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Appendix S: Environmental Management Programme



Environmental Management Programme for the Proposed Continuous Ash Disposal Facility for the Matimba Power Station in Lephalale, Limpopo Province

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Drafted by: Nicole Botham

Checked by: Prashika Reddy

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Approved by: Prashika Reddy

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Glossary

Accident	A road vehicle accident.
Activity (Development)	An action either planned or existing that may result in environmental impacts through pollution or resource use. For the purpose of this report, the terms 'activity' and 'development' are freely interchanged.
Alien Species	A species that is not an indigenous species; or an indigenous species translocated to a place outside its natural distribution range in nature, but not an indigenous species that has extended its natural distribution range by natural means of migration or dispersal without human intervention.
Alternatives	Different means of meeting the general purpose and requirements of the activity, which may include site or location alternatives; alternatives to the type of activity being undertaken; the design or layout of the activity; the technology to be used in the activity and the operational aspects of the activity.
Applicant	The project proponent or Developers responsible for submitting applications (Environmental Authorisation, Waste Management Licence, Water Use Licence etc.) to the relevant environmental authority
Biodiversity	The diversity of animals, plants and other organisms found within and between ecosystems, habitats, and the ecological complexes.
Buffer	A buffer is seen as an area that protects adjacent communities from unfavourable conditions. A buffer zone is usually an artificially imposed zone included in a management plan.
Building and Demolition Waste	Building and demolition waste means waste, excluding hazardous waste, produced during the construction, alteration, repair or demolition of any structure, and includes rubble, earth, rock and wood displaced during that construction, alteration, repair or demolition which include (a) discarded concrete, bricks, tiles and ceramics; (b) discarded wood, glass and plastic; (c) discarded metals; (d) discarded soil, stones and dredging spoil; (e) other discarded building and demolition waste.
Construction	The building, erection or establishment of a facility, structure or infrastructure that is necessary for the undertaking of a listed or specified activity but excludes any modification, alteration or expansion of such a facility, structure or infrastructure and excluding the reconstruction of the same facility in the same location, with the same capacity and footprint.
Contractor	Companies appointed on behalf of the Client to undertake activities, as well as their sub-contractors and suppliers.
Cumulative Impact	The impact of an activity that in itself may not be significant but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area.
Decommissioning	The demolition of a building, facility, structure or infrastructure.
Degradation	The lowering of the quality of the environment through human activities e.g. river degradation, soil degradation.
Demolition	Demolition is the tearing-down of buildings and other structures, the opposite of

construction. Demolition contrasts with deconstruction, which involves taking a building apart while carefully preserving valuable elements for re-use.

Direct Impact	Impacts that are caused directly by the activity and generally occur at the same time and at the same place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally quantifiable.
Domestic Waste	Domestic waste means waste, excluding hazardous waste that emanates from premises that are used wholly or mainly for residential, educational, health care, sport or recreation purposes, which include (a) garden and park waste; (b) municipal waste and (c) food waste.
Emergency	An undesired event that results in a significant environmental impact and requires the notification of the relevant statutory body such as a local or provincial authority.
Environment	In terms of the National Environmental Management Act (NEMA) (No 107 of 1998)(as amended), “Environment” means the surroundings within which humans exist and that are made up of: <ul style="list-style-type: none"> i. the land, water and atmosphere of the earth; ii. micro-organisms, plants and animal life; iii. any part or combination of (i) of (ii) and the interrelationships among and between them; and iv. the physical, chemical, aesthetic and cultural properties and conditions of the foregoing that influence human health and wellbeing.
Environmental Control Officer	An individual nominated through the Client to be present on site to act on behalf of the Client in matters concerning the implementation and day to day monitoring of the EMPr and conditions stipulated by the authorities.
Environmental Impact	A change to the environment, whether adverse or beneficial, wholly or partially resulting from an organisation’s activities, products or services.
Environmental Assessment	The generic term for all forms of environmental assessment for projects, plans, programmes or policies and includes methodologies or tools such as environmental impact assessments, strategic environmental assessments and risk assessments.
Environmental Authorisation	An authorisation issued by the competent authority in respect of a listed activity, or an activity which takes place within a sensitive environment.
Environmental Assessment Practitioner (EAP)	The individual responsible for planning, management and coordination of environmental impact assessments, strategic environmental assessments, environmental management programmes or any other appropriate environmental instrument introduced through the EIA Regulations.
Environmental Impact	Change to the environment (biophysical, social and/ or economic), whether adverse or beneficial, wholly or partially, resulting from an organisation’s activities, products or services.
Environmental Impact Assessment (EIA)	In relation to an application to which scoping must be applied, means the process of collecting, organising, analysing, interpreting and communicating information that is relevant to the consideration of that application as defined in NEMA.
Environmental	Ensuring that environmental concerns are included in all stages of development, so that development is sustainable and does not exceed the

Management	carrying capacity of the environment.
Environmental Management Programme (EMPr)	A detailed plan of action prepared to ensure that recommendations for enhancing or ensuring positive impacts and limiting or preventing negative environmental impacts are implemented during the life cycle of a project. This EMPr focuses on the construction phase, operation phase and decommissioning phase of the proposed project.
Fatal Flaw	An event or condition that could cause an unanticipated problem and/or conflict which will could result in a development being rejected or stopped.
General Waste	General waste means waste that does not pose an immediate hazard or threat to health or to the environment, and includes – <ul style="list-style-type: none"> i. domestic waste; ii. building and demolition waste; iii. business waste; and iv. inert waste.
General Waste Landfill Site	A waste disposal site that is designed, managed and permitted to allow for the disposal of general waste.
Hazardous Waste	Hazardous waste means any waste that contains organic or inorganic elements or compounds that may, owing to the inherent physical, chemical or toxicological characteristics of that waste, have a detrimental impact on health and the environment.
Hazardous Waste Landfill Site	A waste disposal site that is designed, managed and permitted to allow for the disposal of hazardous waste.
Human Waste	Excrement, faeces or other waste material discharged from the human body.
Impact	A description of the potential effect or consequence of an aspect of the development on a specified component of the biophysical, social or economic environment within a defined time and space.
Incident	An undesired event which may result in a significant environmental impact but can be managed through internal response.
Indirect Impacts	Indirect or induced changes that may occur as a result of the activity. These types if impacts include all of the potential impacts that do not manifest immediately when the activity is undertaken or which occur at a different place as a result of the activity.
Integrated Environmental Management	A philosophy that prescribes a code of practice for ensuring that environmental considerations are fully integrated into all stages of the development and decision-making process. The IEM philosophy (and principles) is interpreted as applying to the planning, assessment, implementation and management of any proposal (project, plan, programme or policy) or activity - at local, national and international level - that has a potentially significant effect on the environment. Implementation of this philosophy relies on the selection and application of appropriate tools for a particular proposal or activity. These may include environmental assessment tools (such as strategic environmental assessment and risk assessment), environmental management tools (such as monitoring, auditing and reporting) and decision-making tools (such as multi-criteria decision support systems or advisory councils).
Interested and Affected	Any person, group of persons or organisation interested in or affected by an activity; and any organ of state that may have jurisdiction over any aspect of

Party (I&AP)	the activity.
Invasive Species	Any species whose establishment and spread outside of its natural distribution range.
Method Statement	A method statement is a written submission by the Contractor to the Engineer in response to the specification or a request by the Engineer, setting out the plant, materials, labour and method the Contractor proposes using to carry out an activity, identified by the relevant specification or the Engineer when requesting a Method Statement. It contains sufficient detail to enable the Engineer to assess whether the Contractor's proposal is in accordance with the Specifications and/or will produce results in accordance with the Specifications.
Mitigate	The implementation of practical measures designed to avoid, reduce or remedy adverse impacts or enhance beneficial impacts of an action.
Pollution	The National Environmental Management Act, No. 107 of 1998 defined pollution to mean any change in the environment caused by – substances; radioactive or other waves; or noise, odours, dust or heat emitted from any activity, including the storage or treatment of waste or substances, construction and the provision of services, whether engaged in by any person or an organ of state, where that change has an adverse effect on human health or well-being or on the composition, resilience and productivity of natural or managed ecosystems, or on materials useful to people, or will have such an effect in the future.
Rehabilitation	Rehabilitation is defined as the return of a disturbed area to a state which approximates the state (wherever possible) which it was before disruption. Rehabilitation for the purposes of this Environmental Management Programme is aimed at post-reinstatement re-vegetation of disturbed areas and the stability of the land surface. In attempt to achieve this purpose, disturbed areas should be rehabilitated with the establishment of suitable indigenous vegetation. Re-vegetation should aim to accelerate the natural succession processes so that the plant community develops in the desired way, i.e. promote rapid vegetation establishment.
Sensitive Environments	Any environment identified as being sensitive to the impacts of the development.
Topsoil	The A-horizon of the soil profile. Topsoil is the upper layer of soil from which plants obtain their nutrients for growth. It is often darker in colour, due to the organic (humus) fraction. Where topsoil is referred to, it is deemed to be the soil and grass / ground cover fraction. For the purposes of this management programme, where: topsoil is deemed as the layer of soil from the surface (approximately 300 mm) to the specified depth required for excavation.
Waste	Waste means any substance, whether or not that substance can be reduced, re-used, recycled and recovered - <ul style="list-style-type: none"> i. that is surplus, unwanted, rejected, discarded, abandoned or disposed of; ii. which the generator has no further use of for the purposes of production; iii. that must be treated or disposed of; or iv. 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— v. a by-product is not considered waste; and vi. any portion of waste, once re-used, recycled and recovered, ceases to

	be waste.
Waste Disposal Facility	Waste disposal facility means any site or premise used for the accumulation of waste with the purpose of disposing of that waste at that site or on that premises.
Watercourse	Defined as: <ul style="list-style-type: none">i. a river or spring;ii. a natural channel or depression in which water flows regularly or intermittently;iii. a wetland, lake or dam into which, or from which, water flows; andiv. any collection of water which the Minister may, by notice in the Gazette, declare to be a watercourse as defined in the National Water Act, 1998 (No 36 of 1998) and a reference to a watercourse includes, where relevant, its bed and banks.
Water Pollution	The National Water Act, 36 of 1998 defined water pollution to be the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it – less fit for any beneficial purpose for which it may reasonably be expected to be used; or harmful or potentially harmful (aa) to the welfare, health or safety of human beings; (bb) to any aquatic or non-aquatic organisms; (cc) to the resource quality; or (dd) to property”.
Wetland	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 land in normal circumstances supports or would support vegetation typically adapted to life in saturated soil.
Workforce	The entire project team including people employed by the Developers or the Contractor, persons involved in activities related to the project, or person present at or visiting the construction area, including permanent contactors and casual labour.

Acronyms

ADF	Ash Disposal Facility
DEA	Department of Environmental Affairs
DWS	Department of Water and Sanitation
ECO	Environmental Control Officer
EO	Environmental Officer
EERP	Environmental Emergency Response Plan
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMPr	Environmental Management Programme
EMS	Environmental Management System
ESS	Environmental Scoping Study
I&AP	Interested and Affected Party
IEA	Integrated Environmental Authorisation
LDEDET	Limpopo Department of Economic Development, Environment and Tourism
NCR	Non-Conformance Report
NEM:AQA	National Environmental Management – Air Quality Act (No 39 of 2004)
NEM:WA	National Environmental Management – Waste Act (No 59 of 2008)
NEMA	National Environmental Management Act (No 107 of 1998)
NHRA	National Heritage Resources Act (No 25 of 1999)
PCD	Pollution Control Dam
PM	Project Manager
PrM	Programme Manager
PSM	Power Station Manager
QMS	Quality Management System
SA	Site Alternative
SAHRA	South African Heritage Resources Agency
SHE	Safety, Health and Environment
SMP	Stormwater Management Plan

1 Introduction

Eskom Holdings SOC Ltd (Eskom) is mandated by the South African Government to ensure the provision of reliable and affordable power to South Africa. Eskom’s core business is the generation, transmission and distribution of electricity. Eskom generates approximately 95% of the electricity used in South Africa. The reliable provision of electricity by Eskom is critical for economic development in South Africa.

The Matimba Power Station in Lephalale, Limpopo Province, is a 3990 MW installed capacity base load coal-fired power station, consisting of six units. Matimba is a direct dry cooling power station, an innovation necessitated by the severe shortage of water in the area where it is situated. The station obtains its coal from Exxaro’s Grootegeluk Colliery for the generation of electricity.

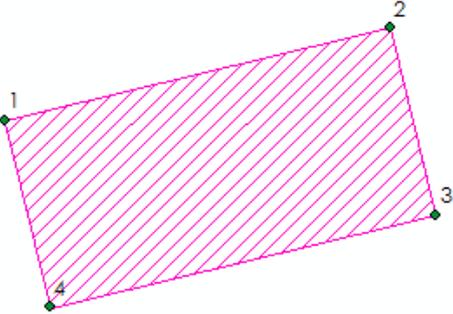
Ash is generated as a by-product from combustion of coal from the power station and Matimba produces approximately 6 million tons of ash annually. This ash is currently being disposed by means of ‘dry ashing’ approximately 3 km south of the Matimba Power Station.

The proposed project entails the development of an ash disposal facility (ADF) and associated infrastructure which may be a continuation of the existing facility or may be a new facility requiring an airspace capacity of 276 249 000 m³ for the next 40 years of operation (2015 – 2055) of the power station.

Two site alternatives were identified and assessed in the EIA study for the establishment of the ADF:

- ✦ Site Alternative 1 (SA1) *Preferred* – located south of the Matimba Power Station the farm Zwartwater 507 LQ. Part of this farm is currently utilized as an ADF.

The coordinates for SA1 are provided below:

Site Alternative 1			
	1	23° 42' 33.48" S	27° 34' 43.83" E
	2	23° 42' 2.66" S	27° 36' 50.78" E
	3	23° 43' 5.09" S	27° 37' 5.94" E
	4	23° 43' 35.63" S	27° 34' 58.93" E

- ✦ Site Alternative 2 (SA2) - This site is located north of the Matimba Power Station and straddles four different farms namely Vooruit 449 LQ, Appelvlakte 448 LQ, Droogeheuvel 447 LQ and Ganzepan 446 LQ. As SA2 is a greenfields site in its entirety, a new conveyor belt system as well as access road (linear infrastructure route) would have to be developed in order to transport ash from the Matimba Power Station to the new ADF.

The coordinates for SA2 are provided overleaf.

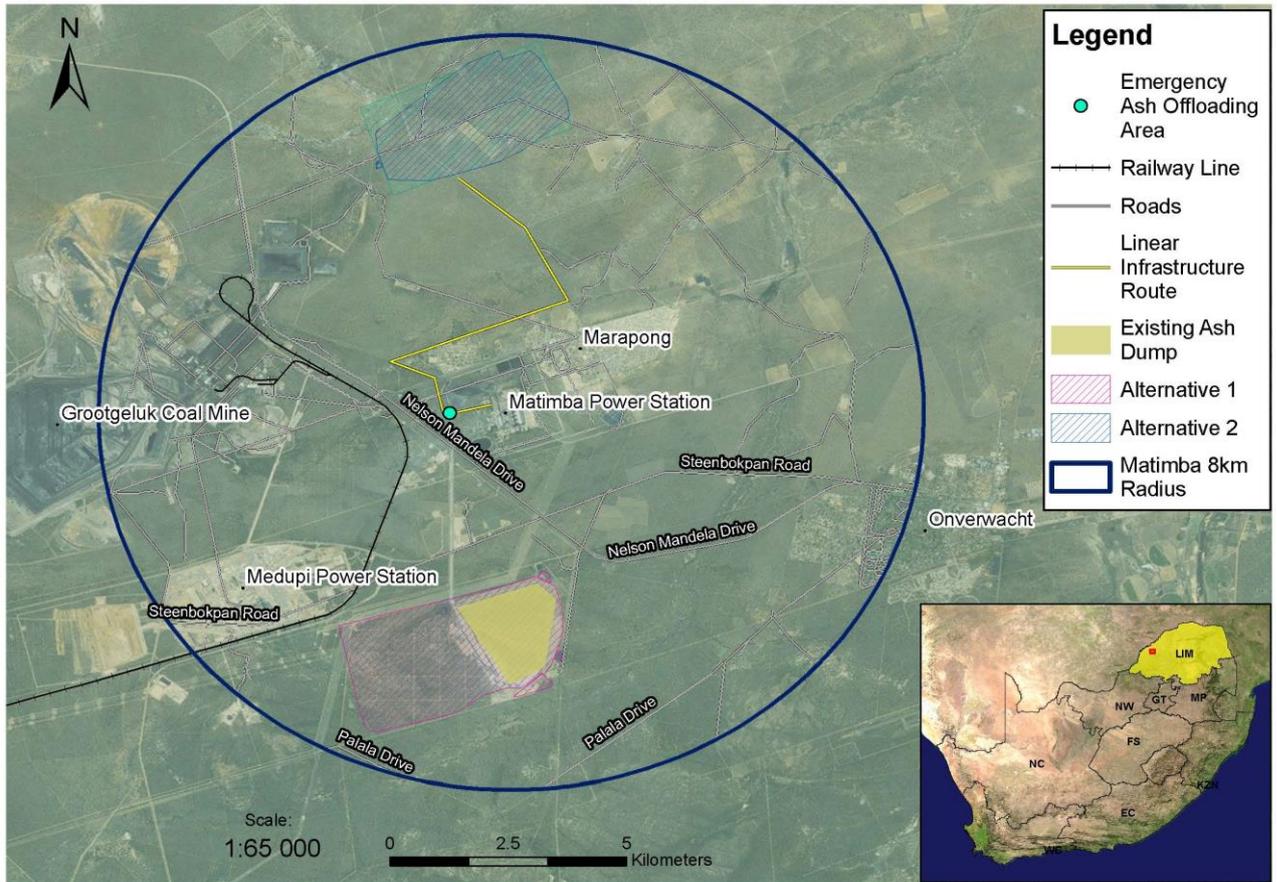
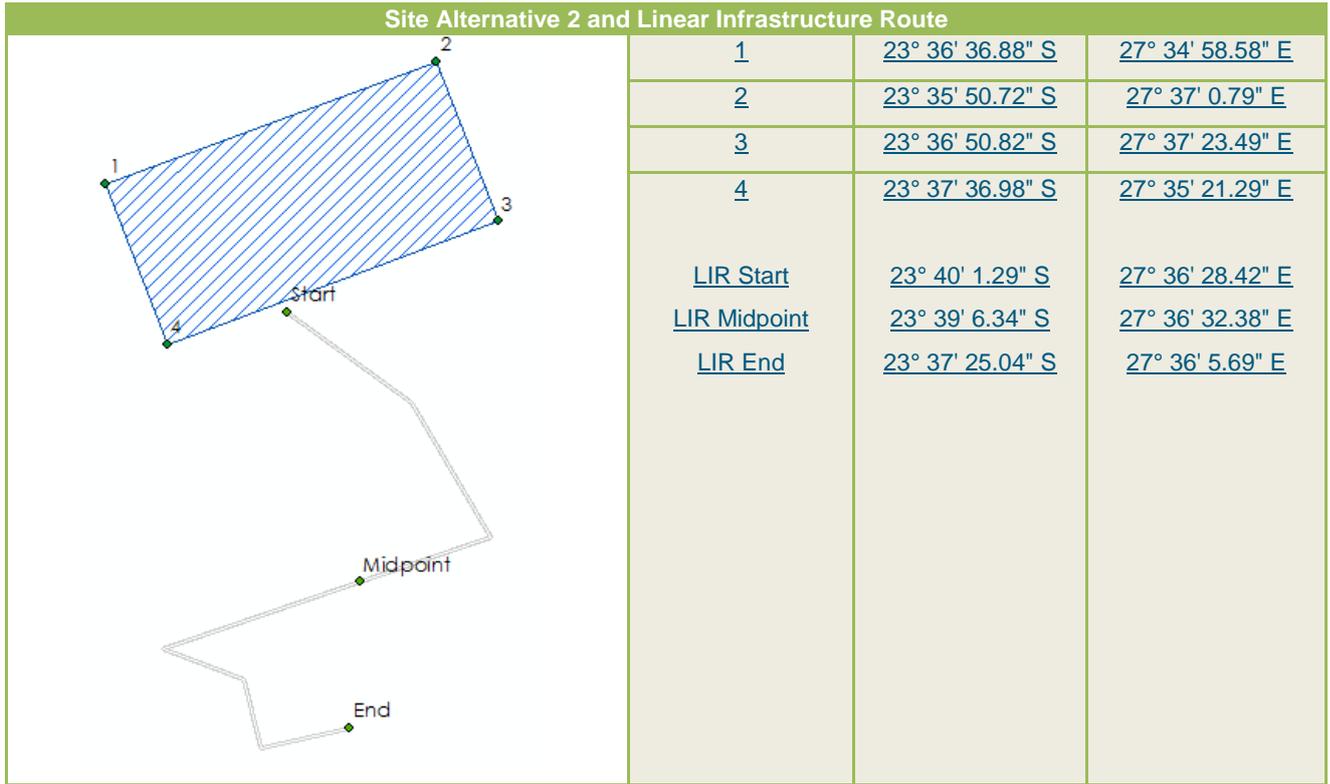
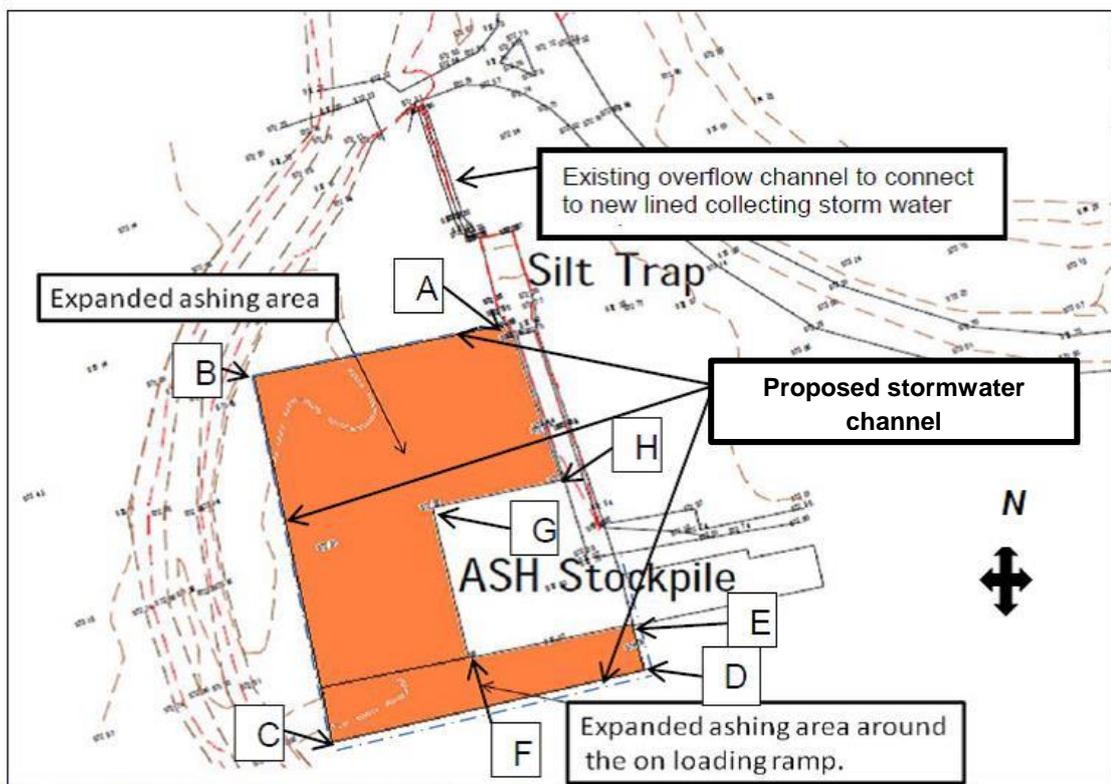


Figure 1: Locality map

In addition to the above site alternatives, the project also considers the extension of the emergency ash offloading area. Emergency ash offloading is an integral part of the ash management system at the Matimba Power Station. It offers the temporary disposal of the ash whilst the ash conveyors systems, that dispose the ash at the ADF, are maintained. It is essential that the emergency ash offloading area is capacitated to adequately handle the amount of ash stored and for proper management of any surface run-off water.

The emergency ash offloading area is located within the perimeter boundary and to the western side of Matimba Power Station (Grootestryd 465 LQ, Figure 2). It is situated adjacent to the transfer house between the Cross and Overland conveyors. Currently, the emergency ash offloading area is a 30 m x 30 m reinforced concrete slab. The function of the area is to offload ash in instances where the Overland Conveyor is unable to transport the ash to the ADF due to breakdown or maintenance activities.

The average volume of ash being stored at the area is approximated at 19500 tons given the amount of days it takes to maintain and bring back the conveyor system back online, which can take a maximum of 5 days.



Corner	Coordinates	
	S	E
A	-23.66824	27.60000
B	-23.66835	27.59956
C	-23.66896	27.59963
D	-23.66883	27.60026
E	-23.66883	27.60024
F	-23.66873	27.59991
G	-23.66856	27.59987
H	-23.66853	27.60011

Figure 2: Proposed emergency loading facility expansion and coordinates

1.1 Applicable Documentation

The following environmental documentation is applicable for the project, and will be read in conjunction with this Environmental Management Programme (EMPr):

- ✧ Environmental Impact Assessment Report for the proposed continuous ADF for the Matimba Power Station.
- ✧ Integrated Environmental Authorisation from the Department of Environmental Affairs (once issued).
- ✧ Integrated Water Use Licence from the Department of Water Affairs (once issued).

1.2 Purpose of the EMPr

In terms of The Constitution of the Republic of South Africa (1996), everyone has the right to an environment that is not harmful to their health or well-being and to have the environment protected, for benefit of present and future generations, through reasonable legislation and other measures that prevent pollution and ecological degradation, promote conservation and secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development (Section 24). The needs of the environment as well as affected parties should thus be integrated into overall project management.

The Constitution is underpinned by the suite of Specific Environmental Management Acts (SEMAs) – including the National Environmental Management Act (No 107 of 1998 - NEMA), National Environmental Management: Waste Act (No 59 of 2008 - NEM:WA), National Environmental Management: Air Quality Act (No 39 of 2004 - NEM:AQA), National Environmental Management Biodiversity Act (No 10 of 2004 - NEM:BA), National Environmental Management Protected Areas Act (No 57 of 2003 - NEM:PAA), and the National Water Act (No 36 of 1998 - NWA) – which combined, serve to control all relevant facets of the environment so as to ensure that Section 24 of the Constitution is upheld.

This EMPr is developed in terms of the SEMAs and ensures that construction activities meet the requirements of existing environmental legislation and good environmental practice in terms of international norms and standards. This is achieved by identifying those activities for the proposed development that may have a negative impact on the environment; outlining the mitigation measures that will need to be taken and the steps necessary for their implementation and describing the reporting system to be undertaken during construction.

1.3 Objectives of the EMPr

The EMPr has the following objectives:

- ✧ To ensure compliance with regulatory authority stipulations and guidelines; which may be local, provincial, national, and/or, international.
- ✧ To outline functions and responsibilities of responsible persons;
- ✧ To state standards and guidelines, which are required to be achieved in terms of environmental legislation;
- ✧ To outline mitigation measures and environmental specifications, which are required to be implemented for all phases of the project in order to minimise the extent of environmental impacts, and to manage environmental impacts;
- ✧ To prevent long-term or permanent environmental degradation.
- ✧ To establish a method of monitoring and auditing environmental management practices during all phases of development.
- ✧ Detail specific actions deemed necessary to assist in mitigating the environmental impact of the project.
- ✧ Ensure that all workers, subcontractors and other involved in the project meet legal and other requirements with regard to environmental management;
- ✧ Incorporate environmental management into project design and operating procedures; and
- ✧ Address concerns and issues addressed in the EIA's stakeholder consultation process and those that will likely to continue to arise during the project's lifetime.

An independent Environmental Control Officer (ECO) must be appointed (by the proponent: Eskom) to ensure compliance with the EMPr. The EMPr will be considered an extension of the Conditions of Approval as set forth by the Department of Environmental Affairs (DEA) and Department of Water and Sanitation (DWS). Non-compliance with the EMPr will constitute non-compliance with the said Conditions.

1.4 Structure of the EMPr

The EMPr provides mitigation and management measures for the following key phases of the project:

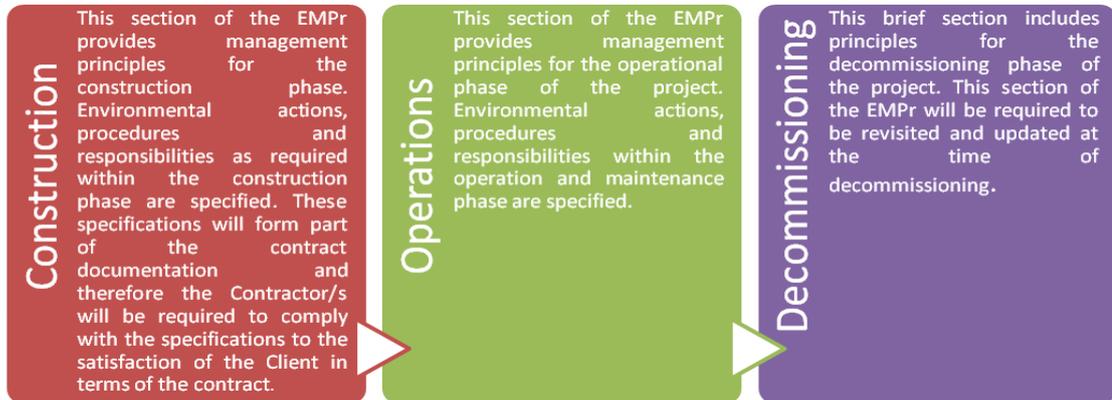


Figure 3: Different phases of the project life-cycle

Additions/revisions from the draft EMPr to the final draft EMPr have been underlined and highlighted for ease of reference to the reader.

1.5 The EMPr as a 'living' Document

The approach adopted for this EMPr is derived from the Deming Cycle (Figure 4), a cycle of continuous improvement that entails the reiterative actions of plan, do, check, act, and critically to then return to the planning phase.

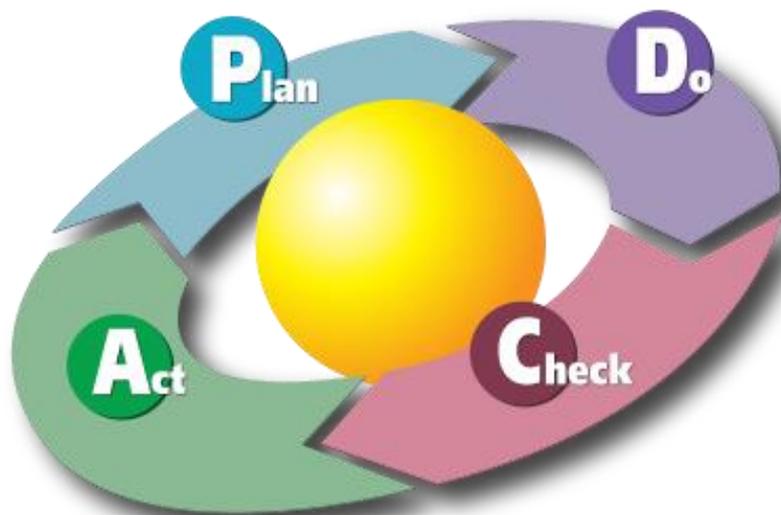


Figure 4: Deming cycle of continuing improvement

1.5.1 Plan

Project-specific planning for the proposed project involves consideration of the legal triggers, the specifics of the proposed development, and the nature of the receiving environment. This provides a starting point for targeted environmental management objectives. Environmental performance indicators are then determined with measurable targets prescribed to monitor the environmental performance of the project. Achieving the targets depends on compliance with this EMPr and the legislative requirements that underpin it.

1.5.2 Do

Throughout the development's life-span, the developer and operator will be required to develop and maintain a Quality Management System – designed to ensure that best management practices are implemented in day-to-day management. Such a QMS should at least include the following information:

- ✧ Location and extent of associated infrastructure;
- ✧ Associated activities, such as the transportation of people and equipment;
- ✧ Resources and experience required (staffing);
- ✧ Materials and equipment to be used;
- ✧ Management actions;
- ✧ Human resources used;
- ✧ Construction-monitoring activities;
- ✧ Emergency / disaster incident and reaction procedures; and
- ✧ Rehabilitation procedures for the impacted environment.

These topics will be cross-linked into the contracts related to the development and operational phases of the project.

1.5.3 Check

A system of assessing monitoring results has been developed to check the environmental management performance. Continuous assessment facilitates proactive management of the environmental issues. Mitigation measures can then be successfully implemented on an ongoing 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.

1.5.4 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 findings of monitoring and auditing programmes can also be used to update the EMPr. Although the EMPr is a project-specific document, it is dynamic and should be updated regularly to address the changing circumstances of the project.

1.6 Details of the Environmental Assessment Practitioner

The particulars of the EAPs responsible for the compilation of this document are presented in Table 1 below:

Table 1: Details of the EAPs

Details	
Consultant:	Royal HaskoningDHV (formerly known as SSI Engineers and Environmental Consultants (Pty) Ltd)
Contact Persons:	Nicole Botham, Prashika Reddy and Malcolm Roods
Postal Address	PO Box 867; Gallo Manor; 2052, Johannesburg
Telephone:	012 367 5916 / 012 367 5973 / 011 798 6442
Facsimile:	012 367 5878 / 011 798 6010
E-mail:	prashika.reddy@rhdhv.com

Details	
	nicole.botham@rhdhv.com
Expertise:	<p>Nicole Botham is an Environmental Consultant with six years experience in the mining sector, having undertaken work in Africa, Europe, Middle East, USA and Fiji. Ms Botham has focussed on management plan preparation, mine decommissioning (closure) and audits of mine investments. Areas of expertise include: Scoping Reports, Environmental Impact Assessment (EIA), Environmental Management Reports, Environmental Audits, and Baseline Studies. Key project experience includes: Sol Plaatje Municipality, Trekkopje Mine, Tshipi è ntle Mine, Bon Accord Mine, Wonderfontein Mine, Manganese mine in Burkina Faso, Vatukoula Gold Mine, Northland Mine, Antimony Process Plant in Oman, and a Biofuels project in Mozambique.</p> <p>Prashika Reddy is a Principal Associate (<i>Pr Sci Nat</i> 400133/10) with a BSc Honours in Geography and Botany. Ms Reddy has the necessary experience in various environmental fields including: environmental impact assessments, environmental management plans/programmes, public participation and environmental monitoring and auditing. Ms Reddy has extensive experience in compiling environmental reports (Screening, Scoping, EIA and <i>Status Quo</i> Reports). Ms Reddy is/has been part of numerous multi-faceted large-scale projects, including the establishment of linear developments (roads, and power lines); industrial plants; electricity generation plants and mining-related projects.</p>

1.7 Department of Environmental Affairs EMPr Request

The DEA requires the following to be submitted as part of the EMPr:

Table 2: Additional request from DEA

Plans / Other Information	Relevant Section(s) of the EMPr
Plant rescue and protection plan	5.1
Open space management plan	5.2
Re-vegetation and habitat rehabilitation plan	8.1
Alien invasive management plan	6.10; 7.7
Stormwater management plan	6.6; 7.5; Appendix B
Monitoring system for the detection of leakage and spillage	6.3; 6.4; 7.2; 0; Appendix C
Erosion management	6.8; 7.6
Traffic management plan	6.17
Environmental sensitivity map	Appendix A
Measures to protect hydrological features such as streams, rivers, pans, wetlands, dams and their catchment and other environmental sensitive areas	6.3; 6.4; 6.5 7.2; 0; 7.4; Appendix C

2 Environmental Legislation, Policies and Guidelines

All relevant environmental legislation pertaining to the project from cradle to grave is listed within Table 3 below. The Contractor is required to comply with this legislation for all phases of the project. This list is intended to serve as a guideline only for the Contractor and is not exhaustive. Additional aspects should be added once the Integrated Environmental Authorisation is obtained and amended as construction commences.

Table 3: Relevant environmental legislation, guidelines and policies applicable to the project

Legislation	Section	Relates to
The Constitution (No 108 of 1996)	Chapter 2	Bill of Rights.
	Section 24	Environmental rights.
National Environmental Management Act (No 107 of 1998 [as amended])	Section 2	Defines the strategic environmental management goals and objectives of the government. Applies throughout the Republic to the actions of all organs of state that may significantly affect the environment.
	Section 24	Provides for the prohibition, restriction and control of activities which are likely to have a detrimental effect on the environment.
	Section 28	The developer has a general duty to care for the environment and to institute such measures as may be needed to demonstrate such care.
EIA Regulations (2010) – Government Notice 543 - 546	GN 543 – Sections 28, 31, 32, 33, 54	Content of scoping reports (Section 28), Environmental Impact Assessment reports (Section 31), specialist report and reports on specialised processes (Section 32), content of draft environmental management programmes (Section 33) and the public participation process (Section 54).
	GN 544 – Listing Notice 1	Activities requiring a Basic Assessment study to be undertaken.
	GN 545 – Listing Notice 2	Activities requiring a Scoping and Impact Assessment study to be undertaken.
	GN 546 – Listing Notice 3	Activities in special geographical areas requiring a Basic Assessment study to be undertaken.
National Environmental Management: Waste Act (No. 59 of 2008)	Section 19	A list of waste management activities (GN R.718) which have, or are likely to have a detrimental effect on the environment have been published.
	Government Notice 921 – Category A	Activities requiring a Basic Assessment study to be undertaken as part of the waste management licence application.
	Government Notice 921 – Category B	Activities requiring a Scoping and Impact Assessment study to be undertaken as part of the waste management licence application.
	Government Notice Regulation 634	Waste Classification and Management Regulations.
	Government Notice Regulation 635	National Norms and Standards for the assessment of Waste for Landfill Disposal.

Legislation	Section	Relates to
	Government Notice Regulation 635	National Norms and Standards for Disposal of Waste to Landfill.
Environment Conservation Act (No 73 of 1989) and Regulations	Sections 19 and 19A	Prevention of littering by employees and subcontractors during construction and the maintenance phases of the proposed project.
National Water Act (No 36 of 1998)	Section 21	General principles for regulating water use.
National Heritage Resources Act (No 25 of 1999) and Regulations	Section 34	No person may alter or demolish any structure or part of a structure which is older than 60 years without a permit issued by the relevant provincial heritage resources authority.
	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 palaeontological 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 (HIAs), which are not already covered under the ECA. Where they are covered under the ECA the provincial heritage resources authorities must be notified of a proposed project and must be consulted during the HIA process. The Heritage Impact Assessment (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.
National Environmental Management: Air Quality Act (No 39 of 2004)	Section 32	Control of dust.
	Section 34	Control of noise.
	Section 35	Control of offensive odours.
National Dust Control Regulations (2013)		The purpose of the Regulations is to prescribe general measures for the control of dust in all areas. A standard for the acceptable dust fall rate is prescribed for residential and non-residential areas. Failure to comply with the standard for dust fall may result in an air quality officer directing the person in question to undertake a dust fall monitoring programme, submission of dust fall monitoring reports and dust fall management plans as well as the undertaking of continuous ambient air quality monitoring.
National Environmental Management Biodiversity Act (Act No. 10 of 2004) and regulations: <ul style="list-style-type: none"> ▪ Threatened or protected species (GN 388) ▪ Lists of species that are 		Provide for the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources.

Legislation	Section	Relates to
<p>threatened or protected (GN 389)</p> <ul style="list-style-type: none"> ▪ Alien and invasive species regulations (GNR 506) ▪ Publication of exempted alien species (GNR 509) ▪ Publication of National list of invasive species (GNR 507) ▪ Publication of prohibited alien species (GNR 508) 		
<p>National Forests Act (No 84 of 1998) and Regulations</p>	Section 7	No person may cut, disturb, damage or destroy any indigenous, living tree in a natural forest, except in terms of a licence issued under section 7(4) or section 23; or an exemption from the provisions of this subsection published by the Minister in the Gazette.
	Sections 12-16	These sections deal with protected trees, with the Minister having the power to declare a particular tree, a group of trees, a particular woodland, or trees belonging to a certain species, to be a protected tree, group of trees, woodland or species. In terms of section 15, no person may cut, disturb, damage, destroy or remove any protected tree; or collect, remove, transport, export, purchase, sell, donate or in any other manner acquire or dispose of any protected tree, except under a licence granted by the Minister.
<p>National Veld and Forest Fire Act (No 101 of 1998) Regulation 9</p>		The application of control measures regarding the utilisation and protection of veld.
<p>Occupational Health and Safety Act (No 85 of 1993)</p>	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.
<p>Hazardous Substances Act (No 15 of 1973) and Regulations</p>		Provides for the definition, classification, use, operation, modification, disposal or dumping of hazardous substances.
<p>Fencing Act (No 31 of 1963)</p>	Section 17	Any person erecting a boundary fence may clean any bush along the line of the fence up to 1.5 meters 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 protection of flora.
<p>Construction Regulations 2014</p>		Contractors must comply with the Construction Regulations which lay out the framework for construction related activities.
<p>SANS 10103 (Noise Regulations)</p>		The measurement and rating of environmental noise with respect to annoyance and to speech communication.
<p>Road Transportation Act (No 74 of 1977)</p>		
<p>Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge Selection of management options: Volume 1 (2006)</p>		
<p>Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge Requirements for the agricultural use of wastewater sludge: Volume 2 (2006)</p>		
<p>Department of Water Affairs and Forestry: Guidelines for the Utilisation and Disposal of Wastewater Sludge:</p>		

Legislation	Section	Relates to
		Requirements for the on-site and off-site disposal of wastewater sludge: Volume 3 (2007)
		Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge: Requirements for the beneficial use of sludge at high loading rates: Volume 4 (2008)
		Department of Water Affairs and Forestry. Guidelines for the Utilisation and Disposal of Wastewater Sludge: Requirements for thermal sludge management practices and for commercial products containing sludge: Volume 5 (2008)
		Waterberg District Municipality Spatial Development Framework (no date)
		Waterberg District Municipality Integrated Development Plan (2014/15)
		Waterberg District Municipality Local Economic Development Strategy (2007)
		Waterberg District Municipality Environmental Management Framework (2010)
		Lephalale Local Municipality Integrated Development Plan (2013-2016)
		Lephalale Local Municipality Spatial Development Framework (2012)
		Lephalale Local Municipality Local Economic Development Strategy (2008)

3 Management and Monitoring Procedures

3.1 Organisational Structure and Responsibilities

The key personnel from an environmental perspective are the Power Station Manager (PSM), Programme Manager (PrM), Project Manager, Environmental Control Officer (ECO) and the Contractor.

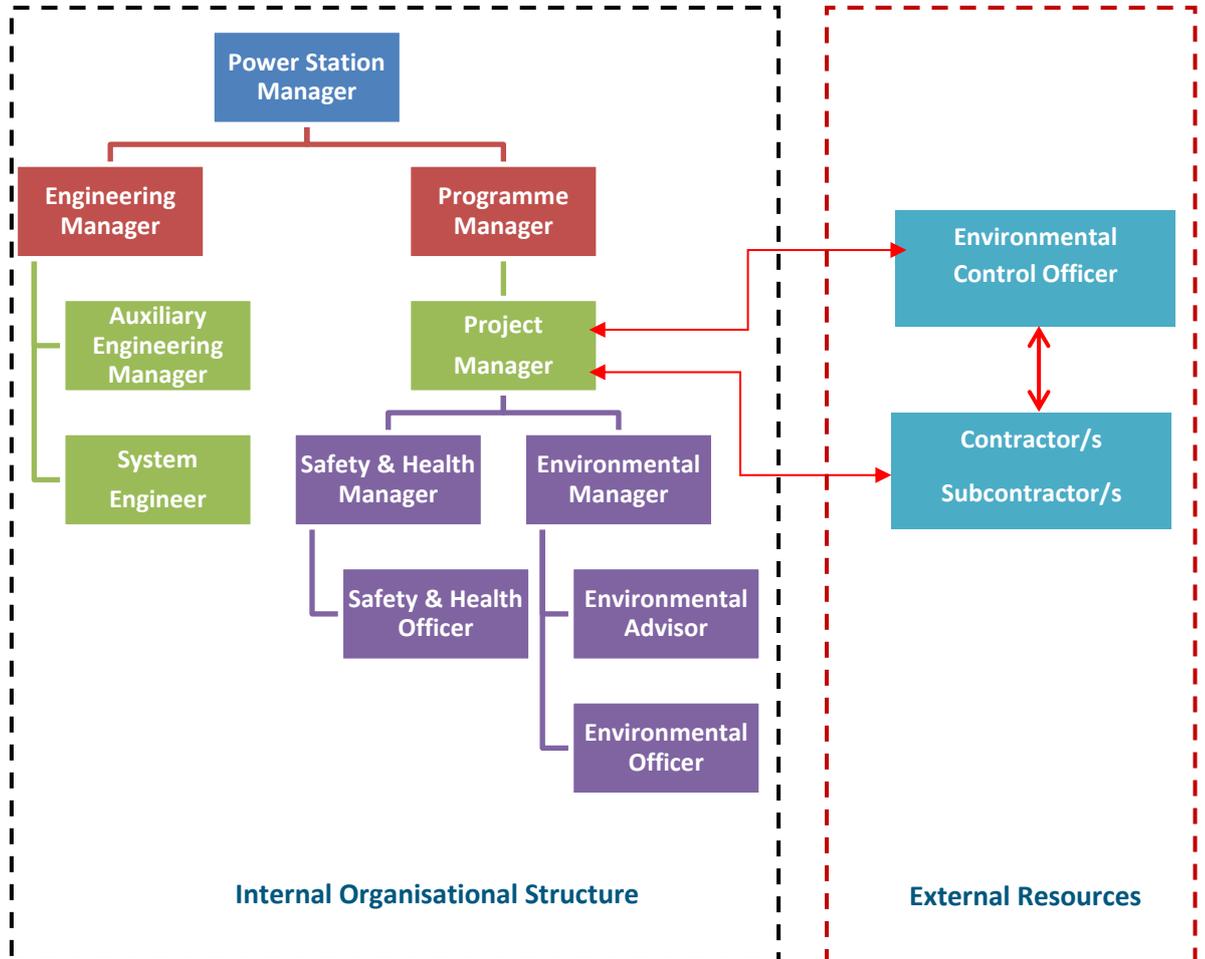


Figure 5: Organogram

Text Box 1: Power Station Manager and Programme Manager

Power Station Manager and Programme Manager
<p>The Matimba Power Station Manager (PSM) and Programme Manager (PrM) are ultimately responsible for ensuring compliance with the environmental specification and upholding Eskom’s environmental commitment to 100% compliance with all National, Provincial and local legislation that relates to management of this environment.</p> <p><i>The PSM and PrM will:</i></p> <ul style="list-style-type: none"> ▪ Appoint a Project Manager (PM) to assume ultimate project responsibility; ▪ Be familiar with the contents of the EMPr; ▪ Ensure the EMPr is in the tender documentation issued to prospective contractors; ▪ Request for, review and approve the Method Statements prepared by the Contractor; ▪ Review and comment on environmental assessments and/or reports produced by the Contractor and ECO; ▪ Undertake regular site visits and ensure environmental specifications are implemented; ▪ Discuss with the ECO the application of penalties for the infringement of the Environmental Specifications, and other possible enforcement measures necessary;

Power Station Manager and Programme Manager

- Arrange information meetings for consultation with Interested and Affected Parties (I&APs) about the impending construction activities;
- May on the recommendation of the Engineer and/or Environmental Officer order the Contractor to suspend any or all works on site if the Contractor or his Sub-Contractor/Supplier fails to comply with the said specifications;
- Maintain a register of complaints and queries by members of the public at the site office; and
- Ensure the EMPr is implemented as well as revised and updated as and when required.

Text Box 2: Matimba Power Station Environmental Officer's role

Matimba Power Station Environmental Officer (EO)

The Matimba Power Station EO shall be:

- Responsible for the day-to-day coordination of environmental management awareness, training and performance of the Matimba Power Station.
- He/she shall also ensure that the EMS and EMPr is effectively implemented.
- Be familiar with the contents of the EMPr;
- Ensure the EMPr is in the tender documentation issued to prospective contractors;
- Request for, review and approve the Method Statements prepared by the Contractor;
- Review and comment on environmental assessments and/or reports produced by the Contractor and ECO;
- Undertake regular site visits and ensure environmental specifications are implemented.

Text Box 3: System Engineer's role

System Engineer

The System Engineer will:

- Enforce the environmental specification on site;
- Be familiar with the contents of the EMPr;
- Ensure the EMPr is in the tender documentation issues to prospective contractors;
- Request for, review and approve the Method Statements prepared by the Contractor;
- Review and comment on environmental assessments and/or reports produced by the Contractor and ECO;
- Undertake regular site visits and ensure environmental specifications are implemented;
- Monitor compliance with the requirements of the specification;
- Assess the Contractor's environmental performance in consultation with the Environmental Officer from which a brief monthly statement of environmental performance is drawn up for record purposes and to be reported to project meetings; and
- Ensure the documentation, in conjunction with the Contractor, the state of the site prior to construction activities commencing. This documentation will be in the form of photographs or video record.

Text Box 4: Principal contractor (incl Subcontractors)

Principal Contractor's (incl. sub-contractors) role

The Contractor is required to:

- Be fully conversant with the EMPr and all conditions of the EA, Water Use Licence (WUL), etc.;
- Provide information on previous environmental management experience and company environmental policy in terms of the relevant forms contained in the Contract Document;
- Supply method statements timeously for all activities requiring special attention as specified and/or requested by the Developers, Environmental Officer and/or Engineer during the duration of the Contract;
- Be conversant with the requirements of this environmental specification/ EMPr. Brief all his/ her staff about the requirements of the environmental specification;
- Ensure any Sub-Contractors / Suppliers who are utilised within the context of the contract comply with the environmental requirements of the project, in terms of the specifications – that is, the Contractor will be held responsible for non-compliance on their behalf;
- Provide appropriate resources – budgets, equipment, personnel and training – for the effective control and management of the environmental risks associated with the construction of the development;
- Bear the cost of any delays, with no extension of time granted, should he or his Sub-Contractors / Suppliers contravene the said specifications such that the Engineer orders a suspension of work - note that the suspension will be enforced until such time as the offending party(ies), procedure, or equipment is corrected;
- Bear the costs of any damages/compensation resulting from non-adherence to the said specifications or written site

Principal Contractor's (incl. sub-contractors) role

instructions;

- Review ECO reports and take cognisance of the information/ recommendations contained therein;
- Comply with all applicable legislation;
- Ensure that he informs the Engineer timeously of any foreseeable activities which will require input from the Environmental Officer;
- Maintain a register of environmental training for site staff and sub-contractor's staff for the duration of the contract; and
- Communicate and liaise frequently and promptly with the ECO and the PM to ensure effective, proactive environmental management with the overall objective of preventing or reducing negative environmental impacts while enhancing positive environmental impacts.

The Contractor will thus conduct all activities in a manner that minimises disturbance to the natural environment as well as directly affected residents and the public in general.

Text Box 5: Environmental Control Officer's role

Environmental Control Officer (ECO)

The ECO will:

- Be fully conversant with the EMPr and perform all tasks assigned to him/her in the approved EMPr;
- Be familiar with the recommendations and mitigation measures of the associated EMPr for the project;
- Monitor the implementation of the EMPr during the construction and rehabilitation phases;
- Ensure site protection measures are implemented on site;
- Monitor that the Principal Contractor, sub-contractors, construction teams and the Developers are in compliance with the EMPr at all times during the construction and rehabilitation phases of the project;
- Monitor all site activities monthly for compliance;
- Conduct monthly audits of the site according to the EMPr, and report findings to the Developers / Contractors;
- Attend monthly site meetings;
- Recommend corrective action for any environmental non-compliance at the site;
- Compile a monthly report highlighting any non-compliance issues as well as progress and compliance with the EMPr prescriptions. These monthly reports are to be submitted to the Developers and the DEA; and
- Conduct once-off training with the Contractor on the EMPr and general environmental awareness.

It must be noted that the responsibility of the ECO is to monitor compliance and give advice on the implementation of the EMPr and not to enforce compliance. Ensuring compliance is the responsibility of the Developer.

Text Box 6: Safety & Health Officer's role

Safety & Health Officer

The Safety & Health Officer will:

- Be fully conversant with the EMPr;
- Be fully conversant with all relevant environmental legislation applicable to the project, and ensure compliance with them;
- Compilation of Method Statements together with the Contractor that will specify how potential environmental impacts in line with the requirements of the EMPr will be managed, and, where relevant environmental best practice and how they will practically ensure that the objectives of the EMPr are achieved;
- Convey the contents of this EMPr to the construction site staff and discuss the contents in detail with the Contractor;
- Undertake regular and comprehensive inspection of the site and surrounding areas in order to monitor compliance with the EMPr;
- Take appropriate action if the specifications contained in the EMPr are not followed;
- Monitor and verify that environmental impacts are kept to a minimum, as far as possible;
- Order the removal from the construction site of any person(s) and/or equipment in contravention of the specifications of the EMPr;
- Compilation of a comprehensive project health and safety risk assessment (HSRA);
- Compilation of health and safety specifications based on risks identified;
- Reviewing and approval of health and safety plan(s) submitted by appointed Principal Contractor(s);
- Conducting monthly health and safety inspections and compiling monthly OHS reports;
- Conducting monthly health and safety audits with audit reports;
- Assisting the Developers / Contractor in the investigation of major accident/incidents;
- Monitoring of site activities for compliance to the Occupational Health and Safety Act and Regulations;
- Establishment and monitoring of project health and safety file;

Safety & Health Officer

- Monitoring the Principal Contractors' health and safety performance;
- Preparation of project close-out reports and submission of project health and safety files to the Client.
- Report any non-compliance or remedial measures that need to be applied to the appropriate environmental authorities, in line with the requirements of the EMPr;
- Ensuring that the list of transgressions issued by the ECO is available on request; and
 - Maintain an environmental register which keeps a record of all incidents which occur on the site during construction. These incidents include:
 - Public involvement / complaints.
 - Health and safety incidents.
 - Incidents involving hazardous materials stored on site.
 - Non-compliance incidents.

3.2 Monitoring

A monitoring programme will be in place not only to ensure compliance with the EMPr through the contract/work instruction specifications, but also to monitor any environmental issues and impacts which have not been accounted for in the EMPr that are, or could result in significant environmental impacts for which corrective action is required.

A monitoring programme will be implemented for the duration of the construction phase of the project. This programme will include:

- ✧ Monthly audits will be conducted by the ECO/s for the duration of the construction phase – the ECO shall undertake this environmental monitoring with the audits considering compliance with the EMPr, the EA conditions, as well as the conditions of any permits and/or licences.
- ✧ On-going monitoring is to be undertaken by the Contractors' Environmental Manager/Officer – this will include notification to the ECO and proponent EO should an incident take place.
- ✧ External auditing may take place at unspecified times by the authorities and/or other relevant authorities.
- ✧ An independent, suitably qualified, auditor will need to be contracted to conduct an audit once the construction phase of the project is completed according to the provisions of the EMPr.
- ✧ The Contractor's Environmental Officer must undertake regular site inspections (at least twice weekly) to ensure all legislative requirements are adhered to. Proof of such inspections shall be kept on file for ease of reference or for audit purposes.

3.3 Conformance with the Matimba Power Station Environmental Management System

The Matimba Power Station is accredited with ISO 14001 certification and thereby requires all development to be undertaken within this philosophy. The ISO 14001 Environmental Management System (EMS) is the internationally recognised standard for the environmental management of organisations. It prescribes controls for those activities that have an effect on the environment. These include the use of natural resources, handling and treatment of waste, energy consumption, water resource management and so forth.

This standard specifies requirements for an EMS to enable an organisation to develop and implement a policy and objectives which takes into account legal and other requirements to which the organisation subscribes, and information about significant environmental aspects. It applies to those environmental aspects that the organisation identifies as those which it can control and those which it can influence. It does not itself state specific environmental performance criteria.

All the requirements in ISO 14001 are intended to be incorporated into any EMS. The extent of the application will depend on factors such as the environmental policy of the organisation, the nature of its activities, products and services, the location and the conditions in which it functions. The ISO 14000 family addresses various aspects of environmental management. It provides practical tools for companies and organisations looking to identify and control their environmental impact and constantly improve their environmental performance. The aim of the ISO 14001 standard is to achieve continuous improvement through the cycle outlined in Figure 6.

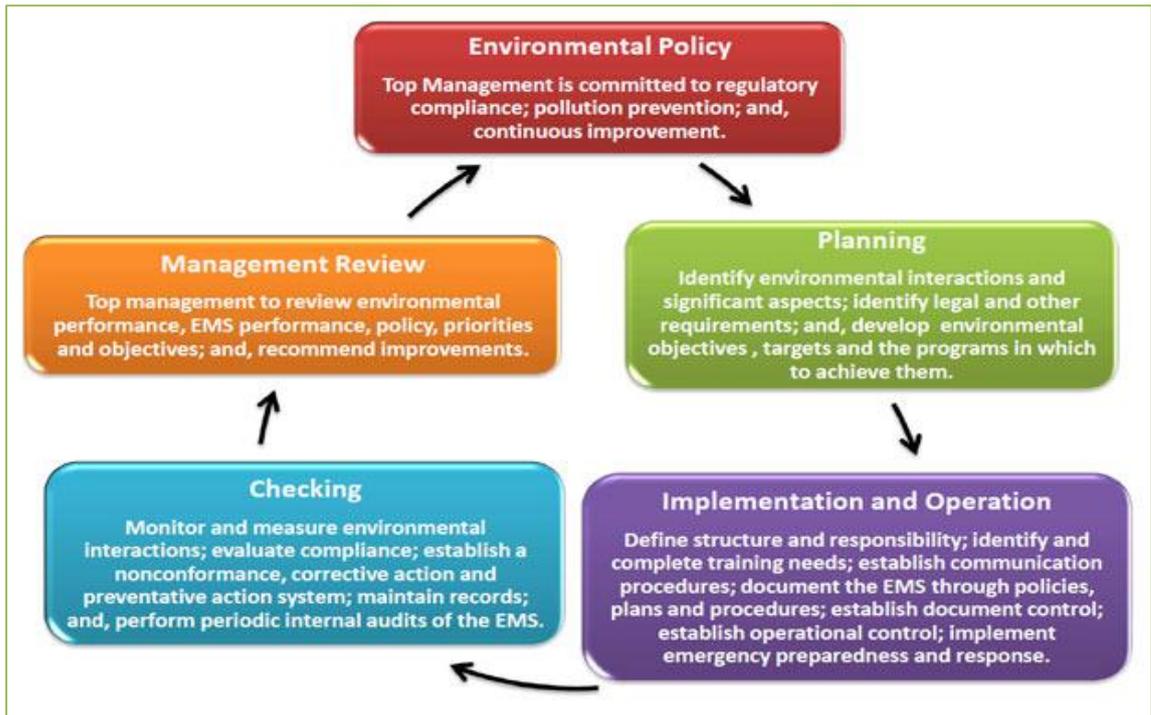


Figure 6: The ISO 14001 EMS cycle of continuous improvement

As part of their ISO 14001 certification, Eskom have a number of Standard Operating Procedures (SOPs) pertaining to environmental management. These include:

- a. Environmental Legal and other Register.
- b. Environmental Management Plan Guideline.
- c. Structure and Responsibility of Matimba Station Environmental Action Committee.
- d. SHE Training.
- e. Environmental Management System Audit.
- f. Environmental Management Review Guideline.
- g. Matimba Safety, Health, Environmental and Quality Policy and Eskom's SHEQ Policy 32-727.
- h. The Identification of SHE Hazards, Risk Assessment and Risk Control.
- i. SHE Objectives and Targets.

3.4 Reporting Procedures

3.4.1 Documentation

The following documentation must be kept on site in order to record compliance with the EMP:

- ✦ An Environmental File which includes:
 - Copy of the EMP;
 - Copy of the EA;
 - Copy of the WUL;
 - Copy of all other licences/permits;
 - Copy of all rehabilitation plans;
 - Copy of the Stormwater Management Plan;
 - Environmental Policy of the Main Contractor;
 - Environmental Method Statements compiled by the Contractor;
 - Non-conformance Reports;
 - Environmental register, which shall include:
 - Communications Register – including records of complaints.

- Monitoring Results – including environmental monitoring reports, register of audits, non-conformance reports.
- Incident book – including copies of notification of Emergencies and Incidents, this must be accompanied by a photographic record.
- ✦ Waste Documentation such as, but not necessarily limited to: Waste Manifest Documents, Safe Disposal Certificates (SDCs) and Sewerage Disposal Receipts;
- ✦ Material Safety Data Sheets (MSDSs) for all hazardous substances;
- ✦ Dust suppression register;
- ✦ Water Quality Monitoring reports (if necessary);
- ✦ Written Corrective Action Instructions;
- ✦ Notification of Emergencies and Incidents; and
- ✦ Minutes and attendance registers of all environmental meetings.

3.4.2 *Environmental Register*

The Developers will put in place an Environmental Register. The Contractor will ensure that the following information is recorded for all complaints / incidents:

- ✦ Nature of complaint / incident.
- ✦ Causes of complaint / incident.
- ✦ Party/parties responsible for causing complaint / incident.
- ✦ Immediate actions undertaken to stop / reduce / contain the causes of the complaint / incident.
- ✦ Additional corrective or remedial action taken and/or to be taken to address and to prevent reoccurrence of the complaint / incident.
- ✦ Timeframes and the parties responsible for the implementation of the corrective or remedial actions.
- ✦ Procedures to be undertaken and/or penalties to be applied if corrective or remedial actions are not implemented.
- ✦ Copies of all correspondence received regarding complaints/incidents.

The above records will form an integral part of the Contractors' Records. These records will be kept with the EMPr, and will be made available for scrutiny if so requested by the Developers.

3.4.3 *Non-Conformance Report*

A Non-Conformance Report (NCR) will be issued to the Contractor as a final step towards rectifying a failure in complying with a requirement of the EMPr. This will be issued by the ECO to the Contractor in writing. Preceding the issuing of an NCR, the Contractor must be given an opportunity to rectify the issue.

Should the ECO assess an incident or issue and find it to be significant (e.g. non-repairable damage to the environment), it will be reported to the relevant authorities and immediately escalated to the level of a NCR. The following information should be 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 to adequately address the non-conformance in terms of specific control measures and should take the hierarchy of controls into account;
- ✦ Agreed timeframe by which the actions documented in the NCR must be carried out; and
- ✦ ECO should verify that the agreed actions have taken place by the agreed completion date, when completed satisfactorily; the ECO and Contractor should sign the Close-Out portion of the Non-Conformance Form and file it with the contract documentation.

3.4.4 Environmental Emergency Response

The Contractor's environmental emergency procedures must ensure appropriate responses to unexpected / accidental actions / incidents that could cause environmental impacts. Such incidents may include:

- ✧ Accidental discharges to water (i.e. into the watercourse) and land;
- ✧ Accidental spillage of hazardous substances (typically oil, petrol, and diesel);
- ✧ Accidental damage to existing utilities e.g. sewer and water pipelines;
- ✧ 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 specifically to environmental incidents and must ensure and include the following:

- ✧ Construction employees shall be adequately trained in terms of incidents and emergency situations;
- ✧ Details of the organisation (i.e. 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 / on-site fire detail, 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; and
- ✧ Information on hazardous materials, including the potential impact associated with each, and measures to be taken in the event of accidental release.

The Contractor and their sub-contractor(s) must comply with the environmental emergency preparedness and incident and accident-reporting requirements as per the relevant legal requirements.

3.4.5 Method Statements

It is a statutory requirement to ensure the wellbeing of employees and the environment. To allow the mitigation measures in this document to be implemented, task-specific method statements should be developed for each set of tasks.

A Method Statement details how and when a process will be carried out, detailing possible dangers/risks, and the methods of control required.

The Contractor will be accountable for all actions taken in non-compliance of the approved Method Statements. The Contractor shall keep all the Method Statements and subsequent revisions on file, copies of which must be distributed to all relevant personnel for implementation.

As a minimum the following Method Statements will be required to be generated:

- ✧ Bunding;
- ✧ Construction site and office/yard establishment;
- ✧ Cement mixing / concrete batching / bentonite mixing (if necessary);
- ✧ Contaminated water;
- ✧ Dust management;
- ✧ Environmental awareness course(s);
- ✧ Environmental monitoring;
- ✧ Erosion control;
- ✧ Fire, hazardous and/or poisonous substances;
- ✧ Fuels and fuel spills (may form part of the item above);
- ✧ Storage, handling and decanting of diesel (may form part of the item above);
- ✧ Personnel, public and animal safety;
- ✧ Rehabilitation of modified environment(s);
- ✧ Solid and liquid waste management;

- ✦ Sources of materials (including MSDSs);
- ✦ Topsoil management;
- ✦ Haulage, stockpiling and management of surplus fill material;
- ✦ Stormwater Management; and
- ✦ Wash-bay areas (if necessary).

3.4.6 Public Communication and Liaison with I&APs

The Developers must ensure that the adjacent landowners are informed and updated throughout the construction phases.

Sufficient signage should be erected around the site (including at the entrance), informing the public of the construction activities taking place. The signboards should include the following information:

- ✦ The name of the Contractor; and
- ✦ The name and contact details of the site representative to be contacted in the event of emergencies or complaint registration.

4 Environmental Awareness Plan

Eskom is committed to promoting and implementing sustainability throughout their operations. As part of this commitment, the Matimba Power Station team recognises the importance of making all employees aware of the potential environmental impacts that could result from conducting their jobs and how this potential can be minimised through effective training. Environmental awareness to the employees of the project will be provided by implementing environmental awareness training in the following forums:

- ✦ SHEQ Meetings (Monthly)
- ✦ Daily meeting (SHE talks/Toolbox Talks)
- ✦ SEAC meeting (Monthly)
- ✦ SHE Inductions courses (Annually)
- ✦ Info sessions
- ✦ Open Days (*ad hoc*)
- ✦ Bulletins
- ✦ Environmental Awareness Courses (Ad hoc)
- ✦ EMPr Awareness (Annually)

The above mentioned awareness activities will be used to share information and to ensure that all personnel are aware of the environment in which they operate and what environmental aspects require attention during their daily operations/activities/tasks. Additionally, personnel awareness training will be undertaken if and when required to strengthen the personnel's understanding of environmental issues.

The method and medium of communication during the environmental meetings will be determined by the site manager facilitating the meetings. The topics discussed in meetings will be recorded, with all employees present signing an attendance register.

As potential environmental impacts differ in each department of the operation, the environmental topics selected for discussion can either be:

- ✦ General topics that are applicable to the entire operation/activity;
- ✦ Area specific topics as identified in the impacts assessment section of the EIA report, or
- ✦ Topics that can be "taken home" and implemented off-site.

4.1 General Topics

There are a number of environmental impacts resulting from the proposed ADF, that are applicable throughout the project. These topics should be discussed at all areas. General topics include, but are not limited to, the following:

- ✦ Water consumption and conservation;
- ✦ Potential for water pollution and the related impacts (including health related);
- ✦ Dust generation related impacts (including health-related) ;
- ✦ Noise generation and related impact (including health-related);
- ✦ Waste minimisation and recycling;
- ✦ Practical training regarding the clean-up of major and minor hydrocarbon spills/use of spill management kit;
- ✦ Practical training on using a fire extinguisher; and
- ✦ Alien vegetation identification and removal, and the importance of indigenous vegetation.
- ✦ Importance of wildlife, snakes and other reptiles in support of ecosystem.

4.2 Activity Specific Topics

Some activities may have environmental impacts that are unique to each area. These must be addressed in the SHEQ meetings. Area specific topics include, but are not limited to those impacts which are ranked as

having a negative “medium” to “high significance” as determined in the EIA study. Some of these topics may be a repeat of those covered under general topics.

- ✧ Stormwater management;
- ✧ Identification and management of erosion;
- ✧ Water consumption and conservation;
- ✧ Vehicle emissions and related impacts (including health related)
- ✧ Practical training regarding the clean-up of major and minor hydrocarbon spills;
- ✧ The importance of the waste management system and implementing good housekeeping; and
- ✧ Dust generation and why and how to reduce dust.
- ✧ Biodiversity interaction awareness

4.3 Take-home Topics

Environmental awareness should not stop at the work place. Many of the concepts learned at work can be applied to employees’ life style at home. Topics that can be covered under “take home topics” include, but are not limited to:

- ✧ Water consumption and conservation;
- ✧ Energy consumption and conservation “49M Remember your power”; and
- ✧ Waste minimisation and recycling - “Reduce, Reuse and Recycle”.

5 Environmental Management Programme: Pre-construction

Requirements for the pre-construction phase include:

- ✦ Proper, timeous, and continuous liaison between the developer, the Contractor and landowners to ensure all parties are appropriately informed at all times.
- ✦ The adjacent landowners must be informed of the starting date of construction as well as the phases in which the construction shall take place.
- ✦ The Contractor must adhere to all conditions of contract including the EMPr and Integrated Environmental Authorisation conditions.
- ✦ Adequate planning of the construction programme to allow for disruptions due to rain and wet conditions.
- ✦ Proper stormwater management must be planned and implemented to ensure that erosion does not take place or run-off does not accumulate in one point.
- ✦ Where existing private roads are in a bad state of repair, such roads' condition shall be documented before they are used for construction purposes. This will allow for easy assessment of any damage to the roads which may result from the construction process. If necessary repairs should be done to prevent damage to equipment.
- ✦ All manmade as well as natural (vegetation) structures outside the boundary of the development footprint shall be protected against damage at all times and any damage shall be reported and rectified immediately.
- ✦ Proper documentation and record keeping of all complaints and actions taken.
- ✦ A formal communications protocol should be set up during this phase. The aim of the protocol is to ensure that effective communication on key issues that may arise during construction is maintained between key parties such as the ECO, PM, Environmental Officer (EO) and Contractor. The protocol should also ensure that concerns / issues raised by I&APs are formally recorded and considered and where necessary acted upon. If necessary, a forum for communicating with key stakeholders on a regular basis may need to be set up. This could be done through an Environmental Monitoring Committee that would meet on a regular basis. The communications protocol should be maintained throughout the construction phase.

Table 4: Pre-construction – general activities

Activity	Environmental Measures and Controls	Frequency	Responsible Person/s
Pre-construction.	<ul style="list-style-type: none"> • Eskom must ensure that this EMPr forms part of any contractual agreements with a Contractor(s) and sub-contractors for the execution of the proposed project. Local labour and contractors must be used wherever possible. • Appoint an independent ECO. 	Once-off	Programme Manager (PrM); Project Manager (PM) & Environmental Officer (EO) PrM
Pre-construction.	<ul style="list-style-type: none"> • Before construction begins, all areas to be developed must be clearly demarcated with fencing. • Confirm with ECO, a suitable area for site offices and areas for the storage of equipment, materials and batching etc. • Unskilled labourers should be drawn from the local market. • Site staff should be trained. Knowledge and skills necessary to achieve 	Once-off	PM; EO; Contractor

Activity	Environmental Measures and Controls	Frequency	Responsible Person/s
	<p>environmental objectives shall be identified and incorporated in the SHE Training Matrix. The matrix shall consider personnel responsible for implementing such objectives, training needs, development of appropriate skills and ongoing environmental education and awareness required to perform duties in an effective and competent manner.</p> <ul style="list-style-type: none"> • Environmental awareness training should be conducted for construction staff, concerning the prevention of accidental spillage of hazardous chemicals and oil; pollution of water resources (both surface and groundwater), air pollution and litter control and identification of archaeological artefacts. • Continuous awareness and training programmes shall be implemented and updated. • The PM shall ensure that the training and capabilities of the Contractor's site staff are adequate to carry out the designated tasks. • Staff in charge of operating equipment (such as excavators, loaders, etc.) shall be adequately trained and sensitised to any potential hazards associated with their tasks. • No operator shall be permitted to operate critical mechanical equipment without having been trained by the Contractor and certified competent by the Engineer/PM. • Staff should be educated on the need to refrain from indiscriminate waste disposal and/or pollution of local soil and water resources and receive the necessary safety training. • Staff should be trained on reporting of environmental incidents. 		

5.1 Plant and Animal Rescue and Protection Plan

An added value biodiversity enhancement strategy should be compiled, of which the major objective would be to improve biodiversity conservation and management on a local and regional scale. Eskom will access the Limpopo Conservation Plan to align current land management practices of the Eskom-owned Grootvallei Game Reserve with 'conservation added value projects', for the purposes of enhancing and securing biodiversity of the region through stewardship. The details of such a plan should form part of a subsequent phase, subjected to the approval by authorities, i.e. a post authorisation requirement.

Activity	Environmental Measures and Controls	Frequency	Responsible Person/s
Pre-construction.	<ul style="list-style-type: none"> • A significant number of protected trees will be adversely affected (removed) for the purpose of constructing and operation of the ADF. Six protected species were recorded on the site, of which 	Prior to and during construction	PM; ECO; EO and Ecologist

Activity	Environmental Measures and Controls	Frequency	Responsible Person/s
	<p><i>Spirostachys africana</i> (Tamboti) occurs in significant numbers on the site.</p> <ul style="list-style-type: none"> Permits for the removal of protected trees need to be directed to the Department of Agriculture Forestry and Fisheries Affairs and Forestry (DAFF). The removal or relocation of protected plants is also subjected to authorisation (permits) from the Limpopo Department of Economic Development, Environment and Tourism (LEDET). An animal rescue (search and rescue) mission must be conducted prior to vegetation clearance. 		

5.2 Open Space Management

Activity	Environmental Measures and Controls	Frequency	Responsible Person/s
Pre-construction.	<ul style="list-style-type: none"> Determination of areas to be controlled as open space within the greater site. Such areas to ensure connectivity of areas of conservation importance (i.e. corridors and maintenance of large blocks of functional open space). Determine level of impact that will be allowed per area of designated open space, as linked to the sensitivity mapping (Appendix A) process carried out. Ensure ECO has knowledge of when specific access activities may trigger permitting processes outside of those already in hand. Link controls to ensure that importance of open space areas are not compromised. <ul style="list-style-type: none"> Open space areas deemed "no go" - strict access controls, delineation required, fencing off from direct access, ensure agricultural species (e.g. cattle) excluded from such areas. Determine an appropriate buffer area around such areas and indicate it on the site plans. 	Prior to and during construction	PM; ECO & EO

5.3 Exemption from Lining

Due to the processes that need to be followed and the timeframes required for preparation of the footprint and construction of the lining system, there will be a period from current operations to disposal on the lining system. The final arrangements for this process are still to be determined.

The area that will not be lined during the 4.69 year period is estimated to be 105.9 ha. The orange area is the area that will be covered in ash, placed by the main system shiftable conveyor and is approximately 55.1 ha (Figure 7). The blue area placed by the standby system shiftable conveyor, is 40.4 ha (Figure 7). The ash will not cover the entire blue section (it will be more triangular shape). This is because the main system still

has to catch up with the standby system. The area indicated in red in Figure 11, will also be covered in ash, however, only once the conveyors reach the end of the ADF, around 2038.

Based on the groundwater studies, there will be additional groundwater impacts as the current ADF is not lined. The impact on groundwater is currently evident, however this is due to the presence of the ADF, since disposal commenced. It is anticipated that the additional impacts of 4.69 years of ash disposal will therefore be less significant than the current impacts. Mitigation measures which must be enforced during the 4.69 year ash disposal includes the following:

- ✦ Any boreholes located on the site footprint where ash disposal will occur must be backfilled so as to prevent direct migration of potentially poor quality water into the aquifers and further groundwater pollution. The sealing procedure will be finalised with an appointed Contractor.
- ✦ Prevent excess water on the ADF, dust suppression must be controlled.
- ✦ The groundwater monitoring programme must be continued as detailed in Section 7.2 and **Appendix C** of this report.

The Applicant (Eskom), will lodge an Application for Exemption (with the DEA) as stipulated under Section 44(1)(a) read with the Section 24M(3) of NEMA (No 107 of 1998) and the National Exemption Regulations (No R.994). In proposing and motivating for the exemption from lining, it must be noted that this situation is practically unavoidable as the basal lining system must first be approved before work can commence on the ground preparation and construction. During this time, it is in the Nation's best interest that the Matimba Power Station continue to operate according to its current ashing model, requiring ash disposal continue as at present. This will mean continued ashing on an unlined surface during this period.

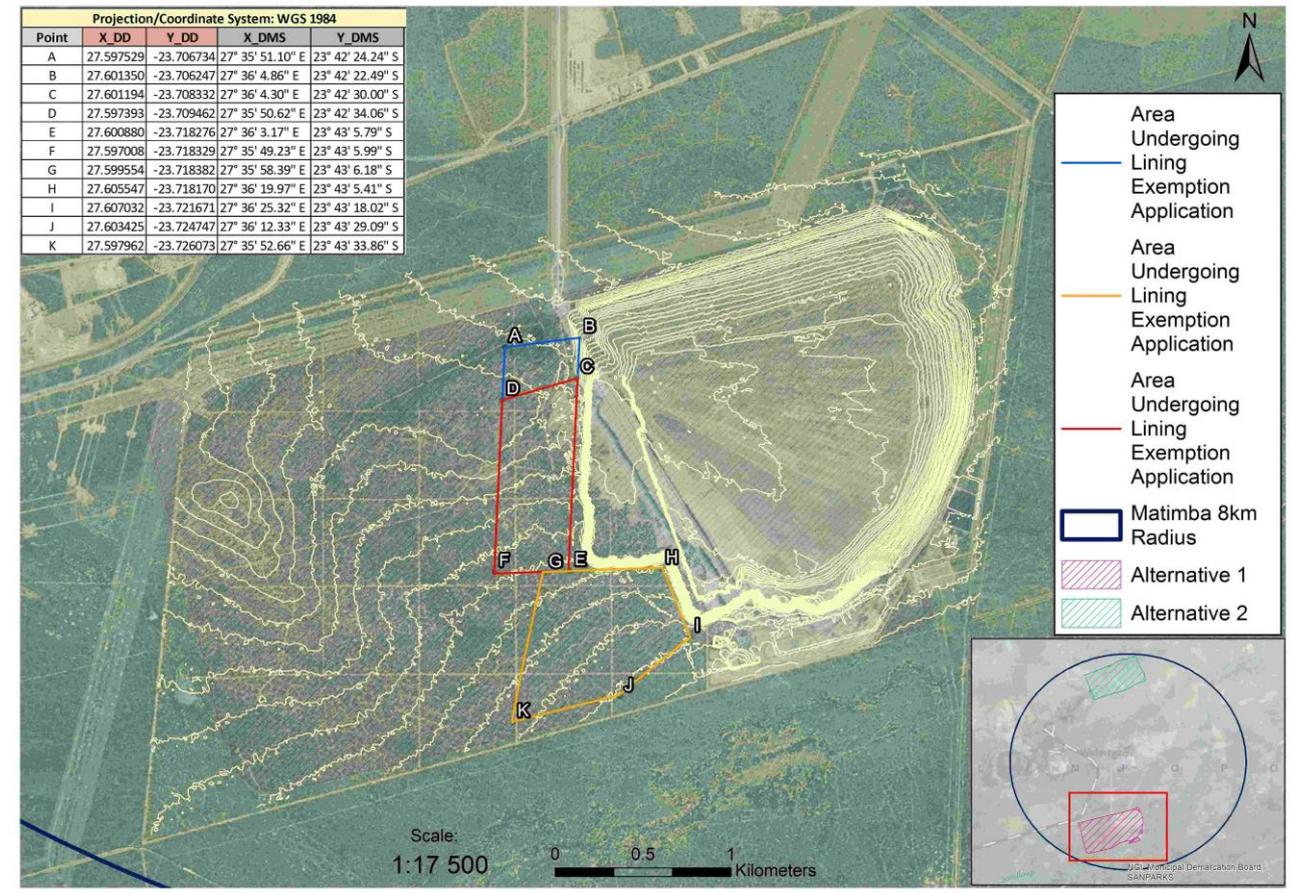


Figure 7: Map of area undergoing exemption application (SA1)

6 Environmental Management Programme – Construction

6.1 Site Preparation, Site Offices, Storage of Materials and Health & Safety

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Site preparation activities.	<ul style="list-style-type: none"> • Site clearing must take place in a phased matter (within the footprint), as and when required. • Areas which are not planned to be constructed within two (2) months must not be cleared so as to reduce risk of erosion. • The area to be cleared must be clearly demarcated and this footprint strictly maintained. • Topsoil obtained from site preparation activities will be stored until it can be used for rehabilitation of the ADF. The EO and ECO will identify a suitable area for the storage of topsoil. • The necessary silt fences and erosion control measures must be implemented in areas where these risks are more prevalent. These include watercourses where applicable. 	Weekly	Contractor
Establishment of the site offices and storage areas.	<ul style="list-style-type: none"> • Choice of site for the Contractor's site offices and storage areas requires the PM and ECO's permission and must take into account ecologically sensitive areas (wetlands), including flood and drainage lines. A site plan/layout (indicating areas for storage of hazchem subs, ablution facilities, waste yards, etc.) must be submitted to the PM for approval. • The site offices may not be situated within the 1:100 year flood line. • The size of the site offices should be minimized (especially where natural vegetation or grassland has to be cleared for its construction). 	Monthly	Contractor
Storage of materials including hazardous materials: improper storage of material has the potential to pollute groundwater and surface water resources as well as soils.	<ul style="list-style-type: none"> • The location of storage areas must take into account prevailing winds, distances to water bodies, general on site topography and water erosion potential of the soil. Impervious surfaces must be provided. • Storage areas must be designated, demarcated and fenced. • Storage areas should be secure so as to minimize the risk of theft. • Fire prevention facilities/equipment must be present at all storage facilities. • Proper storage facilities for the storage of oils, paints, grease, fuel, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillages into the ground and groundwater regime around the temporary storage area(s). 	Weekly - Biweekly	Contractor & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be situated away from drainage lines in a site selected with the approval of the PrM / PM, EO and ECO.</p> <ul style="list-style-type: none"> • Any water that collects in the bund must not be allowed to stand and must be removed and disposed of immediately in accordance with the stormwater management plan (Appendix B). • Contaminated stormwater must be drained from bunds and disposed of as liquid hazardous waste. • All fuel storage tanks (temporary or permanent) and associated facilities must be designed and installed in accordance with the relevant oil industry standards, National codes, Local Authority approval for storage of ≥5000 l and other relevant requirements. • Areas for storage of fuel and other flammable materials must comply with standard fire safety regulations and may require the approval of the relevant Fire Officer. • Flammable fuel and gas must be well separated from all welding workshops, assembly plants and loading bays where ignition of gas by an accidental spark may cause an explosion or fire. • Symbolic safety signs depicting “No Smoking”, “No Naked Flames” and “Danger” are to be prominently displayed in and around the fuel storage area. • The capacity and content of the tank must be clearly displayed and identified. • There must be adequate fire-fighting equipment at the fuel storage and dispensing area(s). • The rated capacity of the tanks must provide sufficient capacity to permit expansion of the product contained therein by the rise in temperature during storage. • Any electrical or petrol-driven pumps must be positioned so as not to cause any danger of ignition of the product. • If fuel is dispensed from 200 litre drums, the proper dispensing equipment must be used. The drum must not be tipped in order to dispense fuel. The dispensing mechanism of the fuel storage tank must be stored in a waterproof container when not in use. • All waste fuel and chemical soiled rags must be stored in leak-proof containers and disposed of at an approved hazardous waste site. • These storage facilities (including any tanks) must be on an impermeable surface in order to ensure that accidental spillage does not pollute local soil or water resources. The facilities must 		

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>also be protected from the ingress of stormwater from surrounding areas</p> <ul style="list-style-type: none"> • Clear signage must be placed at all storage areas containing hazardous substances / materials. • Material Safety Data Sheets (MSDSs) shall be readily available on site for all chemicals and hazardous substances to be used on site. Where possible, the available MSDSs should additionally include information on ecological impacts and measures to minimise negative environmental impacts during accidental releases or escapes. • Storage areas containing hazardous substances / materials must be clearly signed. • Staff dealing with these hazardous materials / substances must be aware of their potential impacts and follow the appropriate safety measures. • A suitable Waste Disposal Contractor must be employed to remove waste oil. These wastes should only be disposed of at a licenced landfill site designed to handle hazardous wastes. • The Contractor must ensure that its workers are made aware of the health risks associated with any hazardous substances used and that the workers are provided with the appropriate protective clothing / equipment in case of spillages or accidents and have received the necessary training. • All excess cement and concrete mixes are to be contained on the construction site prior to disposal off site at a licenced hazardous waste site. • Any spillage, which may occur, shall be investigated and immediate action must be taken. This must also be reported to the ECO and depending on the severity reported to the DEA as stipulated in the conditions of the Integrated Environmental Authorisation. • Keep written records detailing: the type of spill; the corrective and remedial measures implemented in the stopping or reduction of the spill; and the clean-up of the spill. Such progress reporting is important for monitoring and auditing purposes and the written reports may afterwards be used for training purposes in an effort to prevent similar future occurrences. 		
Construction: Health and Safety of construction workers and site staff.	<ul style="list-style-type: none"> • A Health and Safety Plan needs to be developed for the project in respect of construction worker safety and this plan must be adhered to at all times. • The Contractor must adhere to the prescriptions of the relevant 	Weekly	Contractor; ECO; SH Officer

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>health and safety legislation and standards. The contractor must familiarise himself and his employees with the contents of the aforementioned legislation.</p> <ul style="list-style-type: none"> • Suitably stocked First Aid facilities must be on hand at all times in accordance with international practice. All staff must be aware of its location. • The Contractor must implement adequate and mandatory safety precautions relating to all aspects of the construction. Such safety measures and work procedures/instructions must be communicated to all construction workers. • The wearing of PPE on site is mandatory for all personnel and construction workers. Minimum requirements must include the wearing of an approved safety helmet, safety boots, high visibility vests, dust masks, ear plugs, etc. where appropriate. • PPE signs should be erected on site at the areas where it is required and the integrity and availability of the signs must be maintained. • All personnel must be trained in basic site safety procedures. • Construction staff handling chemicals or hazardous materials must be trained in the use of the substances and the environmental, health and safety consequences of incidents. • The Contractor must design, test / exercise appropriate emergency preparedness programmes (plans, schedules, procedures and methods) for addressing environmental accidents, incidents and events such as spills of fuel, oil or lubricants; fires etc. • Smoking will only be allowed at designated areas. • Overloading of equipment and construction vehicles is strictly prohibited to avoid accidents. Eskom specification / policy on transport of personnel to be adhered to. • Safety files must be compiled and signed of by the SH Officer prior to commencement of construction. • Adequate ablutions must be provided for construction workers. 		
Access control.	<ul style="list-style-type: none"> • Access onto the ADF will be provided through a gravel access road that will be constructed around the perimeter (and within the boundaries) of the facility. • Should SA2 be developed, the location where the gravel access road ties into the existing road network is to be confirmed with Eskom, prior to construction. • The access road will be maintained, as far as periodical grading and shaping is concerned. • Existing strict access control procedures will be implemented. 	Daily	PrM & PM

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<ul style="list-style-type: none"> Record all who enter and exit the facility in a log book. Ensure only legitimate entry takes place onto the site. Should SA2 be developed, access control procedures will need to be put in place similar to that which is currently in practice at the existing ADF. 		

6.2 Geology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Site instability during construction due to earthworks.	<ul style="list-style-type: none"> Earthworks should be carried out as stipulated in the guidelines provided in SANS 1200 (<i>Standardised Specification for Civil Engineering Construction</i>). Where necessary, subsoil drains should be provided particularly if fills are constructed over water logged/marshy areas and drainage courses. Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites. The terrace should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from the fill edges and foundations. Trenches excavated in sandy material and in strong groundwater seepage areas should have lateral support. Trenches deeper than 1.5 m should be shored, particularly if left open for significant periods. Lateral support should be used in all situations where shallow groundwater is encountered. Regular inspections of the trenches must be carried out in order to detect potentially unstable sidewall conditions during the construction phase. Onsite inspections and evaluations should be conducted regularly. 	Biweekly	Contractor; PM & Engineering Team
Site instability during construction due to the development of building platforms.	<ul style="list-style-type: none"> Where natural ground slopes are steeper than 1V (vertical) to 6H (horizontal), the fill must be benched into the slope. Benches should be 0.5 m deep and 2.0 m wide. Placement of fill layers should be undertaken in layers not exceeding 200 mm thick when placed loose and compacted using suitable compaction plant to achieve 93% Modified AASHTO maximum dry density. Density control of placed fill material should be undertaken at regular intervals during fill 	Biweekly	Contractor & Engineering Team

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>construction.</p> <ul style="list-style-type: none"> • Terraces should be graded to direct water away from the fill edges, and small earth bunds (450 mm wide and 300 mm high) should be constructed along the crest of the fill. • Boulders larger than 200 mm diameter or 1/3 of the layer thickness should be removed from the fill material as these could complicate the compaction works, and also cause piping within fills. • Cut slopes in soils should be formed to batters of 1V:1.75H and to a height not greater than 1.5 m where retaining walls are not provided. Engineered fill slopes should be formed to batters of 1V:1.5H provided that the edge of the fill is over constructed and thereafter trimmed back to the required position. • Cuts in weathered bedrock should not exceed gradients of 1V in 1H. • Inspection of cuts in weathered bedrock may indicate that the angle of cut batter slopes need to be varied locally to promote stability of the site. • Cut and fill heights greater than 1.5 m would need to be inspected and approved. 		
<p>Site instability during construction due to the subgrade treatment for roads, surface beds and parking areas.</p>	<ul style="list-style-type: none"> • Where Aeolian sandy soils are encountered at the road subgrade level, the subsoils should be ripped to the specified depth and re-compacted to 93% Modified AASHTO maximum dry density. • Where weathered sandstone bedrock is exposed, undercutting into the unsuitable materials (depending on the road formation level or surface bed level) to the specified depth to accommodate a select layer comprising material of at least G8 quality and compacted to at least 93% Modified AASHTO dry density, should take place. • Where calcrete, pebbly conglomerate and moderately to highly weathered sandstone bedrock is encountered at road subgrade level this material should be ripped to the specified depth and re-compacted to 93% Modified AASHTO maximum dry density. Care should be taken to ensure that the ripped bedrock material is suitably broken down to eliminate fragments greater than 2/3 of the layer thickness. • The pavement formation layer for the proposed roads and parking areas should be designed taking into account anticipated traffic loads, volumes and design life of the parking area and road. 	<p>Biweekly</p>	<p>Contractor & Engineering Team</p>

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Site instability during construction due to the development of the foundations for building structures.	<ul style="list-style-type: none"> Reinforced strip footings and/or concrete pad bases should be used for single to double storey building structures. All foundations for the proposed structures should be placed onto the medium dense to dense sandy Aeolian soils where a maximum net allowable bearing pressure of 150 kN/m² is considered applicable. Prior to casting of concrete, the foundation base should be thoroughly compacted with a heavy rammer or similar to limit settlement. Total settlement is likely to be 5-10 mm with differential settlement taken as 50% of the total settlements. A provision for possible movements between floors and walls should be allowed for in the design. All brickwork and foundation footings will need to be reinforced. Higher bearing pressures of up to 500 kN/m² can also be considered for foundations on moderately weathered, medium hard to hard rock. For foundations on bedrock, total settlement is likely to be less than 5 mm with differential settlement taken as 50% of the total settlements. Where the founding depth to bedrock is greater than about 2.5 m, consideration will need to be given to adopting a piled foundation solution in order to found in bedrock. The pressure grouted Continuous Flight Auger (CFA) piles should be use on both site alternatives. Piles must be designed to transfer axial loads into the weathered bedrock and should be socketed into the bedrock. A detailed pile design must be carried out taking into account actual pile loads. The pile installation must also be supervised to ensure that the piles are adequately founded. 	Biweekly	Contractor & Engineering Team

6.3 Geohydrology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Construction activities related to groundwater contamination:</p> <ul style="list-style-type: none"> Spillage of fuel, lubricants and other chemicals; Construction equipment and vehicles, workshop and wash bay areas will be a likely source of pollution as a non-point source; and Lack of provision of ablutions may 	<ul style="list-style-type: none"> Chemicals must be stored in bunded areas. Adequate ablutions must be provided for construction employees. Groundwater monitoring must be conducted to confirm any impacts in accordance with the proposed groundwater management plan (Appendix C). Ensure clean up protocols are in place and followed. Clean-up spills as soon as they occur and maintain an incident register. 	Weekly	Contractor & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>lead to the creation of informal ablutions.</p>	<ul style="list-style-type: none"> Any spillage, which may occur, shall be investigated and immediate action must be taken. This must also be reported to the ECO and depending on the severity reported to the DEA as stipulated in the conditions of the Integrated Environmental Authorisation. Keep MSDS records of chemicals in use up to date. Accurate oil records must be kept (purchased, disposal, and recycled). Implement appropriate actions and measures to reduce or prevent contamination of the ground and surface water as a result of a spill of potentially hazardous substances. Keep written records detailing the type of spill, the corrective and remedial measures implemented in the stopping or reduction of the spill, and the clean-up of the spill. These reports may afterwards be used for training purposes in an effort to prevent similar future occurrences. 		

6.4 Hydrology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Surface water resource contamination:</p> <ul style="list-style-type: none"> Separation of clean and dirty water areas; Seepage to surface water resources from the ADF; Vegetation and topsoil cleared from building sites and roadways; Soil disturbance during soil turning; Construction of ADF slopes; Builders' rubble, packaging and other waste generated in the construction process; Fuel and / or toxic material spills; Seepage to surface water resources from waste disposal 	<ul style="list-style-type: none"> Divert all clean water resources away from dirty water areas prior to construction and compact the base of working areas. Adequate ablutions must be provided for construction employees. Lining of the greenfields portion of the ADF as per the recommendations of the Technical Engineering Report. For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD has been constructed to the south of the ADF. For SA2, the entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps. Refer to the conceptual stormwater management 	<p>Weekly</p>	<p>Contractor & ECO</p>

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>areas;</p> <ul style="list-style-type: none"> • Workshops and wash-bays; and • Wash water entering pollution control dams. 	<p>plan – SMP (Appendix B).</p> <ul style="list-style-type: none"> • A monitoring programme is recommended at the ADF in terms of Best Practice Guidelines G3: Water Monitoring Systems¹, in order to detect any potential contamination as early as possible. The monitoring programme will assist with overall water management at the site and should be amended according to on-site operations and licencing conditions (IEA and WUL), monthly sampling up- and down-stream of relevant rivers and pans within the study site and bi-annual sampling up- and down-stream of relevant rivers and pans in the greater area. It is further recommended that sample site MASW1 is monitored at least biannually as livestock are likely to continue drinking from this pan. • Place all removed / excavated vegetation and topsoil in demarcated overburden stockpile areas to prevent obstruction of natural drainage paths. • Erosion of slopes shall be repaired as soon as practicably possible after they have occurred. • An adequate number of general waste receptacles, including bins must be arranged around the site to collect all domestic refuse, and to minimise littering. • Bins should be clearly marked and lined for efficient control and safe disposal of waste. • Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid). • In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and bioremediated. • Chemical storage areas must be bunded to ensure that if a spill occurs the chemical will be contained. • Ensure that all spills are immediately cleaned up. • Provide a silt trap to contain and allow the removal of sediments. Wash-bays should also include oil/water separator chambers. 		

¹ Department of Water Affairs (DWA). (2006). Best Practice Guidelines for Water Resources Protection in the South African Mining Industry. BPG G3. Water Monitoring Systems. Pretoria: DWA.

6.5 Surface Water (Wetlands)

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Construction activities within wetlands and drainage lines:</p> <ul style="list-style-type: none"> Irresponsible construction practices could lead to the pollution of wetlands (e.g. pollution of surface water through hydrocarbons). Poor stormwater management could lead to the siltation (pollution) of surface waters. Temporary accesses across wetlands could cause hydrological and morphological impacts and degrade the resource quality. 	<ul style="list-style-type: none"> No temporary construction accesses to be constructed through any surface water feature and no machinery to enter any wetland unless authorised under the EMPr by the ECO as part of a construction activity. These areas must be demarcated as no-go areas. No construction should occur on the drainage lines and their associated riparian zones. No batching, parking area, ablution facilities, road construction or chemical / fuel storage areas should be located within any surface water feature or associated buffer. Construction of temporary soil berms should be erected at the edge of the cleared area to ensure that no stormwater carrying any pollutants leaves the active ashing area. The dumping of construction material, including fill or excavated material into, or close to surface water features that may then be washed into these features is prohibited. Clean-up of spills must be done as soon as they occur. Bunded areas should be used to store hazardous materials and chemicals so that if a spill occurs the chemical will be contained. Construction to be monitored by an ECO according to the stipulations of the EMPr. The SMP must be adhered to prevent silt and polluted water ingress into surface water features. 	Weekly	Contractor & ECO

6.6 Stormwater Management

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Contaminated stormwater entering water resources.	<ul style="list-style-type: none"> For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD has been constructed to the south of the ADF. For SA2, the entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps. Refer to the conceptual stormwater management plan – SMP (Appendix B). 	Daily - Weekly	Contractor & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<ul style="list-style-type: none"> The entire linear infrastructure route area was defined as a dirty catchment. The Developer proposes a road situated next to the belt. The road is considered to be a clean area as it would be used to maintain the linear infrastructure route. The stormwater management measures suggested for the linear infrastructure route are a berm and a drain located next to the linear infrastructure route. Rainfall that falls on the roof of the conveyor system will mix with the dust generated by the linear infrastructure route and this water will be contained by the berms and transported to the sumps placed along the route. Sumps A, B and C were placed at the lowest elevation point of the route (refer to Appendix B). Water that accumulates in these sumps must be pumped to the nearest PCD. A culvert is suggested under Sump B to navigate clean water from the above catchment under the belt and back into the environment. This will ensure that clean water does not mix with the dirty water. <u>The overall stormwater management of the emergency offloading area will be upgraded to comply with the GN 704 regulations as the current infrastructure is inadequate to properly manage the surface run-off water. The expanded emergency ash offloading area will be equipped with stormwater channels surrounding the site to collect any ash contaminated surface run-off water. The collecting stormwater canal that transports water to the PCDs is not lined. However, it will be lined through a project (C.GMT0213 – Lining extension of stormwater canal at coal yard) already registered and included in the Station's technical plan.</u> 		

6.7 Soils

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Soil stripping and removal.	<ul style="list-style-type: none"> Prior to the commencement of earthworks, the Contractor should determine the average depth of topsoil, and agree on this with the ECO. The full depth of topsoil should be stripped from areas affected by construction and related activities prior to the commencement of major earthworks (including the building footprints, working areas and storage areas). Topsoil must be reused where possible to rehabilitate disturbed areas in order to facilitate re-growth of species that occur 	Weekly	Contractor & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>naturally in the area.</p> <ul style="list-style-type: none"> Removed polluted topsoil should be transported to a licenced landfill site. 		
Vehicle and machinery operation on site: spillage of lubricants, fuel, and cement and other petroleum products.	<ul style="list-style-type: none"> Limit vehicle movement to absolute minimum or construct proper roads for access. Limit vehicle movement on unpaved areas and vehicle speeds should be restricted on site. Vehicles and machinery to be properly maintained to keep oil and diesel leaks in check. Depending on the nature and extent of the spill, contaminated soil to be excavated / treated on-site. Dust must be suppressed on the construction site and during the transportation of material during dry periods by the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of run-off. 	Weekly	Contractor

6.8 Erosion Management Plan

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Vegetation removal and exposed soils.	<ul style="list-style-type: none"> Limit construction, maintenance and inspection activities to dry periods in order to curb occurrence/ augmentation of erosion in areas of existing erosion. Disturbed areas of natural vegetation as well as cut and fills must be rehabilitated immediately to prevent soil erosion. Erosion control measures that can be implemented in areas that are susceptible to erosion include: <ul style="list-style-type: none"> Use of silt fences and sand bags. Brush packing with cleared vegetation. Mulch, stone chip packing. Planting of vegetation. Hydroseeding / hand sowing. Sensitive areas need to be identified prior to construction so that the necessary precautions can be implemented. Cover material (slag or <i>insitu</i> soils) should be placed on side slopes of the ADF (after the final waste filling has been undertaken to achieve a slope of 1V:3H or flatter) as the waste pile extends vertically, thereby achieving progressive capping. All erosion control mechanisms need to be regularly maintained. Removal of vegetation/ plants should be avoided until such time as soil stripping is required and similarly exposed surfaces must 	Weekly initially – Bi-monthly	Contractor & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>be re-vegetated or stabilised as soon as is practically possible. Remove and store topsoil separately in areas where excavation/ degradation takes place. Removal of topsoil should be done to a depth of at least 1 m.</p> <ul style="list-style-type: none"> • Stockpiled topsoil should be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting. • Stockpiles not used in three (3) months after stripping must be seeded to prevent dust and erosion. • Vehicle movement should be restricted to an absolute minimum that is required for the construction. Unnecessary movement of vehicles will increase the degradation of paths and dirt roads leading to an increased erosion risk. 		

6.9 Fauna and Flora

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Construction impacts on conservation important flora and faunal species.</p>	<ul style="list-style-type: none"> • Prevent contamination of natural habitat and nearby wetlands from any source of pollution. • Provide an adequate buffer between areas of development and surrounding natural habitat. • Demarcate construction areas by semi-permanent means/ material, in order to control movement of personnel, vehicles, providing boundaries for construction and operational sites • No painting or marking of rocks or vegetation to identify locality or other information shall be allowed, as it will disfigure the natural setting. Marking shall be done by steel stakes with tags, if required. • Provide demarcated fire-safe zones, facilities and suitable fire control measures. • Access is to be established by vehicles passing over the same track on natural ground. Multiple tracks are not permitted. • Dust control on all roads should be prioritised. • Conduct a protected species survey. Results of this survey will guide permitting requirements for the removal of protected trees from the selected property. • The applicant must immediately take steps to remove alien vegetation. The size of areas subjected to land clearance will be kept to a minimum. • Only areas as instructed by the Project Manager must be cleared and grubbed. 	<p>Weekly</p>	<p>Contractor & ECO</p>

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<ul style="list-style-type: none"> • Cleared vegetation and debris that has not been utilised will be collected and disposed of to a suitable waste disposal site. It must not be burned on site. • All vegetation not required to be removed will be protected against damage. • Removal of vegetation/ plants shall be avoided until such time as soil stripping is required and similarly exposed surfaces must be re-vegetated or stabilised as soon as is practically possible. • Remove and store topsoil separately in areas where excavation/ degradation takes place. Removal of topsoil should be done to a depth of at least 1 m. • Stored topsoil will be free of deleterious matter such as large roots, stones, refuse, stiff or heavy clay and noxious weeds, which would adversely affect its suitability for planting. • No spoil material will be dumped outside the defined site. • Disturbance of vegetation must be limited to areas of construction. • The removal or picking of any protected or unprotected plants shall not be permitted and no horticultural specimens (even within the demarcated working area) shall be removed, damaged or tampered with unless agreed to by the ECO. • No killing or harming of animals 		

6.10 Alien Invasive Vegetation Management

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Alien invasive vegetation establishment.	<ul style="list-style-type: none"> • Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Environmental monitoring should be conducted at least once a year. • The establishment and re-growth of invasive and alien vegetation must be controlled after the removal of grass. • The proponent must immediately take steps to remove alien vegetation. Currently the Power Station's Horticulture Department and Contractor responsible for the existing ADF are managing alien vegetation. • Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the NEM: Biodiversity Act (No 10 of 2004) and 	Biweekly - Monthly	ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>Regulations must be addressed on a continual basis, through an alien vegetation control and monitoring programme.</p> <ul style="list-style-type: none"> Remove invasive and alien vegetation, particularly in vicinity of riparian zones where alien and invasive trees are known to occur. The implementation of a monitoring programme in this regard is recommended. 		

6.11 Waste Management

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Contamination of the site with general and hazardous waste.</p> <p>General waste produced on site includes:</p> <ul style="list-style-type: none"> Operational waste (clean steel, wood, glass); and General domestic waste (food, cardboards, paper, plastic, bottles, tins). <p>Hazardous waste produced on site includes:</p> <ul style="list-style-type: none"> Hydrocarbons; Oil and other lubricants, diesel, paints, solvent; Containers that contained chemicals, oils or greases; Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen); and Sewage. 	<ul style="list-style-type: none"> An adequate number of general waste receptacles, including bins must be provided around the site to collect all domestic refuse, and to minimise littering. Bins should be clearly marked for efficient control and safe disposal of waste. Different waste bins, for different waste streams must be provided to ensure correct waste separation. A fenced area must be allocated for waste sorting and disposal on the site. General waste produced on site is to be collected in skips for disposal at the local municipal landfill site. Hazardous waste is not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site. Under no circumstances is waste to be burnt or buried on site. Waste bins should be cleaned out on a regular basis to prevent any windblown waste and/or visual disturbance. All general waste must be removed from the site at regular intervals. Hazardous waste is to be disposed at a Permitted Hazardous Waste Landfill Site. The ECO must have as part of his/her records the waste manifest for each batch based disposal. Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored under a roof or the top of the container must be covered with a lid). A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. Proper storage facilities for the storage of oils, paints, grease, fuel, chemicals and any hazardous materials to be used must be provided to prevent the migration of spillages into the ground and groundwater regime around the temporary storage area(s). 	Weekly	Contractor; EO & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>These pollution prevention measures for storage should include a bund wall high enough to contain at least 110% of any stored volume, and this should be situated away from drainage lines in a site selected with the approval of the PM and ECO.</p> <ul style="list-style-type: none"> In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk. Ablution facilities in the form of chemical toilets must be provided on site for construction staff. These toilets must be cleaned and emptied regularly by a registered service provider. 		

6.12 Social

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Health impacts due to air quality and water contamination.	<ul style="list-style-type: none"> Annual occupational health examinations should be conducted. If any increase in respiratory diseases should be identified, investigations to determine the source should be conducted and immediate measures should be put in place to correct it. Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored. Air, surface water and groundwater monitoring should take place on a regular basis, to ensure that any potential threat to health can be detected and rectified immediately. 	Weekly	PM & ECO
HIV/AIDS, STIs and TB.	<ul style="list-style-type: none"> Existing Eskom health policies will be extended for the ADF which provides: <ul style="list-style-type: none"> An HIV/AIDS programme. Extension of the HIV/AIDS awareness programme to local communities. Free condoms to employees. Free testing for HIV/AIDS and counselling to immediate family members of employees. HIV/AIDS programmes as a condition for contracting suppliers and service providers. A TB programme. 	Monthly	Contractor & PM
Possible employment opportunities created.	<ul style="list-style-type: none"> Should any employment opportunities be created, local labour should be used. Eskom will implement and adhere to the conditions stipulated in the Labour Relations Act (No 66 of 1995). 	Weekly	Contractor & PM
Possible inflow of unemployed job	<ul style="list-style-type: none"> Ensure that employment procedures/policies are communicated 	Weekly	Contractor & PM

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
seekers.	<p>to local stakeholders, especially community representative organisations and ward councillors.</p> <ul style="list-style-type: none"> • Have clear rules and regulations for access to the construction site to control loitering. Consult with the local SAPS to establish standard operating procedures for the control and/or removal of loiterers at the construction site. • Construction workers should be clearly identifiable by wearing proper uniforms displaying the logo of the construction company. Construction workers could also be issued with identification tags. 		

6.13 Air Quality

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Dust and emissions generated due to construction activities such as debris handling, movement of vehicles and machines and general construction.	<ul style="list-style-type: none"> • Dust must be suppressed on the construction site and during the transportation of material during dry periods by the regular application of water / watering or by use of environmentally acceptable / friendly binding chemicals. Water used for this purpose must be used in quantities that will not result in the generation of run-off. • Dust fallout monitoring is currently taking place on site by a Contractor. This monitoring should continue during construction and operations as per current agreements. • Loads on trucks should be covered to avoid loss of material in transport, especially if material is transported off site. • Dust and mud should be controlled at vehicle exit and entry points to prevent the dispersion of dust and mud beyond the site boundary. Facilities for the washing of vehicles should be provided at the entry and exit points. • Permanent roads should be paved early. • A speed limit of 40 km/hr should be set for all vehicles travelling over exposed areas. • During the transfer of materials, drop heights should be minimised to control the dispersion of material being transferred. • Equipment and vehicles used by the contractor must be maintained in good working order to prevent smoke emissions. • Any temporary storage piles (cleared topsoil) should be maintained for as short a time as possible and should be enclosed by wind breaking enclosures of similar height to the storage pile. • Storage piles should be situated away from the site boundary, 	Daily	Contractor; PM & ECO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	water courses and nearby receptors and should take into account the predominant wind direction.		

6.14 Visual

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Impact on the visual environment would be caused by excavation of the site for the establishment of infrastructure and the continuous ashing activities.	<ul style="list-style-type: none"> Avoid unnecessary excavations / clearing of land and keep the construction footprint to a minimum. Limited clearing of vegetation on the development site unless required for construction facilities. This will retain the screening function of natural vegetation. Retain a strip (buffer) of natural woodland vegetation on the western edge of any new expansion to the Onverwacht housing area in order to assist in the screening of the active eastern face of the ashing facility from view. Rehabilitate cleared areas as soon as possible. All rubble and cleared infrastructure should be cleared as soon as possible. 	Weekly	Contractor; PM & ECO

6.15 Heritage

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Impact on the identified ruined house structure and other unknown heritage resources.	<ul style="list-style-type: none"> The Contractors and workers should be notified that archaeological sites might be exposed during the construction activities. Should any heritage artefacts be exposed during excavation, work in that area shall cease immediately and the ECO and the EO shall be notified as soon as possible. All discoveries should be reported immediately to a heritage practitioner so that an investigation and evaluation of the finds can be made. Acting upon advice from these specialists, the ECO will advise the necessary actions to be taken. Under no circumstances shall any artefacts be removed, destroyed or be interfered with by anyone on the site. Contractors and workers shall be advised of the penalties associated with the unlawful removal of cultural, historical, archaeological or palaeontological artefacts, as set out in the National Heritage Resources Act (No 25 of 1999), Section 51. (1). 	Weekly	Contractor; PM; ECO & Archaeologist

6.16 Noise

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Noise generation during construction.	<ul style="list-style-type: none"> • Construction site yards and other noisy fixed facilities should be located well away from noise sensitive areas adjacent to the development sites. • All construction vehicles and equipment are to be kept in good repair. • Where possible, stationary noisy equipment (for example compressors, pumps, pneumatic breakers,) should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20 dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators). • Construction activities, and particularly the noisy ones, are to be contained to reasonable hours (06:00 – 18:00) during the day and early evening. • With regard to unavoidable very noisy construction activities in the vicinity of noise sensitive areas, the power station should liaise with local residents on how best to minimise the impact. • Machines in intermittent use should be shut down in the intervening periods between work or throttled down to a minimum. • In general, operations should meet the noise standard requirements of the Occupational Health and Safety Act (No 85 of 1993). • Construction staff working in areas where the 8-hour ambient noise levels exceed 75 dBA should wear ear protection equipment. 	Weekly	Contractor & SH Officer

6.17 Traffic Management and Transportation

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Increase in traffic from construction vehicles.	<ul style="list-style-type: none"> • If an access to SA2 is constructed, it is recommended that a short right-turn lane from the D2001 be provided. If the linear infrastructure route is constructed to SA2, it is recommended that, where the conveyor system crosses a road or path, a 5.2 m clearance is provided from the road surface and bottom of the conveyor system. • As per Eskom Policy, no person is allowed to drive more than 40 km/h on a gravel road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 30 km/h. This is communicated to all persons by means of National Speed Signs. • Seatbelts are to be worn at all times. • When using heavy or large vehicles / equipment, "spotters" are to be present to assist the driver with his blind spots. • Any incident or damage to a vehicle must be reported immediately as per Eskom Policies and Procedures. 	Weekly	Contractor & SH Officer

7 Environmental Management Programme – Operations

A concept operational plan has been compiled for the proposed project that covers basic duties and responsibilities (concept level) for the routine day-to-day operation of the proposed ADF for the Matimba Power Station (**Appendix D**). The operational plan is to be read in conjunction with the Technical Engineering Design Report (**Appendix C of the Main Report**) and reference can be made to the Matimba Power Station Ash Dump Operating Manual².

7.1 Geology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Movement and slope failure.	<ul style="list-style-type: none"> • Earthworks and drainage measures should be designed in such a way as to prevent ponding of, or high concentrations of, stormwater or groundwater anywhere on the sites. • Progressive capping/rehabilitation activities are to be carried out in order to protect the side slopes of the proposed ADF from erosion, reduce stormwater collection volumes and to lessen the visual impact of the ash dump. • The maximum final finished capped side slope of the proposed ADF should not be steeper than 1V:3H to ensure long term stability of the slope. • The terrace should be shaped to a gradient to prevent water ponding on the surface and should be graded to direct water away from the fill edges and foundations. • The ADF should be monitored on a regular basis for possible movement and slope failure. The amount of movement that is likely to occur before failure determines the sensitivity of the monitoring equipment required. Movement varies with the type of material disposed, the disposal facility height and the location at which monitoring will be done. Taking into consideration that scouring and surface/edge slides were noticed along the existing ADF crest, it is recommended that movement monitoring be focused in this area. 	Weekly	Auxiliary Engineering Manager (AEM) & EO

² Roshcon (Pty) Ltd. (2001). Matimba Power Station Ash Dump Operating Manual. Rev01.

7.2 Geohydrology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Continuous ashing may impact groundwater resources through leachate by altering the pH levels, increasing the salt content, and increasing potentially toxic trace element concentrations.</p>	<ul style="list-style-type: none"> Groundwater monitoring must be conducted to confirm any impacts in accordance with the proposed groundwater management plan (Appendix C). Lining of the greenfield portion of the ADF as per the recommendations of the Technical Engineering Report. To ensure that the groundwater environment is protected, monitoring of water quality and levels is required on an on-going basis. Both sites, namely, SA1 and SA2 have sufficient amounts of monitoring boreholes surrounding the site, located both up-gradient and down-gradient. It is imperative that these boreholes are monitored on a regular basis. For SA1, there are monitoring boreholes which are located on the footprint of the site. It is important that if SA1 is selected as the site for the ADF that any borehole located on the site footprint is backfilled using a cement - bentonite slurry so as to prevent direct migration of potentially poor quality water into the aquifers. The following boreholes are currently being monitored by GHT Consulting: P01, P03, P02, P31, P29, P23 and P20. Boreholes GHT01 and GHT 2 are newly drilled boreholes by GHT Consulting. MA01 and MA02 are newly drilled boreholes by GCS. Borehole HP01 is a production borehole used for garden irrigation and stock watering. All these boreholes should be included in the proposed monitoring plan for SA1. Boreholes MA1 and HP01 can be monitored bi-annually whereas the remainder of boreholes should be monitored quarterly. Boreholes APV02, APV01, WB31, MA05, DHL123, DHL05, DHL07, DHL08, GPN07, GPN06, GPN01, GPN05, GPN04, GPN03, GPN02 are all boreholes located around SA2. Boreholes APV02, GPN05 and MA05 which were included in the geohydrology investigation should be monitored on a quarterly basis. Additionally, boreholes NGA090, GPN07 and DHL08 located at a further distance from the proposed site should be monitored on a quarterly basis. If the monitoring data indicates the need for corrective action, the magnitude of the impact must be assessed by an appropriately qualified and experienced specialist and the necessary measures put forward based on the magnitude of the impact. 	<p>Quarterly to Bi-annually</p>	<p>AEM & EO</p>

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
The loss of ash on the conveyor belt during the transportation from the power station to the ADF may have a detrimental effect on the soil and groundwater environment.	<ul style="list-style-type: none"> Regular inspections along the conveyor belt route and along sensitive areas mapped (fault areas) in order to visibly identify any areas where ash has been deposited on the soil. Deposited ash must be removed immediately and transported back to the ADF. 	Weekly	AEM & EO

7.3 Hydrology

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Pollution of local water resources.	<ul style="list-style-type: none"> Adequate stormwater management around the site to comply with GN 704. For SA1, the entire ADF should be regarded as a dirty water area. Run-off from the site could be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is constructed to the south of the ADF for this purpose. For SA2, the entire ADF should be regarded as a dirty water area. Run-off from the site could, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps. A monitoring programme is recommended at the ADF in terms of Best Practice Guidelines G3: Water Monitoring Systems, in order to detect any potential contamination as early as possible. The monitoring programme will assist with overall water management at the site and should be amended according to on-site operations and licencing conditions (IEA and WUL), monthly sampling up- and down-stream of relevant rivers and pans within the study site and bi-annual sampling up- and down-stream of relevant rivers and pans in the greater area. It is further recommended that sample site MASW1 is monitored at least biannually as livestock are likely to continue drinking from this pan. 	Bi-annually	AEM & EO

7.4 Surface Water (Wetlands)

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Stormwater from the ashing area could enter riparian areas and transport pollutants into the surface water features.	<ul style="list-style-type: none"> Stormwater control to be included in the design of the rehabilitated ADF. Temporary stormwater control must be incorporated into the active ashing area. Monthly sampling up- and down-stream of relevant rivers and 	Monthly - Biannually	AEM & EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>pans within the study site should occur.</p> <ul style="list-style-type: none"> • Bi-annual sampling up- and down-stream of relevant rivers and pans in the greater area should occur. • It is further recommended that sample site MASW1 is monitored at least biannually as livestock are likely to continue to drink from this pan. 		

7.5 Stormwater Management

Refer to the Stormwater Management measures and controls included in the Construction phase (Section 6.6) as well as the measures and control indicated below.

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Pollution control dams (PCDs).	<ul style="list-style-type: none"> • All stormwater pipes are to be maintained and kept free of blockages. • Contaminated stormwater shall be directed to the PCDs. Routine maintenance shall be carried out on the PCDs. Levels of contaminated stormwater shall be balanced between the various PCDs to optimise evaporation versus demand for dust suppression. The contents of each PCD are to be routinely emptied into adjacent PCDs to allow for the removal of silt that has accumulated due to settlement. • A minimum freeboard of 0.5 m is to be maintained at all times within the PCDs (<u>that spills on average only once in 50 years</u>). • Care must be taken when pumping from the PCDs to ensure that spillages do not occur, or damage to the PCD liner. • In line with best management practices (BMP) it is favourable that, during dry weather periods, stored contaminated stormwater or leachate be irrigated over the ash dump to be lost through evaporation, transpiration or seepage into the ash dump itself. Adequate site management and safety precautions are required to prevent direct human contact with raw leachate. • It is critical that the ash pile is not over-watered above Optimum Moisture Content (OMC) and thus cause instability of the ash dump. 	Weekly	AEM
Run-off from the advancing ash face.	<ul style="list-style-type: none"> • A berm should be constructed just ahead of the advancing toe of the ash dump. Care should be taken to construct the berm far enough away from the advancing toe of the dump so as to never ash into standing water. As the ash dump approaches a berm, a new berm should be constructed in front of the old berm. • Temporary berms or 'V' drains should be constructed in order to 	Weekly	AEM

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>prevent concentrations of stormwater on the advancing surface areas of the dump both on the completed dump areas and at the shiftable conveyor platform.</p> <ul style="list-style-type: none"> Temporary berms or 'V' drains should be constructed in order to prevent concentrations of run-off and erosion in the spreader and stacker working areas as well as the areas in which the machines will be required to operate in the near future. 		
Run-off from backstack and side slopes.	<ul style="list-style-type: none"> Stormwater run-off from the backstack and side slopes must be controlled by means of berms designed to contain run-off and to minimise erosion. Excess stormwater should be allowed to flow over the berms and collect in a concrete lined canal at the toe of the dump. Water in the ash dump toe canal will be drained to the PCDs. The silt in canals must be cleaned/desilted regularly. 	Weekly	AEM
Stormwater management at the emergency offloading area.	<ul style="list-style-type: none"> <u>The expanded emergency ash offloading area will be equipped with stormwater channels surrounding the site to collect any ash contaminated surface run-off water. The collecting lined stormwater canal will transports water to the PCDs for further treatment and use.</u> 	Weekly	AEM

7.6 Erosion Management and Control

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Continued ashing.	<ul style="list-style-type: none"> Cover material (slag or <i>insitu</i> soils) should be placed on side slopes of the ADF (after the final waste filling has been undertaken to achieve a slope of 1V:3H or flatter) as the waste pile extends vertically, thereby achieving progressive capping. All erosion control mechanisms need to be regularly maintained. Vehicle movement should be restricted to an absolute minimum that is required during operations. Unnecessary movement of vehicles will increase the degradation of paths and dirt roads leading to an increased erosion risk. 	Weekly initially – Bi-monthly	EO

7.7 Alien Invasive Vegetation Management

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Alien invasive vegetation establishment.	<ul style="list-style-type: none"> Compile and implement environmental monitoring programme, the aim of which should be ensuring long-term success of rehabilitation and prevention of environmental degradation. Environmental monitoring should be conducted at least once a 	Biweekly - Monthly	EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>year.</p> <ul style="list-style-type: none"> The establishment and re-growth of invasive and alien vegetation must be controlled after the removal of grass. The proponent must immediately take steps to remove alien vegetation. Currently the Power Station's Horticulture Department and Contractor responsible for the existing ADF are managing alien vegetation. Monitoring the potential spread of declared weeds and invasive alien vegetation to neighbouring land and vice versa and protecting the agricultural resources and soil conservation works are regulated by the NEM: Biodiversity Act (No 10 of 2004) and Regulations must be addressed on a continual basis, through an alien vegetation control and monitoring programme. 		

7.8 Waste Management

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
<p>Contamination of the site with general and hazardous waste.</p> <p>General waste produced on site includes:</p> <ul style="list-style-type: none"> Operational waste (clean steel, wood, glass); and General domestic waste (food, cardboards, paper, plastic, bottles, tins). <p>Hazardous waste produced on site includes:</p> <ul style="list-style-type: none"> Hydrocarbons; Oil and other lubricants, diesel, paints, solvent; Containers that contained chemicals, oils or greases; and Equipment, steel, other material (rags), soils, gravel and water contaminated by hazardous substances (oil, fuel, grease, chemicals or bitumen). 	<ul style="list-style-type: none"> An adequate number of general waste receptacles, including bins must be provided around the site to collect all domestic refuse, and to minimise littering. Bins should be clearly marked for efficient control and safe disposal of waste. Different waste bins, for different waste streams must be provided to ensure correct waste separation. A fenced area must be allocated for waste sorting and disposal on the site. General waste produced on site is to be collected in skips for disposal at the local municipal landfill site. Hazardous waste is not to be mixed or combined with general waste earmarked for disposal at the municipal landfill site. Under no circumstances is waste to be burnt or buried on site. Waste bins should be cleaned out on a regular basis to prevent any windblown waste and/or visual disturbance. All general waste must be removed from the site at regular intervals. Hazardous waste is to be disposed at a Permitted Hazardous Waste Landfill Site. The EO must have as part of his/her records the waste manifest for each batch based disposal. Hazardous waste bins must be clearly marked, stored in a contained area (or have a drip tray) and covered (either stored 	Weekly	EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>under a roof or the top of the container must be covered with a lid).</p> <ul style="list-style-type: none"> • A hazardous waste disposal certificate must be obtained from the waste removal company as evidence of correct disposal. • In the case of a spill of hydrocarbons, chemicals or bituminous, the spill should be contained and cleaned up and the material together with any contaminated soil collected and disposed of as hazardous waste to minimize pollution risk. 		

7.9 Social

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Impact on health due to impacts on air quality.	<ul style="list-style-type: none"> • The authorities should be informed if the incidence of respiratory disease in the area increases. It is advised that clinics and hospitals in the area adopt a formal monitoring programme to enable the identification of increases in respiratory diseases. • Through the legislated annual occupational health examinations, any increase in respiratory diseases should be investigated to determine the source and immediate measures should be put in place to correct it. • Should any out-of-the-ordinary risks to health and safety arise it should be widely communicated to the surrounding community, including employees, business owners, and all other stakeholders. • Measures to prevent air, surface water and groundwater pollution should be implemented, adhered to and monitored. • All employees who are exposed to ash at the power station and the ADF should be supplied with protective gear and the use of such protective gear should be compulsory. • Road users must be warned of dust storms through appropriate signage. 	Annually	AEM; EO & SH Officer

7.10 Air Quality

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Dust generation during continuous ashing.	<ul style="list-style-type: none"> • Dust must be suppressed on the dump by the regular application of water, as per Ash Dump Operating Manual. Water sourced from the PCDs is used to suppress dust. • Water used for this purpose must be used in quantities that will 	Daily	AEM; EO & SH Officer

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>not result in the generation of run-off.</p> <ul style="list-style-type: none"> • Dust fallout monitoring is currently taking place on site by a Contractor. This monitoring should continue during operations as per current agreements. • The following methods, used on their own or combined, can be considered for dust control on the existing ash dump: <ul style="list-style-type: none"> – Spraying the ash dump with water using a sprinkler system. – Spraying the ash dump with water using mobile plant (water bowsers). – Using a sacrificial sand layer - a thin (50 mm) layer of sand spread over the ash surface has proved successful in controlling dust-blown problems. The use of sand also reduces the amount of water required for dust suppression. A truck load of sand dozed over the crest of the advancing face to some degree reduces the amount of ash blown on the crest caused by the eddy effect of the wind at the crest of the ash dump. The sand layer is spread over the ash dump once the advancing front stack has been levelled. • All site workers will need to wear the appropriate PPE to avoid excessive exposure to dust particles. • There should be strict speed limits on site roads to prevent the liberation of dust into the atmosphere. • Dust is expected to be generated from each of the conveyor transfer points (and change in direction or drop from one conveyor to another). Dust sprays can be fitted to the transfer points to ensure minimum dust liberation. 		

7.11 Visual

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Continuous ashing.	<ul style="list-style-type: none"> • In order to assist in the screening of the ash dump for receptors in the surrounding area, it is recommended that a buffer of natural vegetation be maintained around the ash dump site. This buffer is recommended to be at least 150 m wide to allow the natural woodland vegetation to partly screen (the lower parts of) the ash dump from the surrounding area. • It would also be advantageous in a mitigating perspective to ensure that if the housing area of Onverwacht is expanded to the west towards the existing ADF that the housing development layout be planned to include a buffer of the existing woodland vegetation on the western edge of the housing development that 	Annually	AEM and EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	is at least 50 m in width, as this will be a strong mitigating factor in reducing the visual exposure potential of the heightened ashing face by acting as a visual screen.		

7.12 Noise

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Noise impacts associated with operational activities.	<ul style="list-style-type: none"> • The design of all major infrastructure for the project should incorporate all the necessary acoustic design aspects required in order that the overall generated noise level from the new installation does not exceed a maximum equivalent continuous day/night rating level (LRdn), namely a noise level of 70 dBA (just inside the property projection plane, namely the property boundary of the power station and the boundary of the pipeline/conveyor servitude) as specified for industrial districts in SANS 10103. Notwithstanding this provision; the design is also to take into account the maximum allowable equivalent continuous day and night rating levels of the potentially impacted sites outside the power station property and the boundary of the pipeline/conveyor servitude. Where the noise level at such an external site is presently lower than the maximum allowed, the maximum shall not be exceeded. Where the noise level at the external site is presently at or exceeds the maximum, the existing level shall not be increased by more than indicated as acceptable in SANS 10103. • The latest technology incorporating maximum noise mitigation measures for components of the project should be designed into the system. When ordering plant and machinery, manufacturers should be requested to provide details of the sound power level (SPL). Where possible, those with the lowest SPL (most quiet) should be selected. • The design process is to consider the insulation of particularly noisy plant and equipment. • All plant, equipment and vehicles are to be kept in good repair. • Where possible, very noisy activities should not take place at night (between the hours of 20h00 to 06h00) 	Weekly	AEM & SH Officer

8 Environmental Management Programme – Rehabilitation and Decommissioning

8.1 Rehabilitation

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Rehabilitation of the ash dump.	<ul style="list-style-type: none"> The ash dump needs to be rehabilitated progressively. Areas where final shaping and levelling of the ash have been completed need to be topsoiled immediately and rehabilitated as soon as possible. The ash dump is covered daily with a 50 mm thick layer of soil/sandy material while the final rehabilitation cover consists of 300 mm thick topsoil material with seeding for grass and the manual planting of trees. Progressive capping/rehabilitation activities are to be carried out in order to protect the side slopes of the proposed ADF from erosion, reduce stormwater collection volumes and to lessen the visual impact of the ash dump. The maximum final finished capped side slope of the proposed ADF should not be steeper than 1V:3H to ensure long term stability of the slope. In addition, the proponent is considering the use of sludge as soil ameliorant for the rehabilitation of the ash dump. The sludge is applied with topsoil as a soil ameliorant providing organic matter and nutrients to augment the qualities of the soil (Appendix E). It is anticipated that there will be insufficient cover and capping material available on-site due to the shallow refusal depths encountered. As such it is imperative that suitable borrow pits (of a suitable size) for capping material be identified early on at the detail design phase. Rehabilitation of the ADF sides with vegetation should aim to mimic the appearance of the naturally-occurring woodland as far as possible. 	Weekly	AEM

8.2 Decommissioning

At this point of the project planning process, the necessity for and timing of the decommissioning of the proposed project is not known as the proposed ADF will be in operation for the next 40 years. In order to minimise the extent of rehabilitation activities required during the decommissioning phase, Eskom will ensure that constant effort is applied to rehabilitation activities throughout the construction, operation and maintenance phases of the project.

Eskom will further ensure upon site closure and decommissioning of the authorised activity, an application in terms of applicable legislation (if necessary) will be made.

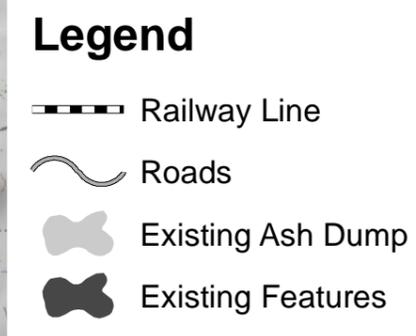
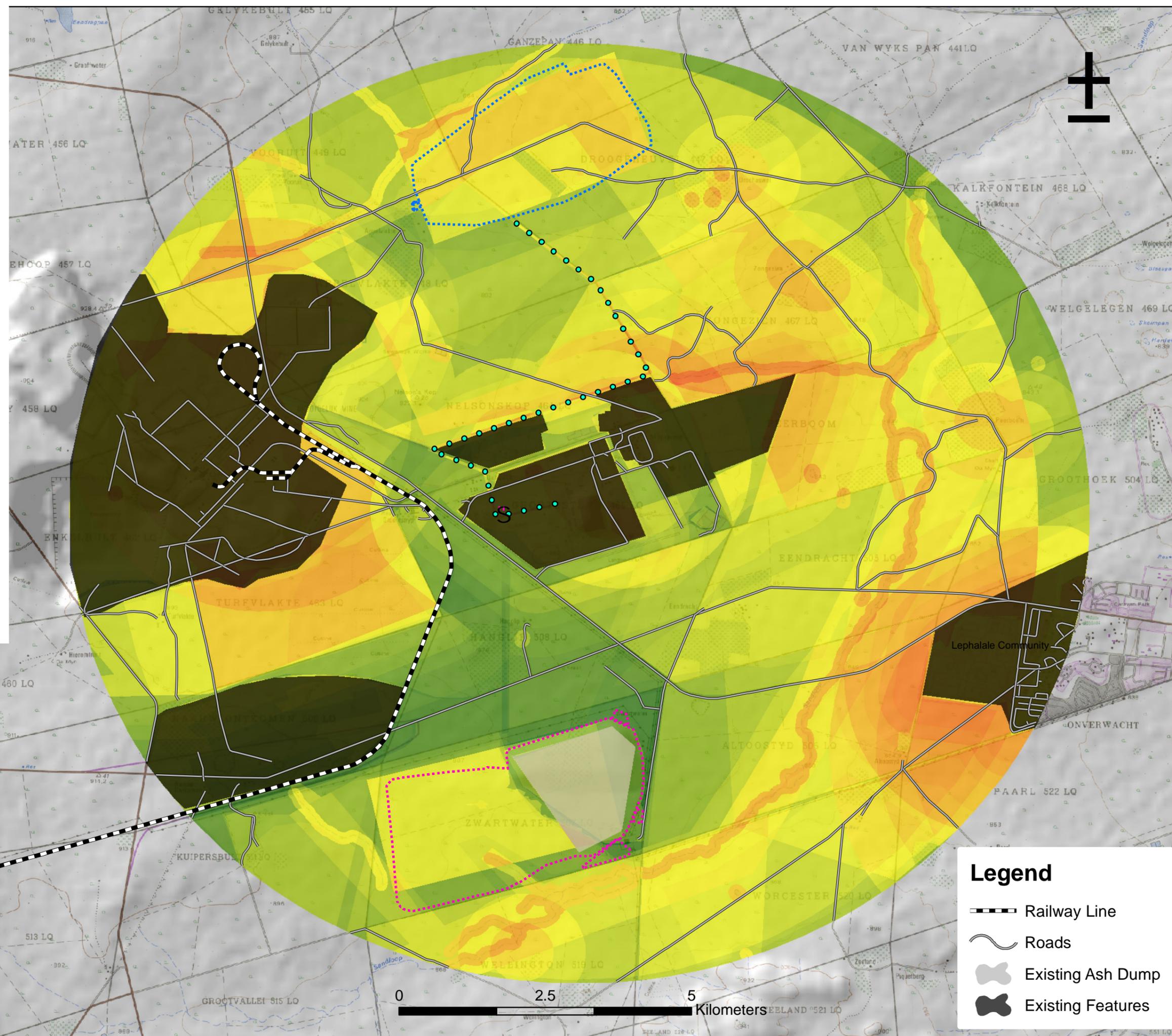
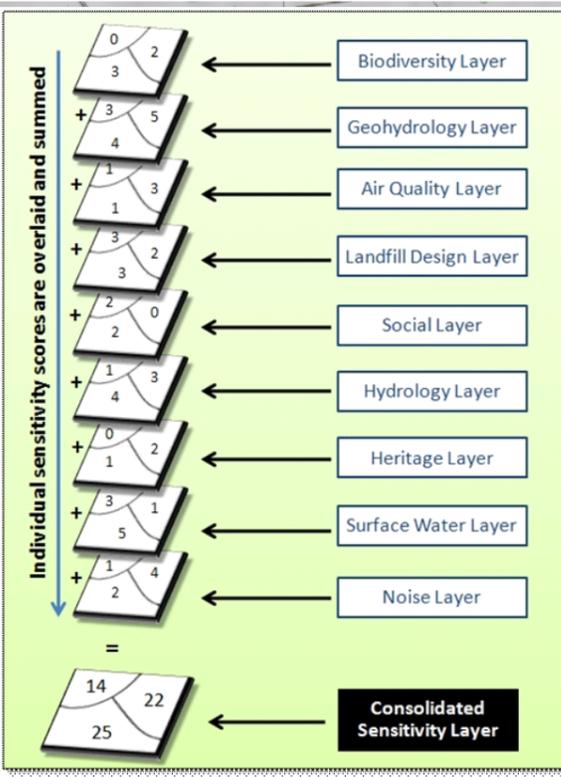
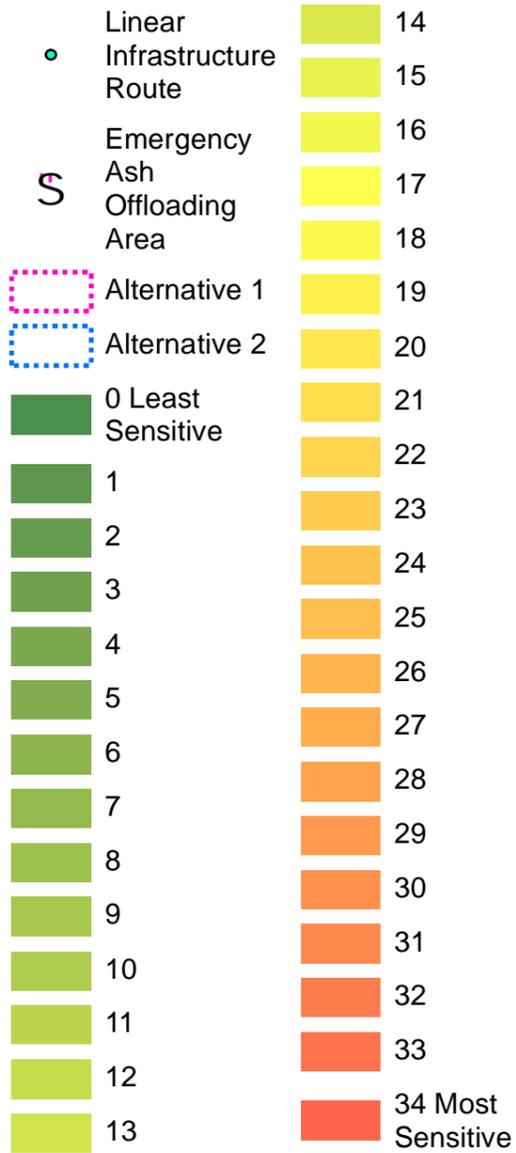
Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
Ashing at the disposal facility may continue to impact groundwater resources post-operations.	<ul style="list-style-type: none"> Groundwater monitoring must be conducted to confirm any impacts in accordance with the proposed groundwater management plan (Appendix C). 	Bi-annually	PM & EO
Pollution of water resources due to infrastructure decommissioning: <ul style="list-style-type: none"> Decommissioning of infrastructure such as buildings in the workshop and plant area would contain materials which could potentially act as pollutants to surface water resources. Residual impacts of disposal activities such as run-off, drainage and seepage from stockpiles and the ADF may result in a continued flow of pollution into water resources. 	<ul style="list-style-type: none"> The surfaces of the ADF are rehabilitated. Drains and PCDs are maintained. Once the rehabilitation of the total catchment area of the dump is complete and stormwater is reasonably clean, the dams could be classified as clean water dams. No stormwater from the ash dump may be discharged directly into the environment from these clean water dams. This water must still be contained and monitored for possible chemical contamination from the ash. 	Bi-annually	PM & EO
Soils: <ul style="list-style-type: none"> Decommissioning of infrastructure and buildings. Re-vegetating and rehabilitating the ADF. Rehabilitation of access roads. 	<ul style="list-style-type: none"> Vehicle movement has to be restricted to designated areas and roads in order to prevent degradation of any additional land or parts of land. Vehicle movement has to be restricted to an absolute minimum that is required for the decommissioning. Unnecessary movement of vehicles will increase the degradation of paths and dirt roads leading to an increased erosion risk. Progressive rehabilitation of the ADF will occur. The final phase of rehabilitation should take place as soon as decommissioning has begun to prevent soil erosion. Rehabilitation of access roads should start as soon as decommissioning is initiated. 	Weekly	PM & EO
Waste generation during decommissioning activities.	<ul style="list-style-type: none"> Disposal of waste must be in accordance with relevant legislative requirements and Eskom procedures. Waste must be disposed of in the appropriate manner at a 	Weekly	PM & EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>licensed disposal site.</p> <ul style="list-style-type: none"> All rubble is to be removed from the site to an approved disposal site as approved by the EO. 		
Dust and emissions generated by decommissioning activities.	<ul style="list-style-type: none"> Re-vegetation of exposed areas. Plants used for re-vegetation should be indigenous to the area, hardy, fast-growing, nitrogen-fixing, provide high plant cover, be adapted to growing on exposed and disturbed soil (pioneer plants) and should easily be propagated by seed or cuttings. Implement existing recommendations established in the Ash Dump Operational Manual (2011). 	Weekly	PM & EO
Increase in noise pollution from vehicles and staff.	<ul style="list-style-type: none"> All decommissioning vehicles and equipment are to be kept in good repair. Where possible, stationary noisy equipment should be encapsulated in acoustic covers, screens or sheds. Proper sound insulation can reduce noise by up to 20 dBA. Portable acoustic shields should be used in the case where noisy equipment is not stationary (for example drills, angle grinders, chipping hammers, poker vibrators). 	Weekly	PM & EO
During decommissioning, there is likely to be an increase in traffic from construction vehicles	<ul style="list-style-type: none"> As per Eskom Policy, no person is allowed to drive more than 40 km/h on a gravel road. This is applicable only to the access roads on site. All areas within the site itself, has a reduced speed limit of 30 km/h due to the danger of driving into the pipeline. This is communicated to all persons by means of National Speed Signs. Seatbelts are to be worn at all times. Persons are to be authorised for the specific vehicle they are operating in terms of an Eskom Licence. Any accident or damage to a vehicle is to be reported immediately as per Eskom Policies and Procedures. 	Daily	PM & EO
Impact similar to construction – clearing of infrastructure could create bare, un-vegetated areas that would create a visual contrast with the natural vegetation. Stockpiling of rubble / cleared infrastructure that are not removed could create a contrast with the aesthetics of the natural environment.	<ul style="list-style-type: none"> Decommissioning to be monitored by the EO according to the stipulations of the EMPr. Ensure proper surface restoration and re-sloping in order to prevent erosion, taking cognisance of local contours and landscaping. Exposed areas with slopes less than 1:3 should be rehabilitated with a grass mix that blends in with the surrounding vegetation. The grass mix should consist of indigenous grasses adapted to the local environmental conditions. Re-vegetated areas should be fenced to prevent damage by grazing animals. Re-vegetated areas showing inadequate surface coverage (less than 30% within eight months after re-vegetation) should be 	Weekly	PM & EO

Aspect and Associated Impact	Measures and Controls	Monitoring Frequency	Responsible Person/s
	<p>prepared and re-vegetated from scratch.</p> <ul style="list-style-type: none"> • Damage to re-vegetated areas should be repaired promptly. • Exotic weeds and invaders that might establish on the re-vegetated areas should be controlled to allow the grasses to properly establish. 		
Visual impacts to receptors during decommissioning.	<ul style="list-style-type: none"> • Once all ashing has been completed, the facility needs to be fully re-vegetated so that no bare 'face' exists. • Rehabilitation follow ups need to be conducted, with re-planting if necessary in order to ensure the success of rehabilitation. • All operational equipment such as conveyor systems, etc. must be fully removed from the ADF. 	Weekly	PM & EO

Appendix A: Sensitivity Map

Legend



Appendix B: Stormwater Management Plan

Stormwater Management Plan

Any SWMP in South Africa must comply with GN704, Regulation 77 and other relevant legislation. The measures taken to develop this plan must also conform to the following Best Management Guidelines published by the Department of Water Affairs:

- i. G1 Storm Water Management
- ii. A4 PCDs
- iii. A5 Water Management for Surface Mines
- iv. A6 Water Management for Underground Mines

In order to comply with best practice Storm Water principles, areas of clean and dirty water need to be identified and managed accordingly. This involves separating the clean water areas from the dirty water areas using a series of berms and channels and diverting dirty water around clean areas and finally into a PCD. Typical areas of dirty water would be any areas where activities pose a pollution risk to surface water resources. Typical areas of clean water include the natural environment, such as areas around streams and rivers (CSIR, 1995). Run-off from clean water areas must be diverted around dirty water areas.

Run-off from dirty water areas must be collected and contained, and may not spill from the dirty water area more than once, on average, in 50 years. Dirty water areas should be managed as a closed separate system regulated by a collection point or PCD. All dirty water should be directed to this collection point and then be managed accordingly, either by re-use in the dirty system, evaporation, or treatment and discharge downstream.

A conceptual plan is required that indicates all areas of clean and dirty water as well as proposed stormwater management measures (infrastructure) that are required to ensure the separation of these different water areas. A mine plan is required to finalize this conceptual SWMP.

The conceptual SWMP was produced for the Matimba ADF and the conveyor belt. The Matimba ash disposal differs slightly from normal processes, in that GCS was requested to develop full plans for two potential sites.

Site Alternative 1

Separation of clean and dirty water systems

The proposed ADF is located at some distance from the Matimba Power Station and straddles a catchment divide. The site also constitutes an extension of the existing ADF. With the exception of the extreme south-west corner of the proposed site, there are no upstream catchments that could contribute clean water flows to the site. Water tends to drain naturally away from the site. Toe drains of spoil-heaps constructed on the site will allow collection of all run-off from the site (which must be considered dirty water).

In the extreme south-west corner of the proposed site, overland flood flow from an upstream catchment area is likely to occur. There is no defined watercourse in this area. This water must, however, be diverted away from the proposed ash disposal area. The ideal diversion would likely include laser levelling of a 50m wide waterway that follows the 1:500 slope along the western boundary of the proposed disposal facility area, back to the Sandloop River. Upstream slopes are, however, so flat that a 1m high earth berm along this western boundary would effectively divert flood water. It is unlikely that this simplified diversion would result in any local erosion of soils. As expected, flow depths and velocities will be low.

The entire ADF site should be regarded as a dirty water area. Run-off from the site could, however, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is available to the south of

the ash disposal site. The layout of recommended stormwater management measures is detailed in Figure 1, below.

Containment of Dirty Water

Run-off and drainage from spoil heaps will be considered dirty water and, as such, this water must be captured on site and contained in a PCD. The entire proposed ADF site is approximately 700 hectares in extent.

Assuming that the entire site was covered by a layer of fly-ash between 20 and 30m deep, it is likely that 50% of the expected 430mm per annum rainfall would penetrate the spoil heaps and report to toe drains (approximately 1.5 million cubic meters per annum). Some seepage water is, however, likely to enter the groundwater. In practice, ash spoil heaps are covered with top-soil and rehabilitated on an on-going basis. As spoil heaps extend to new areas, older areas need to be covered and rehabilitated.

Under the arid local climatic conditions, water falling on rehabilitated surfaces will largely be lost to evaporation and transpiration and very little rain water is likely to infiltrate into the dump. If one assumes 60 hectare of active ash pile, 60 hectare in the process of being rehabilitated (and being actively irrigated) and the remainder of the site as rehabilitated ash pile, provisional simulations indicate that total annual drainage and run-off from the site is unlikely to exceed 360 000m³ per annum (on average) and that this quantity of water could readily be captured on site and lost to evaporation. It is, however, estimated that 50% of this outflow (some 25mm per annum over the site area) will seep into the groundwater and not report to toe drains.

Assuming an average surface area of 8ha, PCD storages are simulated in Figure 2. This equates to a required PCD storage capacity, for a dam that spills on average only once in 50 years, of 203 600m³. Matimba Power Station has already constructed an independent PCD design of approximately this capacity for this site. The GCS analysis confirms this dam's design capacity. It is suggested that the main toe drain indicated on the figure above should be capable of conveying a peak flow rate of 0.88m³/sec.

MATIMBA ASH DUMP SWMP OPTION 1

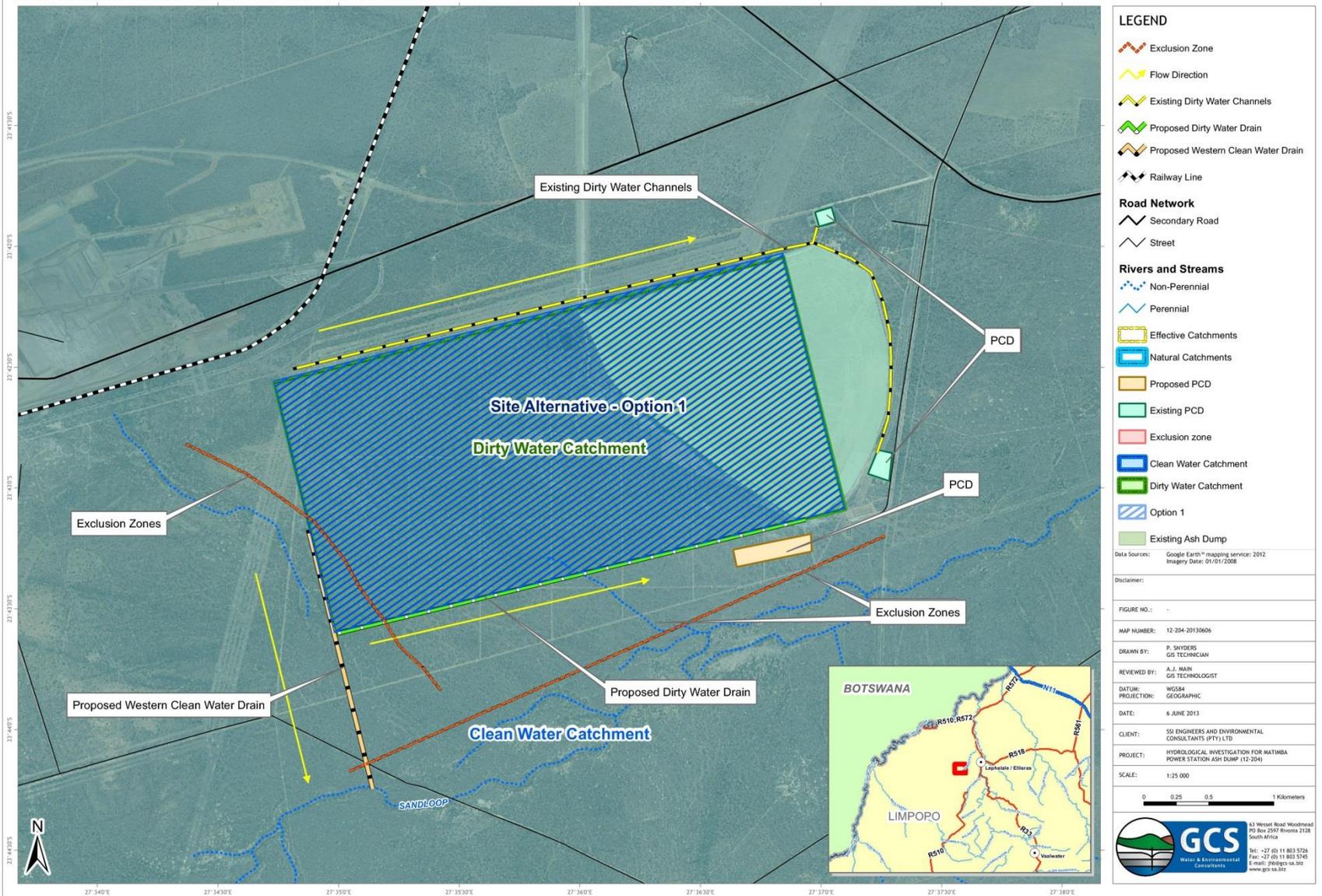


Figure 1: Site alternative1 Conceptual stormwater management measures

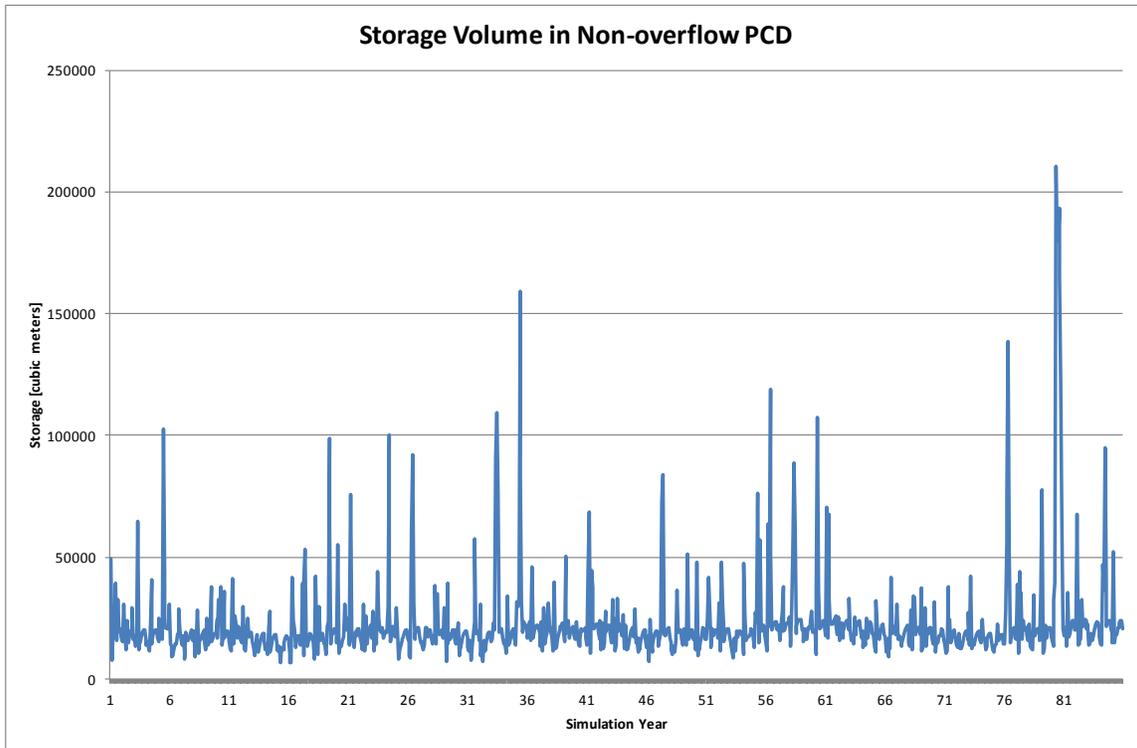


Figure 2: PCD storage

Site Alternative 2

Separating Clean and Dirty Water Systems

This site alternative lies more on a hill-slope with run-off from above the site that would need to be diverted away. A long clean-water drain can be constructed that captures this run-off and conveys clean water run-off to a south-eastern discharge point.

A particular problem at this site is that the flow path of the river is poorly defined. It would seem that with each flood event a new stream-line is established in a wide, poorly defined, flood plain. The area is so flat that vegetation, roads, fence-lines and other transient features may have more impact on the flow path than topographical features. While it is possible to model probable flood lines in HEC-RAS or a similar hydraulic model, actual flow paths are likely to be less definable.

For the purpose of this study, the larger flood plain was delineated using Google Earth imagery, and a 100 m buffer zone was drawn above this line to indicate areas that seem to be safe from flooding. This exercise excludes large sections of the proposed site towards the northern and western boundaries of the site. A down-slope toe-drain would be required to collect dirty water run-off and convey this to a PCD.

The entire ADF site should be regarded as a dirty water area. Run-off from the site could, however, be easily captured in a down-slope drain system and removed to a PCD. A single, large PCD is recommended to the north of the dump site and below all likely spoil heaps. The layout of recommended stormwater management measures is detailed in Figure 3 below:

Containment of Dirty Water

The ash-disposal facility area should be considered as a dirty water area, and is treated in much the same way as the Site alternative 1, described above. A reduced ash disposal site area would lead to a reduced PCD of approximately 180 000m³ capacity. Toe drains would be long and would be designed to accommodate peak flow rates in the order of 0.75m³/sec.

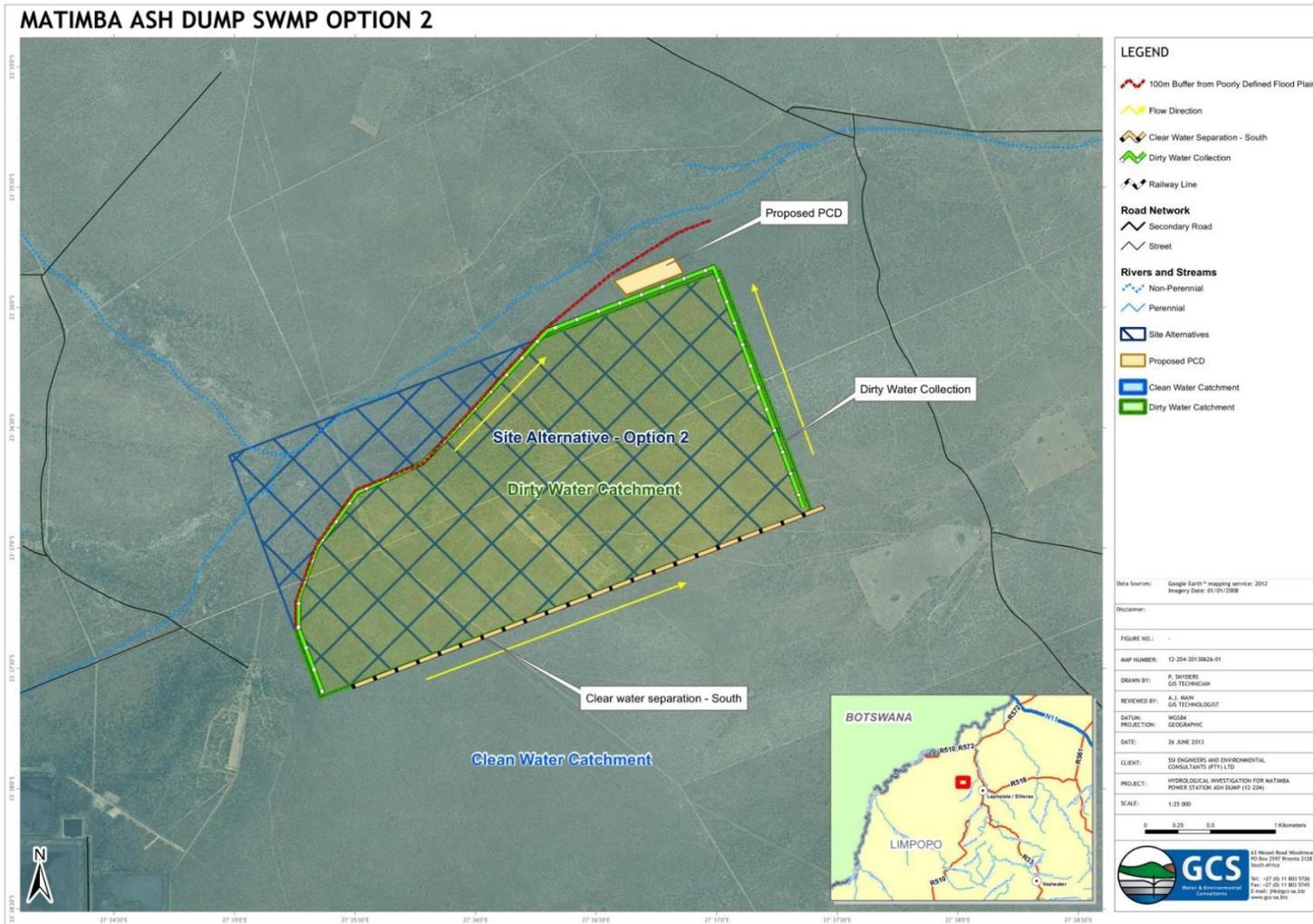


Figure 3: Site alternative 2 conceptual stormwater management measure

Linear Infrastructure Route

The entire conveyor belt area was defined as a dirty catchment. During the operation of the belt, dust will be generated and therefore this area can be considered dirty. The width of the belt was assumed to be 5m with a length of approximately 10km, as agreed-upon with the Client. The total area of the belt is 0.0464km².

The Client stated that there will be a road situated next to the belt with the length, width and area the same as the conveyor belt. The road was considered to be a clean area as it would be used to maintain the conveyor belt. If this road is used to transport material or waste then it should be considered dirty and the proposed stormwater management measures of the conveyor belt should be implemented on the road.

Proposed Stormwater Management Measures

The stormwater management measures suggested for the conveyor belt are a berm and a drain located next to the belt as shown in Figure 4.

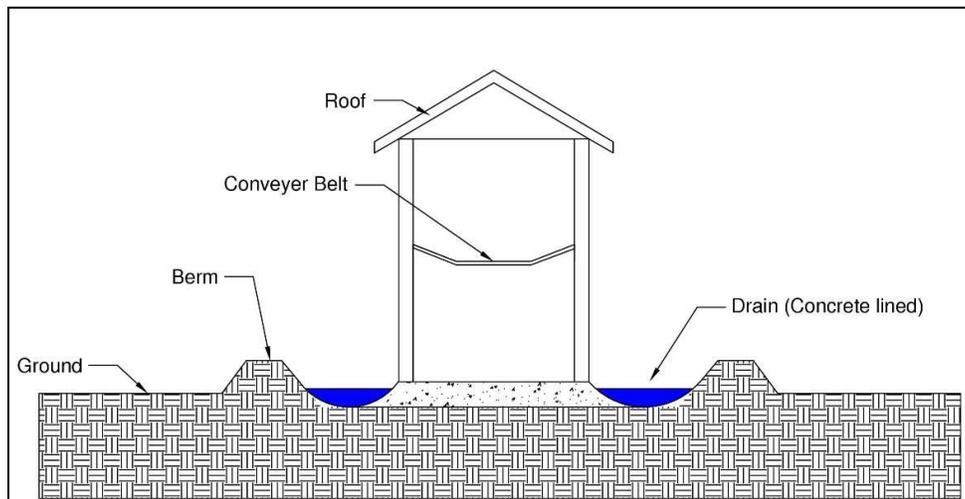


Figure 4: Stormwater measurements for the linear infrastructure route

The drains are placed to stop clean water from entering the dirty water system and vice versa. Rainfall that falls on the roof will mix with the dust generated by the conveyor belt and this water will be contained by the berms and transported to the sumps placed along the route. Sumps A, B and C were placed at the lowest elevation point of the route. The areas contributing run-off to these sumps can be seen in Table 1. Water that accumulates in these sumps must be pumped to the nearest PCD. The topography of the area was determined using 20m contours. For an accurate placement of sumps, a detailed topography survey of up to 1m should be done on the route. A culvert is suggested under Sump B to navigate clean water from the above catchment under the belt and back into the environment. This will ensure that clean water does not mix with the dirty water.

Table 1: Area contributing run-off to the sumps

Sump	Area (km ²)
A	0.012
B	0.030

Sump	Area (km ²)
C	0.0044

The conceptual SWMP and location of the stormwater management measures can be seen in Figure 5. The elevation profile of the belt can be seen in the left hand side top corner of Figure 5.

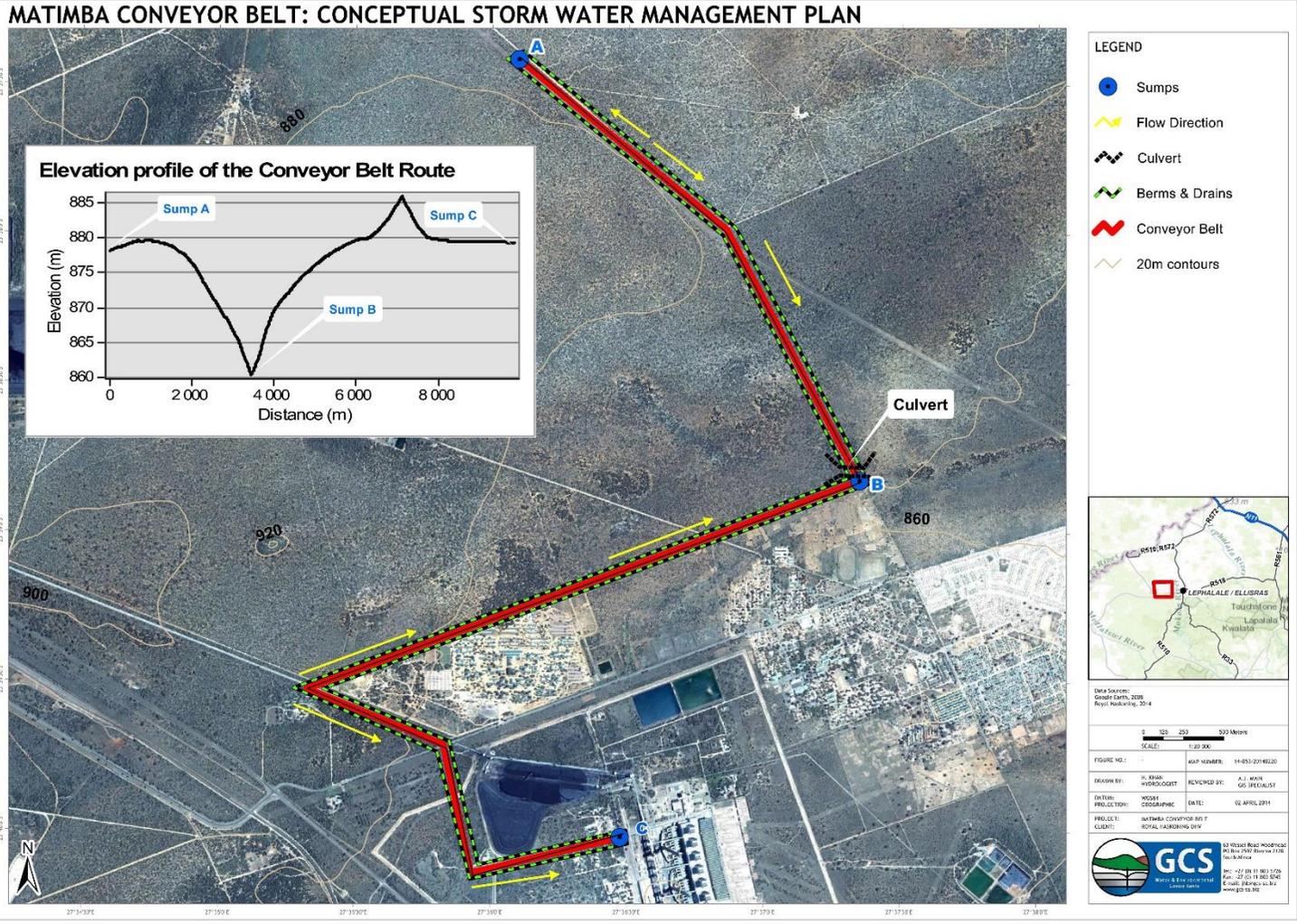


Figure 5: Conceptual stormwater management plan for the linear infrastructure route

Appendix C: Proposed Groundwater Monitoring Plan

Groundwater Management Plan

A Groundwater Management Plan is required to ensure that the ADF does not impact negatively on groundwater levels and quality to unacceptable levels. To ensure that the groundwater environment is protected, monitoring of water quality and levels is required on an on-going basis. The recommended monitoring includes groundwater level and groundwater quality monitoring as well as the visual inspection of the boreholes, as outlined below.

Both sites, namely, Alternative 1 and Alternative 2 have sufficient amounts of monitoring boreholes surrounding the site, located both upgradient and downgradient. It is imperative that these boreholes are monitored on a regular basis.

For Alternative 1, there are monitoring boreholes which are located on the footprint of the site. It is important that if Alternative 1 is selected as the site for the ADF that any borehole located on the site footprint is backfilled using a cement – bentonite slurry so as to prevent direct migration of potentially poor quality water into the aquifers.

The following boreholes are currently being monitored by GHT Consulting: P01, P03, P02, P31, P29, P23 and P20. Boreholes GHT 01 and GHT 02 are newly drilled boreholes by GHT Consulting. MA 01 and MA 02 are newly drilled boreholes by GCS. Borehole HP 01 is a production borehole used for garden irrigation & stock watering. All these boreholes should be included in the proposed monitoring plan for Site Alternative 1. Boreholes MA1 and HP01 can be monitored bi-annually whereas the remainder of boreholes should be monitored quarterly as indicated in Table 1.

Boreholes APV 02, APV 01, WB 31, MA 05, DHL 123, DHL 05, DHL 07, DHL 08, GPN 07, GPN 06, GPN 01, GPN 05, GPN 04, GPN 03, GPN 02 are all boreholes located around the Alternative 2 site. Boreholes APV02, GPN05 and MA05 which were included in this investigation should be monitored on a quarterly basis. Additionally, boreholes NGA090, GPN07 and DHL08 located at a further distance from the proposed site should be monitored on a quarterly basis as indicated in Table 2.

A large data set is currently in place for Alternative 1 as groundwater monitoring is already in place. Therefore all new data collected from the existing boreholes must be compared to the existing data to identify any trends in the groundwater levels and chemistry over time. Long-term groundwater monitoring at similar ash disposal facilities have indicated varying degrees of groundwater quality deterioration.

It is recommended that the following parameters must be recorded: pH, EC, Na, K, Ca, Mg, K, NH₄-N, Cl, SO₄, F, NO₃-N, N, PO₄, TDS, Total Alkalinity, bicarbonate, carbonate, Al, Mn, Fe, Zn, Pb, Cu, Cr, Cr (VI), B, Mo, Cd and Ni;

Typically groundwater monitored within boreholes adjacent to ash disposal facilities indicates a rise in the salt content of the groundwater due to seepage from surface sources and also because of the dissolution of salt from the previously unsaturated zones. The increase in salinity is, therefore, a combination of artificial recharge from poor quality (saline) surface water sources and the mobilisation of salts in the exposed zones in the boreholes.

The rate of salts leaching into the subsurface depends on the ADF (wet versus dry), liners, soil /geology and depth to water level. Typically very slow migration of salts and metals are expected if the site is well selected and managed.

Water levels are in general expected to rise due to the availability of water on the site and increase in recharge from both the clean water and dirty water systems. This will cause a flow gradient away from the site, even in slight upgradient direction of groundwater flow.

If the monitoring data indicates the need for corrective action, the magnitude of the impact must be assessed by an appropriately qualified and experienced specialist and the necessary measures put forward based on the magnitude of the impact.

Table 1: Monitoring schedule for alternative 1

Borehole ID	Co-ordinates, WGS 84 Geographic		Frequency of Monitoring	Current Borehole Use
	S	E		
MA1	-23.71	27.58282	Bi-annual	GCS Monitoring borehole
MA2	-23.7305	27.58542	Quarterly	GCS Monitoring borehole
HP 01	-23.6854	27.60393	Bi-annual	Production borehole
P01	-23.7012	27.6190	Quarterly	GHT Monitoring
P03	-23.6972	27.61782	Quarterly	GHT Monitoring
P31	-23.7236	27.60577	Quarterly	GHT Monitoring borehole
P29	-23.7204	27.61705	Quarterly	GHT Monitoring borehole
P23	-23.7143	27.6216	Quarterly	GHT Monitoring borehole
P20	-23.6973	27.62408	Quarterly	GHT Monitoring borehole

Table 2: Monitoring schedule for alternative 2 and linear infrastructure route

Borehole ID	Co-ordinates, WGS 84 Geographic		Frequency of Monitoring	Current Borehole Use
	S	E		
APV02	-23.6257	27.58165	Bi-annual	Production borehole
GPN05	-23.597	27.63763	Quarterly	Production borehole
MA05	-23.6157	27.63042	Bi-annual	Production borehole
NGA090	-23.6166	27.56757	Quarterly	Production borehole

Borehole ID	Co-ordinates, WGS 84 Geographic		Frequency of Monitoring	Current Borehole Use
	S	E		
GPN07	-23.5851	27.60082	Quarterly	Production borehole
DHL08	-23.6265	27.61908	Quarterly	Production borehole

Appendix D: Conceptual Operational Plan



CONCEPT OPERATIONAL PLAN FOR:

**ENVIRONMENTAL IMPACT ASSESSMENT AND WASTE
MANAGEMENT LICENSE APPLICATION FOR THE
PROPOSED ASH DISPOSAL FACILITY FOR THE
MATIMBA POWER STATION, LEPHALALE, LIMPOPO
PROVINCE**

FINAL

APRIL 2015

Prepared by:

Jeffares & Green (Pty) Ltd
P.O. Box 38561
PINELANDS
7405

Contact Person: Mr Richard Emery

Tel: 021 532 0940
Fax: 021 532 0950
Email: emeryr@jgi.co.za
www.jgi.co.za

Prepared for:

Royal HaskoningDHV
P.O. Box 25302
MONUMENT PARK
0105

Contact Person: Mrs Prashika Reddy

Tel: 012 367 5800
Email: prashika.reddy@rhdhv.com
www.rhdhv.co.za

VERIFICATION PAGE

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CARRIED OUT BY : Jeffares & Green (Pty) Ltd. Cape Town PO Box 38561 PINELANDS 7430 Tel (021) 532-0940 Fax (021) 532-0950 Email: emeryr@jgi.co.za			COMMISSIONED BY : Royal Haskoning DHV PO Box 25302 Monument Park Tel : 021 863 2810 Email: Prashika.Reddy@rhdhv.com	
AUTHOR : Lloyd Wallace, Richard Emery			CLIENT CONTACT PERSONS : Prashika Reddy	
SYNOPSIS : This report covers the basic duties and responsibilities (concept level) for the routine day-to-day operation of the proposed ash disposal facility at the Matimba Power Station ash disposal facility.				
KEY WORDS : Geotechnical, Thermal, Temperature, Monitoring, Matimba, Ash Landfill, Licensing, Waste, Ash Waste, Operational Plan				
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QUALITY VERIFICATION				
This report has been prepared under the controls established by a quality management system that meets the requirements of ISO9001: 2008 which has been independently certified by DEKRA Certification under certificate number 90906882				
Verification	Capacity	Name	Signature	Date
By Author	Design Engineer	L Wallace		14/04/2015
Checked by	Discipline Head	R Emery		14/04/2015
Authorised by	Discipline Head	R Emery		14/04/2015

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1. SCOPE OF THE REPORT

This report covers the basic duties and responsibilities (concept level) for the routine day-to-day operation of the proposed ash disposal facility for the Matimba Power Station.

This report was compiled in April 2015, using information supplied from Eskom, *via* Royal Haskoning DHV (RHDHV).

This report is to be read in conjunction with the Technical Engineering Design Report (Jeffares & Green, April 2015) compiled in preparation for the Waste Management License Application by RHDHV.

All recommendations and proposals are made and are in accordance with the following Legislation, Standards and Guidelines:

- The National Environmental Management Waste Act (NEMWA- Act 59 of 2008).
- National Waste Information Regulations (GNR 625, 2012)
- Notice 634 of 2013 Waste Classification and Management Regulations
- Notice 635 of 2013 National Norms and Standards for the Assessment of Waste for Landfill Disposal
- Notice 636 of 2013 National Norms and Standards for Disposal of Waste to Landfill
- Minimum Requirements for Waste Disposal by Landfill: Second Edition 1998: Department of Water Affairs and Forestry (Trilogy of documents);
- National Water Act (Act 36 of 1998) relates to the pollution of a water source.
- The National Environmental Management: Air Quality Act (No. 39 of 2004).
- National Environmental Management: Air Quality Amendment Act (Act No. 20 of 2014)

2. OPERATIONAL REQUIREMENTS

2.1 General

As a minimum the proposed ash disposal facility (ADF) must be operated in accordance with recognised sanitary land filling practices. Daily covering of waste, drainage control, control of nuisances and fires, and security at the landfill form the basis of these requirements, as specified hereafter.

The “Waste Generator¹” and the “Waste Manager²” are noted as Eskom in both cases.

2.2 Staffing

A Supervisor / Manager (“Waste Management Officer” as per the Waste Act, 2008) employed by Eskom shall monitor activities by routine daily visits to the proposed ADF, and shall take over all responsibility for the management of the facility.

A Day-time and Night-time Access Control Officer³ (ACO) shall be appointed and the duties of this officer will include the monitoring and record keeping of persons and vehicles entering the site, the type and quantity of waste received (by tonnage) for accounting purposes, directing incoming waste to the appropriate area of deposit on the proposed ADF.

The ACO shall also be responsible for the submission of information to South African Waste Information System (SAWIS), as prescribed.

2.3 Staffing requirement

All staff employed on site shall be suitably qualified and trained to perform their duties in operating the ADF in the manner and to the requirements as specified. Suitable backup procedures shall be put in place to maintain the full complement of staff on site.

It is not a requirement that the Supervisor be stationed on site full time, but he shall visit the site at least once daily during the operation of the site, and the day-to-day running of the site shall be assigned to a competent and responsible full time Foreman on site. The Foreman and ACO may be the same person.

In addition, a minimum of one labourer will be required full time to ensure that the site is maintained in a clean and sanitary condition. He shall be responsible for ensuring that dust suppression measures are correctly undertaken, repairing any damage due to erosion around and on the site and keeping drainage channels clear of debris.

2.4 Site facilities required

Eskom will be responsible for providing adequate facilities for use by their staff. Essentially these comprise of ablution facilities, a facility to assess the incoming waste, and emergency mitigation infrastructure due to the nature of the waste to be disposed.

¹ "waste generator" means any person whose actions, production processes or activities, including waste management activities, results in the generation of waste;

² "waste manager" means any person who re-uses, recycles, recovers, treats or disposes of waste;

³ The site is operated for 24 hours continuously and thus requires shift work and day-time and night-time ACOs.

2.5 Plant and Equipment

Critical Plant that will be required includes:

- Trucks for transporting the waste (where necessary) and cover material,
- A water bowser or water cannon (or the like) for dust suppression, as necessary,
- Front end loaders, for loading the haul trucks and to move the waste on the site.
- Spray irrigation at the working face.
- A conveyor system will be used to transport the ash-waste material from the power station to the disposal site. Eskom are to have a back-up system should mechanical failure (or other issue that ceases operation) of the conveyor occur. This is a critical component of the works due to the large volumes being generated on a continuous basis. This plan should be a living document with copies readily available.

The Site is to have a repair ledger to keep record of any failures to any critical plant or equipment. This is to be kept on site at all times.

The plant and equipment shall be maintained in good working order so as to eliminate nuisances such as noise, air and dust pollution.

2.6 Health and Safety

In terms of the Occupational Health and Safety Act (Act No 85 of 1993) and the Construction Regulations (2014) Eskom is responsible for the health and safety of all personnel and visitors on site, and compliance with these regulations will need to be enforced.

All workmen and operators shall be provided with protective clothing while working on the site. Overalls, gumboots and high-visibility vests shall be worn at all times. These items shall be washed and disinfected on a daily basis at the end of each shift. Masks and gloves shall also be provided as and when required, and similarly washed and disinfected or disposed of after use.

A suitably stocked first aid kit shall be kept in a prominent place on Site. All staff must be aware of its location, and shall have full access to it at all times. Perishable items or items with expiry dates shall be replaced on a regular basis as may be required.

A responsible person shall be appointed for the maintenance of equipment and the education of workers in respect of all health and safety aspects on site. This extends to plant (machinery) to be used.

2.7 Security

A boundary fence around the proposed ADF is necessary. A nominated staff member shall be made responsible for security on the site, and the following aspects shall form the basis of the security arrangements:

- Only authorized personnel will be allowed on the Site whilst executing their duties.
- No vagrants, informal salvagers or animals shall be allowed on the site.

2.8 Weather monitoring

The ACO will be responsible for recording the following prevailing weather conditions for each day of the week:

- Minimum/maximum temperature
- Wind speed and direction
- Rainfall
- Evaporation
- Volume/ recording of airbourne dust/ particles

Readings shall be obtained every Monday (or as deemed suitable) from the nearest weather station recording such information, or from instrumentation to be supplied and erected on site by the waste managers.

2.9 Fire control

No open fires for whatever reason will be permitted on the site, and all personnel shall be instructed to adhere to this stipulation.

A fire action programme shall be put in place (should an existing programme not be in position). It shall include appropriate training of all personnel as to fire drills in case of fire, basic fire fighting skills, and an emergency call procedure to summon the nearest Fire Department. A list of emergency phone numbers shall be placed in a prominent position and all staff informed thereof, including the location of the nearest phone.

3. ROUTINE OPERATION

3.1 Times of Operation

The Site shall be operated 24 hours per day continuously, or as agreed by the Waste Management Officer.

3.2 Site access

Specific access onto the proposed ADF will be provided through a 5m wide gravel access road that will be constructed around the perimeter (and within the boundaries) of the proposed ADF.

Should site alternative 2 be developed, the location where the gravel access road ties into the existing road network is to be confirmed with Eskom, prior to construction.

The access road will be maintained, as far as periodical grading and shaping is concerned, by the waste generators who will also be responsible for spraying the road with water as and when required to control any potential dust nuisance.

Provision and maintenance of access roads within the boundaries of the proposed ADF shall be the sole responsibility of the Waste Management Officer (Site Supervisor), who shall ensure that all plant and equipment have full access to the work-face under all weather conditions.

3.3 Access control

The existing Matimba ADF is a live industrial facility with strict access control procedures in place. Access to the proposed ADF should be included in the access control procedures already in place.

The ACO will be responsible for the administration of a log book recording entry onto site for accounting purposes. The ACO will be responsible to keep a fully detailed record as specified, and to ensure that only legitimate entry takes place onto the site.

Should Site Alternative 2 be developed, access control procedures will need to be put in place similar to that which is currently in practice at the existing ADF.

3.4 Classification of waste

The proposed ADF is being designed to be in accordance with Class C basal liner requirements as described in the Waste Classification and Management Regulations (WCMR (GNR 635 of 2013, Waste Disposal to Landfill)). See Waste Classification Report by Jeffares and Green (2013). The ash waste is classified as a Type 3 waste.

3.5 Waste handling

The Client is in favour of using a conveyor stacker/spreader system (using a combination of radial and parallel shifting stacker/spreading system) to transport and dispose of the waste on-site, as per the

Final side slopes shall not be steeper than 1V in 3H (Eskom is in favour of a final finished side slope of 1V in 5H), and the upper surface (final cap-dome) of the landfill shall be shaped to fall at 1V in 50H minimum so that surface drainage is adequate and no ponding occurs.

The final finished height of the proposed ADF has been estimated at:

- Site Alternative 1: 90m above the highest NGL.
- Site Alternative 2: 84m above the highest NGL.

The final slope profile will be finished such that a 5m wide terrace will be provided every 10m of vertical height gained. The terrace will have a slope of 1V:25H away from the landfill face at closure. Should progressive closure take place, then these terraces may need to be sloped towards the landfill face to control contaminated stormwater runoff versus clean stormwater runoff.

3.6 Daily Cover material

It is assumed that dust suppression measures will negate the requirement for daily cover. Should daily cover be required, it may be possible to obtain cover from the Power Station facility (Slag) or in-situ soil (currently the Operators of the site excavate ahead of the waste pile (where new cells are earmarked for development) and use this soil material for cover.) Once this source of material is depleted (which will likely be towards the end of the life of the Disposal Facility, then material will need to be imported from outside the Disposal Facility.

Should daily cover material be required, material shall be spread to a minimum of 100mm thickness where necessary to completely cover the processed waste. Cover material shall also be applied during the course of the day's operations if the weather conditions (e.g. strong wind) demand it.

3.7 Compaction of waste

In-situ ash waste at the existing ADF was shown to dry to approximately optimum moisture content and exhibited a good amount of compaction without post placement manipulation efforts. As such, post placement compaction of the ash waste is not essential.

3.8 Embankment protection

It is recommended that cover material be placed on side slopes (after the final waste filling has been undertaken to achieve a slope of 1V:3H or flatter) as the waste pile extends vertically, thereby achieving progressive capping. Side slopes which will form the ultimate extreme of the landfill shall be covered with an additional 150mm layer of cover material, to a total compacted thickness of 300mm.

Erosion of slopes shall be repaired as soon as practicably possible after they have occurred.

3.9 Leachate Monitoring

The leachate collected in the collection layer of the basal lining system (which is expected to be minimal) will be directed toward a leachate collection manhole and will subsequently be diluted with contaminated stormwater runoff to an acceptable level for recirculation back onto the proposed ADF.

The Supervisor must monitor the level of the leachate in the leachate collection manholes.

The Supervisor shall monitor for any possible leachate collected from the leak detection layer.

The feasibility of installing flow meters to both the leachate collection and detection outfalls shall be investigated at detail design phase.

3.10 Pollution control

The Supervisor will be responsible for keeping the contaminated stormwater diversion channels free of litter, sediment and excessive growth. Growth shall be kept to a maximum of 300mm height, and channels shall be maintained in a free-flowing condition to provide adequate runoff.

Regular inspections of the Pollution Control Dam (PCD) liners shall be undertaken; in particular an inspection of the edge of the liners shall be made to ensure that there are no areas where the liner has come loose and where wind and water can flow under the geosynthetic liner and cause lifting.

Unsurfaced access roads and uncovered areas prone to producing dust shall be watered as necessary to prevent any dust nuisance.

3.11 Stormwater Infrastructure and Pollution Control Dams

All stormwater pipes are to be maintained and kept free of blockages.

Contaminated stormwater shall be directed to the Pollution Control Dams (PCDs). Routine maintenance shall be carried out on the PCDs. Levels of contaminated stormwater shall be balanced between the various PCDs to optimise evaporation versus demand for dust suppression. The contents of each PCD are to be routinely emptied into adjacent PCDs to allow for the removal of silt that has accumulated due to settlement.

A minimum freeboard of 0.5m is to be maintained at all times within the PCDs.

The chemical composition of the contaminated stormwater is to be analysed to determine its suitability for recirculation back onto the waste pile for dust suppression. Should the contaminated stormwater be found to be unsuitable for recirculation, it could be treated (on-site) to a suitable level for dust suppression irrigation or disposed or transported to an existing wastewater facility.

Care must be taken when pumping from the PCDs to ensure that spillages do not occur, or damage to the PCD liner.

In line with best management practices (BMP) it is favourable that, during dry weather periods, stored contaminated stormwater or leachate be irrigated over the landfill wastepile to be lost through evaporation, transpiration or seepage into the wastepile itself. Adequate site management and safety precautions are required to prevent direct human contact with raw leachate. The suitability of the leachate generated for recirculation would also need to be confirmed.

It is critical that the ash pile is not over-watered above Optimum Moisture Content (OMC) and thus cause instability of the waste ash pile.

3.12 Dust Suppression

Dust suppression is a vital component of the operational controls that need to be established. Dust suppression will be carried out by way of irrigating the waste body and watering the access road, as required, to ensure that particulate dust from the disposed waste does not become airborne.

The Supervisor must ensure adequate dust suppression on a daily basis, as required.

Contaminated stormwater is to be directed to a PCD where there is a possibility of irrigating the waste pile for dust suppression, thus negating the need to use clean, potable/surface water for dust suppression (the suitability of the leachate collected for dust suppression will need to be managed on site by the Supervisor / Manager).

On-going dust suppression measures during rainfall and high wind conditions shall be an operational control that will require on-site management and will be the responsibility of the Supervisor / Manager.

3.13 Pest control

Pest control is assumed not to be an issue due to the fact that the expected waste to be disposed should contain limited, if any, organic wastes.

3.14 Record keeping

Records shall be kept of all site conditions, waste material brought to site, activities and functions performed in dealing with the operation of the site.

The quantity of waste disposed will be measured by conducting of regular topographical surveys of the landfill to monitor the available airspace/lifespan of the waste disposal facility.

The ACO will be required to report to SAWIS on disposal volumes, characteristics, etc, as necessary and as legislation prescribes.

The following items shall be diarised during the course of each working day:

RECORDS TO BE KEPT BY THE ACO:

- a) Heading
 - i) Site name
 - ii) Day and date

- b) Any visitors to the disposal site area
 - i) Time of day
 - ii) Person's name
 - iii) Company represented
 - iv) Vehicle registration
 - v) Telephone number
 - vi) Time in
 - vii) Time out

- c) Weather conditions (from nearest local weather station or instruments installed on site)
 - i) Temperature
 - ii) Rainfall
 - iii) Wind speed and direction
 - iv) Evaporation
 - v) Dust/ airbourne contaminant

- d) Monitoring of tasks
 - i) Supervisor to meet with site staff and agree daily tasks
 - ii) Task register to be signed by all parties

- e) Miscellaneous items
 - i) Leachate collection manhole levels
 - ii) Leachate detection manhole levels
 - iii) PCD levels
 - iv) Condition of road sign posts and notice boards
 - v) Incidents and time of occurrence.

3.15 Legal documents

Eskom shall keep on site a copy of the Waste Management Licence for the ADF, referenced documents, and daily operation files.

3.16 Internal and external audits

Eskom are to continue with internal and external compliance audits, as required under the Waste Management Licence for the ADF.

3.17 Monitoring

The monitoring of groundwater and any gas monitoring boreholes is a requirement of the Minimum Requirements for Waste Disposal by Landfill: Second Edition 1998 for a G:L:B+ landfill facility.

Boreholes are to be maintained in a serviceable condition for use by the external monitoring contractors as agreed with by the waste manager.

The contaminated stormwater contained within the PCDs and leachate within the leachate collection manhole shall be routinely monitored to determine its suitability for recirculation back over the waste pile.

Eskom to continue with public monitoring committee meetings, as required under the Licence for the ADF.

Appendix E: Sludge Beneficial Use Assessment

REPORT FOR:

**BENEFICIAL USE ASSESSEMENT
MATIMBA WASTEWATER
TREATMENT WORKS SEWAGE
SLUDGE, LEPHALALE.**

Final Revision 003

Prepared by:

Jeffares & Green (Pty) Ltd

P.O. Box 38561
PINELANDS
7405

Contact Person: Mr Richard Emery

Tel: 021 532 0940
Fax: 021 532 0950
Email: emeryr@jgi.co.za

Prepared for:

SSI Engineers and Environmental Consultants (Pty) Ltd
t/a Royal HaskoningDHV

P.O. Box 867
GALLO MANOR
2052

Contact Person: Mrs/Ms Prashika Reddy

Tel: 012 367 5800
Email: prashika.reddy@rhdhv.com
www.rhdhv.co.za

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1. INTRODUCTION

Jeffares & Green (Pty) Ltd were appointed by RHDHV to assess the beneficial utilisation of wastewater sludge generated by Matimba Wastewater Treatment Works (WWTW). The Matimba WWTW services the Eskom Matimba Power Station, Limpopo and is located south east of the station (Figure 1).

Wastewater sludge is reportedly generated and stored in skips for a period of three months. Estimated average monthly volume generated is 11m³ per month. The wastewater process is not known. Sludge is then dried and disposed at Holfontein landfill some 350km to the south of Johannesburg.

Based on the volume of sludge produced, distance and cost of landfilling alternative options are being considered by the Matimba management. One option being assessed is the use of the sludge as a soil ameliorant for rehabilitation of the ash dump.

This revision of the report looks at the feasibility of beneficial use of the sludge as a soil ameliorant in rehabilitation by using the **Guidelines for the utilisation and disposal of wastewater sludge** series of documents published by the former Department of Water Affairs and Forestry (DWAF).

This report represents the second revision of the report as a result of clarity on the re-use options under consideration. The beneficial use is described as being utilised in rehabilitation of the ash disposal facility. The dried sludge is to be used applied to soils following capping of the ash disposal facility to ameliorate topsoils and enhance vegetation growth.

This assessment looks at the suitability of this application in accordance with the aforementioned guidelines and does not talk to physical aspects such as soil structure, moisture content and nutrient status.

Information to date is inconclusive as to the application rates and so definition in terms of beneficial use is considered to be application at agronomic rates or a once off high rate application. See section 5. Surface water is routed to pollution control dams and the site has restricted public access.

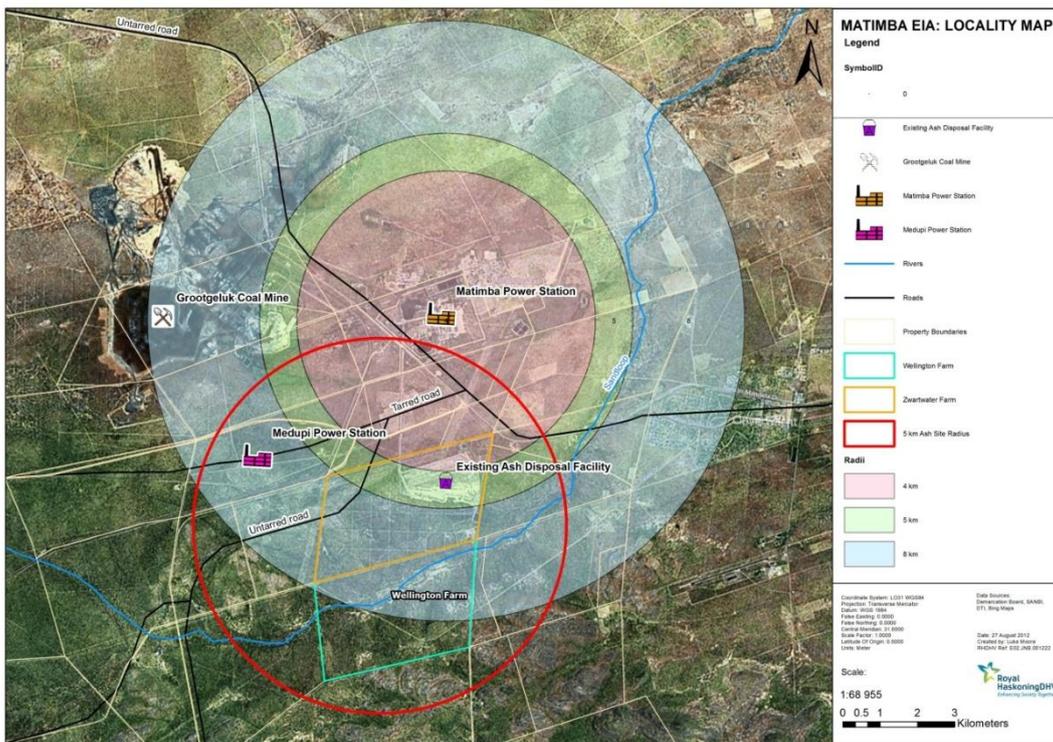


Figure 1-1 - Locality of the Matimba WWTW, Lephalale

2. METHODOLOGY

The methodology of the assessment follows that described by the **Guidelines for the utilisation and disposal of wastewater sludge** series of documents published by the former Department of Water Affairs and Forestry (DWAF). The documents define the options and framework for selecting the management options of wastewater sludge.

The methodology comprises:

- Sludge characterisation;
- Preliminary sludge classification; and
- Selection of Appropriate management options.

2.1 Utilisation Assessment

2.1.1 Sludge Characterisation

Sludge characterisation is the key step in determining appropriate management options for the wastewater sludge. Sludge is characterised by assessing microbiological parameters, physical and stability indicators and chemical characteristics.

Three samples of sewage sludge were collected by site personnel¹ and submitted to Waterlab (Pty) Ltd on the 24.01.2014. The samples were subjected to the classification of sludge in accordance to the Guidelines. The suite of analysis comprises:

- Aqua regia digestion and metal analysis;
- Detection, enumeration and determination of Helminth and Ascaris ova²
- Polycyclic Aromatic Hydrocarbons (PAH);
- Nutrients (Total Kjeldahl Nitrogen (TKN), Total Phosphorous (TP) and potassium (K)); and
- Physicochemical factors.

2.1.2 Sludge Classification

The sludge is classified by assigning a class for each of the microbiological, stability and pollutant characters as outlined in *Figure 2-1*.

¹ Sampling protocols were not observed by Jeffares & Green scientists and cannot be commented on.

² Guidelines for the Utilisation and Disposal of Wastewater Sludge: Volume 1 (as adapted from EPA/625/R-92/013)

Microbiological class	A	B	C
Stability class	1	2	3
Pollutant class	a	b	c

Figure 2-1: Preliminary classification of wastewater sludge

2.1.3 Management Option Selection

The final process in selection of a beneficial utilisation is to determine the appropriate management option based on the preliminary classification. Management options listed in the guidelines include:

- Agricultural use at agronomic rates;
- On-site or off-site disposal;
- Beneficial use (other than agricultural use at agronomic rates);
- Thermal treatment methods; and
- Product saleable products.

3. FINDINGS

3.1 Sludge Characterisation and Preliminary Classification

All analytical results are referred to Appendix A which contains copies of the Waterlab (Pty) Ltd certificates of analysis.

3.1.1 Microbial Characterisation

The microbial classification is assigned an **A** class (Table 3-1).

3.1.2 Stability and physical indicators

The sludge is characterised by neutral conditions with a high total solids content ranging from 91-95%. Volatile solids measured at 550 °C is 54-57% indicating further stabilisation could be achieved. Nitrogen and phosphorous ranges from 0.82-1.96% and 0.29-0.62% respectively. Potassium constitutes approximately 0.23%.

Assigning a stability class is typically done with intimate knowledge of the plant, however results indicate that dewatering to above 90% in all samples is achieved. Consequently the sludge is considered to be stable and assigned a class **1**.

3.1.3 Chemical Characterisation

No metal limits are exceeded for the average metal content of the sludge which allows for a class **a** pollutant classification. Benchmark values the sludge is classed as a Class **c** material (Table 3-2) due to barium content in the digestate. This indicates that the material is within the bottom 20% of sludges in the country and requires further investigation and monitoring for barium.

Polycyclic Aromatic hydrocarbons (PAH) analysis indicated no presence of organic contaminants.

3.1.4 Preliminary Classification

The sludge is consequently classified as a Class **A1a** sludge.

Table 3-1: Results of the microbial analysis of the Matimba WWTW sludge

Analysis CFU	Sample ID				Microbiological Class CFU / g			Classification
	28613	28614	28615	Average	A	B	C	
Total Viable Helminth Ova / 4g dry	0	0	0	0	<0.25	<1-4	>4	A
Faecal Coliform Bacteria / g dry	13586	22959	2688	13078	<1000	< 1x10 ⁶	> 1x10 ⁷	B

Table 3-2: Pollutant Class for the Matimba WWTW sludge

Parameter (mg/kg)	Sample ID				Metal Limits (mg/kg)			Classification
	28613	28614	28615	Average				
Arsenic	<4	<4	<4		<40	40-75	>75	a
Cadmium	<2	<2	<2		<40	40-85	>85	a
Chromium	75	73	78	75.33	<1200	1200-3000	>3000	a
Copper	180	214	223	205.67	<1500	1500-4300	>4300	a
Lead	28	23	27	26.00	<300	300-840	>840	a
Mercury	3.2	3.2	4	3.47	<15	15-55	>55	a
Nickel	30	30	25	28.33	<420	420	>420	a

Matimba WWTW Sewage Sludge
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Parameter (mg/kg)	Sample ID				Metal Limits (mg/kg)			Classification
Zinc	816	879	394	696.33	<2800	2800-7500	>7500	a
					BENCHMARK VALUES			
Antimony	<0.4	<0.4	<0.4		<1.1	1.1-7	>7	a
Boron	29	30	15	24.67	<23	23-72	>72	b
Barium	330	320	225	291.67	<108	108-250	>250	c
Beryllium	0.8	0.7	0.8	0.77	<0.8	0.8-7	>7	a
Cobalt	5.47	5.75	4.96	5.39	<5	5-38	>38	b
Manganese	320	269	152	247.00	<260	260-1225	>1225	a
Molybdenum	7.59	11	12	10.20	<4	4-12	>12	b
Selenium	4.82	6.04	4.42	5.09	<5	5-15	>15	b
Strontium	42	36	23	33.67	<84	84-205	>205	a
Thallium	<0.4	<0.4	<0.4		<0.03	0.03-0.14	>0.14	
Vanadium	22	27	23	24.00	<85	85-430	>430	a

4. APPROPRIATE MANAGEMENT OPTION ANALYSIS

The appropriate management options are defined by suitability of the assigned class to the use as per the *Figure 4-1*. The appropriate management options are considered to include:

- Agricultural use at agronomic rates
- On-site/off-site disposal
- Beneficial use (other than agricultural use at agronomic rates)
- Produce saleable product

Sludge Classification	Available management options for each sludge classification														
	Agricultural use at agronomic rates			On-site or off-site disposal			Beneficial use (other than agricultural use at agronomic rates)			Thermal treatment methods			Produce saleable products		
	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
A1a	i	i	i	iii	i	iv	i	ii	i	v	iii	i	i	i	i
A1b	i	i	ii	iii	i	iii	i	ii	iii	v	iii	ii	i	i	iii
A1c	i	i	v	iii	i	iii	i	ii	iv	v	iii	ii	i	i	iii
A2a	i	ii	i	iii	ii	iv	i	iii	i	v	ii	i	i	iv	i
A2b	i	ii	ii	iii	ii	iii	i	iii	iii	v	ii	ii	i	iv	iii
A2c	i	ii	v	iii	ii	iii	i	iii	iv	v	ii	ii	i	iv	iii
A3a	i	v	i	iii	iv	iv	i	iv	i	v	i	i	i	v	i
A3b	i	v	ii	iii	iv	iii	i	iv	iii	v	i	ii	i	v	iii
A3c	i	v	v	iii	iv	iii	i	iv	iv	v	i	ii	i	v	iii

Figure 4-1: Management options available for A1a classification

4.1 Agricultural use at agronomic rates

According to the Volume 2, **Requirements for the agricultural use of wastewater sludge**, the material is classified as an A1a sludge however benchmarking indicates that barium is a contaminant of concern. Sludges are valuable as a soil conditioner and fertiliser and there is a major benefit to its use in soils.

The sludge is relatively low in nutrients when compared to average South African sludges.

No restrictions are placed on this sludge to be utilised as an agricultural product however, the sludge requires additional analysis before the classification can be confirmed³.

4.2 On-site/off-site disposal

Since the publication of the guidelines, the regulations governing waste disposal has changed and the following regulations are now enforceable.

- A. Waste Classification and Management Regulations (WCMR – GN R 634 of 2013)
- B. National Norms and Standards for Assessment of Waste for Landfill Disposal (NSAW – GN R. 635 of 2012)

³ Volume 2: Requirements for the agricultural use of wastewater sludge requires 10 samples to be assessed rather than the three supplied for assessment.

- C. National Norms and Standards for Disposal of Waste to Landfill (NSDW – GN R. 636 of 2012)
- D. National Environmental Management Waste Act (NEMWA - Act 59 of 2008)

The former classification system was through the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Wastes (MRs - 2nd Ed. DWAF, 1998).

The analytical⁴ techniques utilised by the guidelines do not make it possible to assign a waste classification in terms of the new regulations or the Minimum Requirements. Furthermore, no delisting exercise can be completed and no liner requirements can be calculated.

4.3 Beneficial use

Beneficial use is described in Volume 4 of the guidelines as including once off high rate sludge application, continuous high rate applications and sludge as landfill cover material.

4.3.1 Once off high rate sludge application

This comprises rehabilitation of disturbed/degraded soils or the establishment of non-productive areas such as golf courses, race courses, embankments and parks.

The classification of A1a allows the material to be utilised as a product without restriction on public and private land.

4.3.2 Continuous high rate application

This application relates to a continuous application which sustains an area and includes applications in forestry, orchards, industrial crops and instant lawn cultivation, *inter alia*.

The classification of A1a allows the material to be utilised as a product without restriction on public and private land.

4.3.3 Sludge as landfill cover

This is essentially the co-disposal of sludge at a landfill as a daily cover and is a beneficial use in that it acts as a cover material and has a high capacity to adsorb water and mitigate odours.

This use cannot be ascertained due to the lack of leachable data.

4.4 Production of saleable product

Saleable products refer to the use of sludge in fertilisers (compost and pellets) and commercial products primarily in the construction industry (bricks, pumice, cement and aggregate).

4.4.1 Fertiliser applications

The A1a application allows for unrestricted use in saleable fertiliser products.

4.4.2 Construction product applications

The embodiment of sludge within construction materials, typically produced in thermal processes, renders microbiological hazards harmless whilst pollutants and typically oxidised to insoluble products. As a result no restrictions are placed on this material being utilised in this manner.

⁴ Aqua regia digestion is too aggressive and provides a total decomposition of the solids and is overly conservative.

5. USE OF SLUDGE IN REHABILITATION OF ASH DISPOSAL FACILITY

The intended use is for the sludge to be applied with topsoil in rehabilitation of the ash disposal facility. This implies that the ash disposal facility is capped and made impervious prior to application. It is proposed by Eskom to apply the sludge as a soil ameliorant providing organic matter and nutrients to augment the topsoil qualities and enhance vegetative growth. The Rehabilitation Plan does not specify the application technique however, beneficial use is then considered to be either agronomic application (Volume 2 of the Guidelines) or once off high application rates (Volume 5 of the Guidelines).

5.1 Agronomic Utilisation

This application will not involve consumer products or agriculture destined for human consumption. Hence the risk associated with application is limited to surface water and groundwater risks. The capping of the ash disposal facility prevents ingress to groundwater and thus no groundwater impacts are anticipated in rehabilitation. Surface water is routed to PCDs and thus risk to surface water is not considered to be manifest.

These factors will need to be accounted for in preparation of the soil/sludge application.

The sludge can be utilised without restriction however can only be applied at a maximum rate of 10t dry mass/hectare/year to fall into this beneficial use.

5.2 Once-off High Rate Application

The application for rehabilitation is considered to be a once off high rate application and thus Part 4 of Volume 5 of the Guidelines apply. The rehabilitation method, in order for this to apply, is the application of sludge to the same area at higher than agronomic rates three times or less in a five year period.

5.3 Restrictions for once off high rate application

5.3.1 Site Selection

The site must be selected such that a buffer is maintained from adjacent downwind settlements, isolated from sensitive surface water features and that the potential for erosion is avoided.

The placement of the sludge on top of the ash dump would like comply with these requirements.

5.3.2 Buffer Zones

Buffer zones from groundwater and surface water (200m) must be maintained. In this case, the capping and height of the ash disposal facility negates the groundwater risk. The surface water controls of the ash disposal facility result in the risk to surface water being low as discussed previously.

5.3.3 Topography

The slope of the land application site should be considered to minimise run-off, erosion and ponding. If vegetation is established on a steep slope the vegetation will minimize run-off and erosion and the slope consideration can be relaxed. Whilst ponding must be avoided, there is no apparent restriction in the intended use.

5.3.4 Soil properties

Understanding the soil properties to be mixed with the sludge is important to assess the mobility of metals, ability of the soil to attenuate the metals and prevent leaching.

No information on the topsoil is available, however the low risk to groundwater and surface water results in leaching and metal mobility becomes a superfluous issue.

It is recommended and good practice supports this that the topsoil properties be understood prior to rehabilitation.

5.3.5 Management Requirements

5.3.5.1 Odour Control

The application or mixture of the sludge with topsoil will must result in a 90% dry solids ratio. The sludge, based on information supplied is already dried to greater than a 90% dry mass basis and so complies with this requirement.

5.3.5.2 Soil quality

The total metal concentration of the soil on which the sludge is to be applied should be determined prior to high rate application. This determines the ability of the soil to attenuate the additional metal load without risk to groundwater and surface water. The land will not be used for agriculture and will have public access limited, the maximum permissible level of soil metals is applicable.

Whilst MPLs are not known at this stage, the need to understand this is not vital due to groundwater and surface water controls which are in place already.

5.3.5.3 Sludge rate application

The industrial and rehabilitation maximum application rate (MAR) of 120t dry sludge/ha/year is applicable in this case. The sludge application will be well below the MAR.

5.3.5.4 Transportation and storage

The Guidelines indicate that transport (Part 4 pg. 23) should be handled as if the material is hazardous due to potential infectious substances. The material will not leave the applicant's site and therefore the need for compliance must be applied with this in mind.

Storage must follow applicable legislation and policy requirements.

6. CONCLUSIONS

Based on the initial assessment the following conclusions are made with regards to the utilisation of sludge generated by Matimba WWTW:

1. The sludge is classed as an A1a.
2. Benchmark metals do exceed the listed benchmark for barium (class c) and result in the sludge being linked to a poor quality sludge with guideline recommendations for further assessment. That is when application to soils, barium must be considered with regards to the total soil concentrations and the exposure to public.
3. The appropriate management options include agricultural agronomic use, on-site/off-site disposal, beneficial use (other than agronomic applications) and production of saleable products.
4. No thermal treatment is allowed.
5. Based on reviews of the appropriate guidelines volumes, the material is largely unrestricted in beneficial utilisation however barium must be considered prior to application.

Matimba WWTW Sewage Sludge
Beneficial Use Assessment

6. The on-site/off-site disposal cannot be ascertained due to the need for realistic leachable data analysis.

Based on the application of the soils for beneficial use in rehabilitation, the following findings are made:

1. The application in a rehabilitation scenario – restricted public access, no agriculture and grazing, with surface water controls and capping of the ash dump to minimise water infiltration – indicates a low risk application.
2. Application at agronomic rates is unrestricted.
3. Application in rehabilitation is unrestricted
4. Jeffares & Green's view is the application of the sludge as a soil ameliorant in the rehabilitation of a capped facility is acceptable.

7. RECOMMENDATIONS

Additional seven samples to be analysed via *aqua regia* digestion for the eight trace metals and barium to confirm the classification as per the guideline requirements.

Additional sampling of sludge for leachable analysis as per the requirements of General Regulation 635 National Norms and Standards for the assessment of waste to landfill, in the event disposal be a preferred management option.

It is recommended that the sludge is not applied to the slopes of the site in order to minimise run-off entrainment into the surface water controls, but rather to the top surface of the facility.

Application of the sludge should be addressed in the Rehabilitation Plan indicating where the sludge will be placed, wet or dry application and the control measures which should be employed.

8. LIMITATIONS

The assessment is based on the accuracy of the Guidelines for Utilisation of Wastewater Sludge. The recommendation within the guidelines is for the technical data to be reviewed every 5-10 years.

Jeffares & Green is limited to the information made available which comprises of the analysis conducted by Waterlab (Pty) Ltd.

Jeffares & Green (Pty) Ltd is limited to with regards to sampling and assumes that samples were correctly recovered, handled and submitted to the laboratory timeously, in accordance with an acceptable sampling protocol.

The capping and rehabilitation programme is the responsibility of Eskom and it is assumed that the capping and rehabilitation will follow standard procedures. It is further assumed that the capped will be impermeable in nature and that the sludge is applied as a soil ameliorant to the topsoil portion of the ash dump.

9. REFERENCES

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APPENDIX A

ANALYTICAL RESULTS



WATERLAB (PTY) LTD

Building D, The Woods,
Pretorius Techno Park,
Meiring Naudé Road, Pretoria
P.O. Box 283, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za

**CERTIFICATE OF ANALYSES
WATER QUALITY PARAMETERS**

Date received: 2014-01-24	Report number: 43967	Date completed: 2014-02-26
Project number: 1000		Order number: ML143
Client name: Mpumamanzi Group		Contact person: Ms. W. Matoloayika
Address: P.O. Box 881 Witbank 1035		e-mail: wadza@mpumamanzi.com
Telephone: 013 246 2633	Facsimile: 013 246 2692	Mobile: 082 686 6206

Analyses in CFU / g	Sample Identification:			Microbiological Class CFU / g		
	Nelsonko p WWTW DB NO3 23/01/14	Matimba DB 2	Matimba Nelsonko p WWTW B114	A	B	C
Sample Number	28613	28614	28615			
Total Viable Helminth Ova / 4g dry	0	0	0	<0.25	<1 - 4	>4
Faecal Coliform Bacteria / 1g dry	13 586	22 959	2 688	<1000	<1 x 10 ⁶ – 1 x 10 ⁷	>1 x 10 ⁷

Analyses in mg/kg	Sample Identification:			Metal Limits for South African Wastewater Sludges Pollutant Class mg / kg		
	Nelsonko p WWTW DB NO3 23/01/14	Matimba DB 2	Matimba Nelsonko p WWTW B114	a	b	c
Sample Number	28613	28614	28615			
Arsenic as As	<4.00	<4.00	<4.00	<40	40 – 75	>75
Cadmium as Cd	<2.00	<2.00	<2.00	<40	40 – 85	>85
Chromium as Cr	75	73	78	<1200	1200 - 3000	>3000
Copper as Cu	180	214	223	<1500	1500 – 4300	>4300
Lead as Pb	28	23	27	<300	300 – 840	>840
Mercury as Hg	3.20	3.20	4.00	<15	15 – 55	>55
Nickel as Ni	30	30	25	<420	420	>420
Zinc as Zn	816	879	394	<2800	2800 - 7500	>7500
Sludge Classification	Microbial classification: B Stability Classification: Guidelines for the Utilisation and Disposal of Wastewater Sludge: Volume 1, p.24 Pollutant Classification: a					

As per the "Guidelines for the Utilisation and Disposal of Wastewater Sludge – Volume 1 of 5" – DWAF 2006

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WATERLAB (Pty) Ltd

Reg. No.: 1983/009165/07 V.A.T. No.: 4130107891
 Building D P.O. Box 283
 The Woods Persequor Park, 0020
 41 De Havilland Crescent Tel: +27 12 – 349 – 1066
 Persequor Techno Park Fax: +27 12 – 349 – 2064
 Meiring Naudé Drive e-mail: admin@waterlab.co.za
 Pretoria

**CERTIFICATE OF ANALYSES
ORGANIC ANALYSES PARAMETERS**

Date received: 2014-01-24	Report number: 43967	Date completed: 2014-02-26
Project number: 1000		Order number: ML143
Client name: Mpumamanzi Group		Contact person: W. Matoloayika
Address: PO Box 881, Witbank, 1035		e-mail: wadza@mpumamanzi.com
Telephone: 013 246 2633	Facsimile: 013 246 2692	Mobile: 082 686 6206

Organic Analyses: PAH [s]			
Analyses in ppm (Unless specified otherwise)	Sample Identification		
	Nelsonkop WWTW DB NO3 23/01/14	Matimba DB 2	Matimba Nelsonkop WWTW B114
Sample Number	28613	28614	28615
Naphthalene	< 0.001	< 0.001	< 0.001
2-Methyl naphthalene	< 0.001	< 0.001	< 0.001
1-Methyl naphthalene	< 0.001	< 0.001	< 0.001
Acenaphthylene	< 0.001	< 0.001	< 0.001
Acenaphthene	< 0.001	< 0.001	< 0.001
Flourene	< 0.001	< 0.001	< 0.001
Phenanthrene	< 0.001	< 0.001	< 0.001
Anthracene	< 0.001	< 0.001	< 0.001
Fluoranthene	< 0.001	< 0.001	< 0.001
Pyrene	< 0.001	< 0.001	< 0.001
Benzo(a)anthracene	< 0.001	< 0.001	< 0.001
Crysene	< 0.001	< 0.001	< 0.001
Benz(b)fluoranthene*	< 0.001	< 0.001	< 0.001
Benz(k)fluoranthene*	< 0.001	< 0.001	< 0.001
Benz(a)pyrene*	< 0.001	< 0.001	< 0.001
Benzo(g,h,i)perylene *	< 0.001	< 0.001	< 0.001
Dibenz[a,h]anthracene *	< 0.001	< 0.001	< 0.001
Indeno[123-cd]pyrene *	< 0.001	< 0.001	< 0.001

[s]= Results obtained from subcontracted laboratory

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WATERLAB

WATERLAB (PTY) LTD

Building D, The Woods,
Perseus Techno Park,
Mering Naudé Road, Pretoria
P.O. Box 283, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2064
Email: accounts@waterlab.co.za

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Telephone: 013 246 2633	Facsimile: 013 246 2692	Mobile: 082 686 6206

Analyses in mg/kg (unless otherwise specified)	Sample Identification:		
	Nelsonkop WWTW DB NO3 23/01/14	Matimba DB 2	Matimba Nelsonkop WWTW B114
Sample Number	28613	28614	28615
Paste pH	6.9	6.0	7.0
%Total Solids at 105°C	91	95	92
%Volatile Solids at 550°C	54	57	57
Kjeldahl Nitrogen (mg/ℓ)	8 180	9 360	19 600
Total Phosphate as P (mg/ℓ)	2 900	2 920	6 260
Aluminium as Al	16 800	14 800	17 600
Iron as Fe	14 400	14 000	15 600
Potassium as K	2 254	2 311	2 346
Silver as Ag	<10	<10	<10
Sodium as Na	<800	<800	<800
Poly Aromatic Hydrocarbons (PAH) [s]	See attached report 43967 PAH	See attached report 43967 PAH	See attached report 43967 PAH

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WATERLAB

WATERLAB (PTY) LTD

Building D, The Woods,
Perseus Techno Park,
Meiring Naudé Road, Pretoria
P.O. Box 263, 0020

Telephone: +2712 – 349 – 1066
Facsimile: +2712 – 349 – 2084
Email: accounts@waterlab.co.za

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Telephone: 013 246 2633	Facsimile: 013 246 2692	Mobile: 082 686 6206

Analyses in mg/kg	Sample Identification:			Benchmark Metal Values Pollutant Class mg / kg		
	Nelsonko p WWTW DB NO3 23/01/14	Matimba DB 2	Matimba Nelsonko p WWTW B114	a	b	c
Sample Number	28613	28614	28615			
Antimony as Sb	<0.400	<0.400	<0.400	<1.1	1.1-7	>7
Boron as B	29	30	15	<23	23-72	>72
Barium as Ba	330	320	225	<108	108-250	>250
Beryllium as Be	0.8	0.7	0.8	<0.8	0.8-7	>7
Cobalt as Co	5.47	5.75	4.96	<5	5-38	>38
Manganese as Mn	320	269	152	<260	260-1225	>1225
Molybdenum as Mo	7.59	11	12	<4	4-12	>12
Selenium as Se	4.82	6.04	4.42	<5	5-15	>15
Strontium as Sr	42	36	23	<84	84-205	>205
Thallium as Tl	<0.400	<0.400	<0.400	<0.03	0.03-0.14	>0.14
Vanadium as V	22	27	23	<85	85-430	>430
Sludge Classification	Pollutant Classification: 28613 – c 28614 – c 28615 – b					

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Matimba WWTW Sewage Sludge
Beneficial Use Assessment