul data-bbox="512 1682 1517 2029" style="list-style-type: none"> ○ If there are currently informal recyclers on the landfill site, the municipality may consider putting a programme in place for the informal recyclers. A certain area on the entrance to the site could be identified where these informal recycles can still do recycling, but in a more controlled and hygienic way. ○ The informal recyclers allowed on the landfill site should register themselves and get a permit from the waste manager. They should be provided with Personal Protective Equipment (PPE). Permit conditions can include the following: <ul data-bbox="608 1906 1134 2029" style="list-style-type: none"> ▪ Do not eat anything found on the site ▪ Do not burn anything on the site ▪ Do not allow children and animals on the site ▪ You are only allowed on site with in working hours

Activity /Issue	Action required
Operation And Maintenance	
	<ul style="list-style-type: none"> ▪ Wear PPE at all times ▪ Obey the rules on the site enforced by the Security Guards <p>Payment is based on the waste volumes collected.</p>

9. TIMEFRAMES

It is recommended that the detailed design as laid out in the EMPr must commence immediately upon receipt of the licence licence, so that the works can be carried out immediately thereafter to rehabilitate and implement operational best practice.

10. CONCLUSION

The activities set out in this EMPr will effectively mitigate the impacts related to the operation of the Nondweni 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;
- 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 proper waste classification must be done at the site gate;
- Continuous training of site staff must be done to ensure that they are conversant with the provisions contained within this EMPr; and
- On-site monitoring must continuously be done so that the Municipality and the KZN EDTEA become aware of any pollution impacts early on.

11. REFERENCES

AECOM, 2015. Basic Assessment Report - Licence for Operation of Nondweni Waste Disposal Facility, Nquthu Local Municipality, KwaZulu-Natal