





Prepared for:
Limpopo Economic Development Agency

Contact person:
Laurence Fenn

Tel: (071) 398 4411
Email: laurence.fenn@lieda.co.za

PROPOSED MUSINA-MAKHADO SPECIAL ECONOMIC ZONE

WASTE SPECIALIST STUDY

DRAFT REPORT
REVISION 00

AUGUST 2020

Prepared by:
Delta Built Environment Consultants (Pty) Ltd

Contact person:
Lise Steyn

Tel: (012) 368 1850
Fax: (012) 348 4738
Email: lise.steyn@deltabec.com

DOCUMENT CONTROL

TITLE:	WASTE SPECIALIST STUDY		
ELECTRONIC FILE LOCATION:	P17102_REPORTS_23_REV 00-Waste impact assessment report		
REPORT STATUS:	Draft		
REVISION NUMBER:	00		
CLIENT:	Limpopo Economic Development Agency Enterprise Development House Main Road Lebowakgomo 0737		
CONSULTANT:	Delta Built Environment Consultants (Pty) Ltd P.O. Box 35703 Menlo Park 0102		
DATE:	August 2020		
REFERENCE NUMBER:	P17102/R5906		
PREPARED BY:	Lise Steyn	Environmental Scientist	
REVIEWED BY:	Kobus Otto	Pr. Civil Engineer: External Waste Specialist	
APPROVED BY:	Piet de Wet	Pr. Civil Engineer	
DISTRIBUTION LIST:	**COMPANY**	**NAME & SURNAME**	
	LEDA	Laurence Fenn	

RECORD OF REVISIONS

REV. NO.	STATUS	DESCRIPTION OF REVISION	REV. DATE
00	Draft	Issued for comments	01/09/2020

EXECUTIVE SUMMARY

The Musina-Makhado Special Economic Zone (SEZ) is one of the ten SEZs announced by the Minister of Trade and Industry (DTI), in line with Act No. 16 of 2014: Special Economic Zone Act, 2014. Its proposed establishment is driven by the projected outlook for logistics and cross border transport as well as the potential downstream beneficiation of mineral resources endowed in Vhembe District and its neighbouring areas.

The Limpopo Economic Development Agency (LEDA) was established in terms of the Limpopo Development Corporation Act of 1995. It was established as a special purpose vehicle to promote sustainable economic growth and job creation through accelerated industrial diversification, increased levels of trade and investment, developing sustainable enterprises through the special economic zones.

Delta Built Environment Consultants (Delta BEC) has been appointed by the Limpopo Economic Development Agency (LEDA) to assist with the Environmental Impact Assessment (EIA) for the Musina-Makhado Southern (Bokmakierie) SEZ.

The purpose of this report is to inform the EIA application for land development, focusing on the trigger of land clearance of an area larger than 20 hectares, in a holistic way to identify the potential cumulative impacts from the overall development if approved. This report focuses on the impacts of waste generation and management within the Musina-Makhado SEZ.

The report includes:

- A high-level overview of the waste generation and management status quo in the Musina and Makhado Local Municipalities;
- Estimated waste generation and identified options for the management of the waste to be generated by the SEZ;
- Potential impacts of the waste to be generated in the SEZ and the management thereof; and
- High-level recommendations for mitigating the identified potential impacts.

Part of the Musina-Makhado SEZ is located within the Musina Local Municipality (MuLM) and another part within the Makhado Local Municipality (MaLM) in the Limpopo Province. Both Municipalities are in the Vhembe District Municipality.

The solid waste management status quo analysis thus focuses on the MuLM and MaLM, but mention is made of other developments in the area which may impact on an integrated waste management approach.

Within the Musina and Makhado Local Municipalities, there are two municipal landfill sites which accept general waste and garden refuse, including:

- Musina landfill; and
- Makhado landfill.

The status of each of the landfills is summarised in the following table.

LANDFILL SITE	STATUS	AIRSPACE REMAINING (m^3)	PLANS FOR FUTURE DEVELOPMENT
Musina landfill	Active	Unknown	Municipality applied for MIG funding to extend the cell which has been in use since April 2019.
Makhado landfill	Active	93%	18 cells to be developed in future.

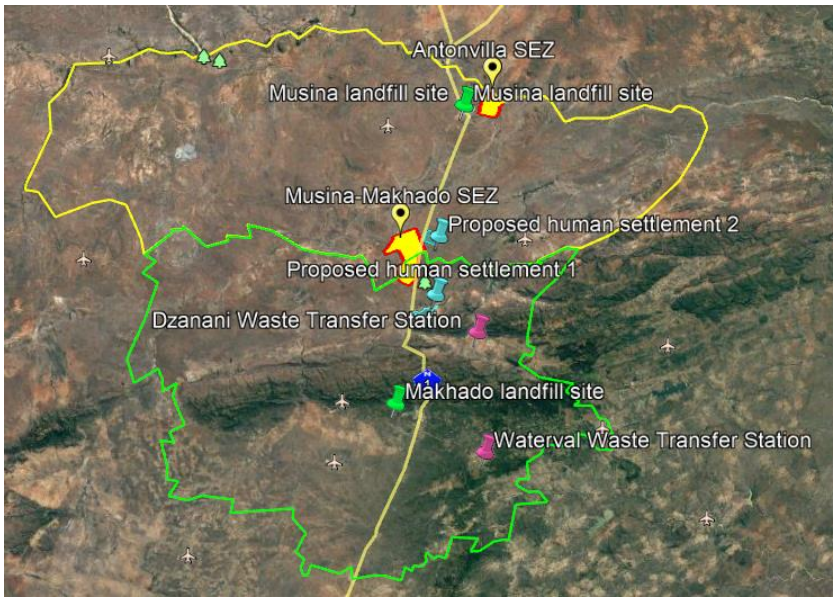
There are currently no transfer stations in the MuLM. There are two transfer stations in the MaLM:

- Dzanani Waste Transfer Station; and
- Waterval Waste Transfer Station.

There are no hazardous waste disposal sites in existence in Limpopo. The closest hazardous waste disposal site to the SEZ is the Class A (High Hazardous) Holfontein Waste Disposal Facility owned by Enviroserv Waste Management (Pty) Ltd in Gauteng. This facility is located approximately 450 kilometres from the Musina-Makhado SEZ.

As the environmental impact of waste generated by the proposed SEZ cannot be considered in isolation, it is important to take note of two other proposed developments in the area, including the ECO Industrial Estate at Musina, by a private developer, and the Antonvilla SEZ site in Musina.

The locations of the existing waste disposal and transfer facilities in relation to the Musina-Makhado SEZ and Antonvilla SEZ are shown in the following figure.



Typical waste types which will be generated during the construction phase of the development of the SEZ includes waste that will be generated by the accommodation camps, site offices and construction works (iX Engineers, 2019). During the operational phase, it is

envisaged that waste types will include waste generated by occupants of the SEZ and the following industries: logistics, metals, petrochemicals, building materials, food processing, tools and machinery, transportation and automotive and other (iX Engineers, 2019).

Average waste generation will range between approximately 72 721 to 86 590 tonnes per annum (iX Engineers, 2019).

In the Internal Master Plan for the SEZ, iX Engineers (2019) recommended that a centralised Waste Management Area (WMA) (for general waste and low volumes of hazardous waste) be developed, along with a hazardous waste management facility for the treatment/disposal of hazardous waste outside the SEZ complex. iX Engineers (2019) indicated that this could be complemented by disposal facilities established by the owners of the plants within the SEZ. They further stated that should negotiations for the expansion of the Musina landfill not be successful for the disposal of general waste, a new disposal facility for the disposal of general waste should be established in close vicinity to the SEZ complex.

The results of the high-level environmental impact assessment for the construction phase of the project are shown below.

ASPECT	IMPACTS	MITIGATION MEASURE	SIGNIFICANCE (NO MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Organic waste generation	Short-term increase in organic waste. Soil pollution (leachate). Groundwater pollution (leachate). Air pollution (smoke) if set alight.	On-site chipping of vegetation for removal to composting yards.	Moderately high	Low
General waste generation	Increased general waste generation due to construction workers. Soil pollution (leachate). Groundwater pollution (leachate). Odours.	Waste minimisation, reuse, recycling, and disposal of the remaining waste fraction in a Class B lined landfill.	High	Low
Construction waste generation	Increased construction waste generation.	Sorting builders' rubble on site and transporting it to a builders'	High	Low

	Compromised aesthetics. Windblown litter. Generation of dust.	rubble crushing facility. Using as fill material during rehabilitation of quarries.		

The results of the high-level environmental impact assessment for the operational phase of the project is shown below.

ASPECT	IMPACTS	MITIGATION MEASURE	SIGNIFICANCE (NO MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
General waste generation	Increased general waste generation due to construction workers. Soil pollution (leachate). Groundwater pollution (leachate). Odours.	Waste minimisation, reuse, recycling, and disposal of the remaining waste fraction in a Class B lined landfill.	High	Low
Hazardous waste generation	Increased hazardous waste generation from industries in the SEZ. Soil pollution (leachate). Groundwater pollution (leachate).	Waste minimisation. Use as feedstock for other processes. Treatment/disposal in Class A lined landfill (or Class B landfill – depending on waste classification and license conditions).	High	Low
General and hazardous waste facility operation	Soil pollution (leachate). Groundwater pollution (leachate). Dust. Odours. Breeding of flies and rodents.	Operation in line with facilities' waste management licenses, best practice standards and relevant legislation.	High	Low

	Air pollution (smoke) if set alight. Health risks associated with spreading of diseases and inhaling of hazardous fumes. Windblown litter. Aesthetics.			

The following must be taken into account when considering recommendations regarding the approach to be taken to ensure protection of the environment during development and operation of the SEZ:

- There are existing municipal waste disposal facilities within the two municipality areas within an acceptable transport distance with the potential to be upgraded to the legally required standards to accommodate waste from the SEZ and the associated human settlements.
- The potential volumes of industrial and hazardous waste to be generated by the SEZ are high. Currently there are no hazardous waste disposal facilities in the Limpopo province that would be able to accommodate the hazardous waste. The existing facilities that can accommodate hazardous waste are more than 400 km from the site. Due to the volumes involved, rail transport would most likely be the most viable option to transport the waste to the existing landfills in Gauteng – subject to the landfills being equipped with the required rail transfer station infrastructure. In addition to the financial implications, road and rail transport would greatly increase the carbon footprint of the SEZ.
- The SEZ Internal Masterplan compiled by iX Engineers (iX Engineers, 2019) identified a potential site for the development of an industrial and hazardous waste disposal facility in close proximity to the SEZ site. No detailed studies have been conducted to inform the selection of this site.
- The significance of the potential impacts on the environment, due to the generation and management of waste during the construction and operational phases of the SEZ, including the risk of pollution of groundwater, pollution of soil and negative impacts on air quality, is high.
- If waste generated within the SEZ is not managed appropriately, it could have major impacts on the environment, and more specifically socio-economic impacts related to human health, animal health and agriculture in general due to high reliance on groundwater in the area.
- Waste management is regulated by the National Environmental Management: Waste Act (Act 59 of 2008), as amended and all Regulations and norms and standards published in effect thereof as well as the National Waste Management Strategy (2011) which has been updated and is currently in draft (2019).

- The Integrated Waste Management Plans of the municipalities are outdated and must be updated, taking cognisance of the proposed industrial developments in the area, such as the Musina-Makhado SEZ, the Antonvilla SEZ and the ECO Industrial Estate.

Taking the above into account, the following high-level recommendations are made:

- The Integrated Waste Management Plans of the district and local municipalities must be updated, taking cognisance of the planned developments in the area, such as the Musina-Makhado SEZ, the Antonvilla SEZ and the ECO Industrial Estate.
- The potential for the reduction, re-use and recycling of waste exists and requires detailed feasibility studies to be undertaken to ensure that the potential benefits from such activities are technically feasible and financially feasible. Waste reduction, reuse, recycling or recovery must, as per the Waste Management Hierarchy adopted in the National Waste Management Strategy, be prioritised as part of the integrated waste management plans for the district and local municipalities and in particular for the SEZ.
- The need for the upgrade and/or expansion of the existing municipal general waste disposal facilities must be investigated further by means of a feasibility study.
- The most environmentally sound and financially viable way in which to deal with hazardous waste generated in the SEZ and the need for the development of a hazardous waste disposal facility in close proximity must be investigated further by means of a feasibility study. This feasibility study should include a proper investigation in terms of the siting of such a facility, in compliance with legislative requirements, should that be the most feasible option.
- The planning of waste management facilities for the SEZ must comply with the applicable policy and legislative framework that may require the licencing of waste activities. This entails detailed feasibility studies regarding the site and the assessment of alternative sites. It also entails undertaking an environmental impact assessment process as environmental authorisation is required, should a listed activity be triggered.
- The environmental impacts of the waste disposal facilities, should that be the preferred option, must be mitigated by compliance to the Waste Classification and Management Regulations (R.634) and the associated norms and standards, National norms and standards for the assessment of waste for landfill disposal (R.635), and National norms and standards for disposal of waste to landfill (R.636). Such facilities must also be operated in compliance with the Minimum Requirements for Waste Disposal by Landfill, 2nd edition (DWAF, 1998).

TABLE OF CONTENTS

LIST OF FIGURES

LIST OF TABLES

1 INTRODUCTION

1.1 BACKGROUND

The Musina-Makhado Special Economic Zone (SEZ) is one of the ten SEZs announced by the Minister of Trade and Industry (DTI), in line with Act No. 16 of 2014: Special Economic Zone Act, 2014. Its proposed establishment is driven by the projected outlook for logistics and cross border transport as well as the potential downstream beneficiation of mineral resources endowed in Vhembe District and its neighbouring areas.

The Limpopo Economic Development Agency (LEDA) was established in terms of the Limpopo Development Corporation Act of 1995. It was established as a special purpose vehicle to promote sustainable economic growth and job creation through accelerated industrial diversification, increased levels of trade and investment, developing sustainable enterprises through the special economic zones.

Delta Built Environment Consultants (Delta BEC) has been appointed by the Limpopo Economic Development Agency (LEDA) to assist with the Environmental Impact Assessment (EIA) for the Musina-Makhado southern (Bokmakierie) SEZ.

1.2 PURPOSE OF REPORT

The purpose of this report is to inform the EIA application for land development, focusing on the trigger of land clearance of an area larger than 20 hectares, in a holistic way to identify the potential cumulative impacts from the overall development if approved. This report focuses on the impacts of waste generation and management within the Musina-Makhado SEZ.

The report includes:

- A high-level overview of the waste generation and management status quo in the Musina and Makhado Local Municipalities;
- Estimated waste generation and identified options for the management of the waste to be generated by the SEZ;
- Potential impacts of the waste to be generated in the SEZ and the management thereof; and
- High-level recommendations for the identified potential impacts.

1.3 STRUCTURE OF REPORT

The report comprises the following sections:

- Section 2: Status quo;
- Section 3: Estimated waste generation and identified options for the management of the waste to be generated by the proposed Musina-Makhado SEZ;
- Section 4: Impact assessment and mitigation measures;

- Section 5: Recommendations and conclusion;
- Section 6: References;
- Appendix A.

2 STATUS QUO

The status quo is discussed under the following headings:

- Roles and responsibilities;
- Musina Local Municipality;
- Makhado Local Municipality;
- Summary of status quo; and
- Other developments in the area.

Part of the Musina-Makhado SEZ is located within the Musina Local Municipality (MuLM) and another part within the Makhado Local Municipality (MaLM) in the Limpopo Province. Both Municipalities are in the Vhembe District Municipality.

The solid waste management status quo analysis below thus focuses on the MuLM and MaLM, but mention is made of other developments in the area which may impact on an integrated waste management approach.

2.1 ROLES AND RESPONSIBILITIES

In terms of the Constitution, district municipalities have the following powers and responsibilities in terms of refuse removal, refuse disposal facilities and solid waste disposal:

- The determination of a waste disposal strategy;
- The regulation of waste disposal; and
- The establishment, operation and control of waste disposal sites, bulk waste transfer facilities and waste disposal facilities for more than one local municipality in the district.

Local municipalities have the following powers and responsibilities:

- The establishment, operation, management, control and regulation of solid waste disposal sites that serve the area.

2.2 MUSINA LOCAL MUNICIPALITY

2.2.1 POLICY DOCUMENTS

According to the 2018/2019 Final Draft Integrated Development Plan of the Musina Local Municipality (MuLM), the latest Integrated Waste Management Plan (IWMP) compiled for MuLM is dated 2005 (Musina Local Municipality, 2018). The IWMP of MuLM is thus outdated, with updates to IWMPs required every five years, by law. The latest available IWMP dated 2005 was not made available to the consultants, but would have added little value to this status quo assessment due to it being outdated.

In the absence of an up to date IWMP, the IDP was used to provide an overview of waste management in MuLM.

2.2.2 WASTE TYPES

The waste types assumed to be generated in MuLM include the following:

- General waste:
  - Domestic waste;
  - Commercial and industrial general waste;
  - Garden refuse;
  - Construction and demolition waste;
  - Health care general waste (HCGW);
- Hazardous waste:
  - Industrial hazardous waste; and
  - Health care risk waste (HCRW).

No data regarding the tonnage or volume of each type of waste generated in MuLM was made available. An estimate of the general waste generation was, however, calculated in the following section.

2.2.3 GENERAL WASTE GENERATION

In the absence of waste collection and disposal data, the estimated waste generation of MuLM was calculated as follows.

The current (2020) population was calculated by escalating the 2016 population of 132 009 people (Musina Local Municipality, 2018) with a growth factor of 5.53% per annum (Statistics SA, 2019) as shown in the table below.

Table 2-1: Escalation of MuLM population

YEAR	2016	2017	2018	2019	2020
Population	132 009	139 309	147 013	155 143	163 722

Waste generation per income category in 2020 was then calculated using the percentage of the population per income group, calculated in the section above.

The contribution of each income group was calculated as follows:

$$Waste\ generation_i = p\ x\ r$$

$$where\ i = income\ group$$

$$p = percentage\ of\ population\ in\ income\ group$$

$$r = waste\ generation\ rates\ per\ person\ per\ year.$$

Waste generation rates per person-year (r), according to the Guidelines for the Development of Integrated Waste Management Plans (IWMPs), assumed to be for domestic waste only (Department of Environmental Affairs, 2006):

Low income = 149.65 kg/person-year = 0.14 tonnes/person-year

Middle income = 270.1 kg/person-year = 0.27 tonnes/person-year

High income = 470.85 kg/person-year = 0.47 tonnes/person-year

Current (2020) domestic waste generation per income group is shown in the table below.

Table 2-2: Current (2020) annual domestic waste generation per income group in tonnes

INCOME GROUP	PERCENTAGE OF POPULATION PER INCOME GROUP	NUMBER OF PEOPLE PER INCOME GROUP	WASTE GENERATED ANNUALLY (TONNES)
Low	44.5%	72 856	11 000
Medium	48.3%	79 078	22 000
High	7.3%	11 788	6 000
Total	**100.0%**	**163 722**	**39 000**

*Percentage per income group as per distribution of households by annual income at national level (Statistics SA, 2011).

2.2.4 MUNICIPAL REFUSE REMOVAL SERVICE

As per the Statistics by place website (Statistics SA, 2019), 61.5% of households in MuLM receive a weekly refuse removal service. The 2018/2019 MuLM IDP states that 15 350 urban households and 5 239 households (from 24 villages in Madimbo, Malale, Domboni, Tshikundini, Tanda and Masisi) receive a weekly refuse removal service.

2.2.5 WASTE DISPOSAL FACILITIES

There are two waste disposal facilities within the MuLM's area of jurisdiction, including:

- Musina landfill (municipal landfill); and
- Venetia mine landfill (private landfill).

The waste management permits/licenses for the landfills could not be obtained and are not available on the South African Waste Information Centre (SAWIC).

The Musina Landfill is located north of Harper Road, 772 meters after Maseri Avenue. The location of the landfill site is shown in Figure 2-1.

Figure 2-1: Location of Musina Landfill site

As per e-mail communication (6 April 2019) with Ms Rendani Kutama, Manager: Waste and Parks at MuLM, the Musina Landfill site is reportedly a Class B landfill. Ms Kutama supplied the following table (Table 2-3) with regard to the remaining airspace of the landfill as measured in March 2018. If the disposal rate (7 812.7 m^3 per month) remained unchanged, the landfill should have reached its maximum capacity by March 2020, or earlier, if an allowance for daily cover is taken into account.

Table 2-3: Remaining airspace at Musina Landfill site as received from Ms Kutama (March 2018)

	m^3	m^3/MONTH	TOTAL MONTHS REMAINING
March 2018	170 000	7 812.7	21.8

According to Ms Kutama, the above calculations were made in March 2018, prior to the commissioning of a new cell which has been in use since April 2019. No calculations have been made regarding the new cell to date (confirmed via telephonic communication on 24 October 2019). The municipality is currently in the process of requesting Municipal Infrastructure Grant (MIG) funding to extend the cell they commissioned in April 2019. It is not known whether the recently contracted landfill cells are Class B cells in accordance with R.636 for it to be legally compliant.

2.2.6 WASTE TRANSFER STATIONS

As per a telephonic conversation with Ms Rendani Kutama, Manager: Waste and Parks at MLM on 24 October 2019, the municipality does not have any waste transfer stations. There are plans to develop waste transfer stations in rural areas, but no areas have been pinpointed at this stage.

2.2.7 CHALLENGES

The following challenges pertaining to waste management in the MuLM were noted in the 2018/2019 IDP:

- Lack of waste management collection strategy for rural areas;
- Long distance from the villages to the landfill site;
- Unsurfaced roads in the villages;
- Illegal dumping of waste;
- Lack of backup plant and equipment; and
- Burning of waste, also, in skips.

2.3 MAKHADO LOCAL MUNICIPALITY

2.3.1 POLICY DOCUMENTS

The latest IWMP compiled for Makhado Local Municipality (MaLM) is dated 20 October 2017 and the latest IDP compiled for the municipality is dated 2019-2022. These documents were used to provide an overview of waste management in the MaLM.

2.3.2 WASTE TYPES

The waste types assumed to be generated in MaLM include the following:

- General waste:
  - Domestic waste;
  - Commercial and industrial general waste;
  - Garden refuse;
  - Construction and demolition waste;
  - Health care general waste (HCGW);
- Hazardous waste:
  - Industrial hazardous waste; and
  - Health care risk waste (HCRW).

The following table, taken from the 2017 IWMP, indicates the results of the waste characterisation study undertaken at the Makhado Landfill site.

Table 2-4: Results of waste characterisation study undertaken at Makhado Landfill site

MAKHADO LANDFILL SITE		
Waste type/streams	Waste generated per annum (tonnes)	Total percentages
Organic waste	21 915	21.00
Cans	7 263	6.97
Paper	24 210	23.20
Glass	7 868	7.53
Plastic	21184	20.30
Construction and demolition	21 914	21.00
Tyres	0	0.00
Other	0	0.00
Total	**104 354**	**100**

2.3.3 GENERAL WASTE GENERATION

In the absence of waste collection and disposal data, the estimated waste generation for MaLM was calculated as follows.

The current (2020) population was calculated by escalating the 2016 population of 416 728 people (Yes Media, 2020) with a growth factor of 0.85% per annum (Statistics SA, 2019) as shown in the table below.

Table 2-5: Escalation of MLM population

YEAR	2016	2017	2018	2019	2020
Population	416 728	418 520	420 320	422 127	431 078

Waste generation per income category in 2020 was then calculated using the percentage of the population per income group, calculated in the section above.

The contribution of each income group was calculated as follows:

$$Waste\ generation_i = p\ x\ r$$

$$where\ i = income\ group$$

$$p = percentage\ of\ population\ in\ income\ group$$

$$r = waste\ generation\ rates\ per\ person - year.$$

Waste generation rates per person-year (r), according to the Guidelines for the Development of Integrated Waste Management Plans (IWMPs), assumed to be for domestic waste only (Department of Environmental Affairs, 2006):

Low income = 149.65 kg/person/year = 0.14 tonnes/person-year

Middle income = 270.1 kg/person/year = 0.27 tonnes/person-year

High income = 470.85 kg/person/year = 0.47 tonnes/person-year

Current (2020) domestic waste generation per income group is shown in the table below.

Table 2-6: Current (2020) annual domestic waste generation per income group in tonnes

INCOME GROUP	PERCENTAGE OF POPULATION PER INCOME GROUP	NUMBER OF PEOPLE PER INCOME GROUP	WASTE GENERATED ANNUALLY (TONNES)
Low	44.5%	191 830	27 000
Medium	48.3%	208 211	57 000
High	7.3%	31 038	15 000
Total	**100.0%**	**431 078**	**99 000**

*Percentage per income group as per distribution of households by annual income at national level (Statistics SA, 2011).

2.3.4 MUNICIPAL REFUSE REMOVAL SERVICE

As per the Statistics by place website (Statistics SA, 2019), 9.5% of households in MaLM receive a weekly refuse removal service. The 2017 MLM IWMP states that 13 606 (10%) of the 134 889 households receive a weekly refuse removal service. The backlog for weekly refuse removal thus equates to 121 283 households, or 89.9% of households.

The table below, copied from the 2017 IWMP, provides a breakdown of the refuse removal service per household.

Table 2-7: Breakdown of refuse removal service per household

Item	Total number
Households	134889
Serviced households	13606
Un-serviced households	121283
Indigent households	24464
Un-serviced indigent households	14678.4
Service Level A: On-site appropriate and regularly supervised disposal	0
Service Level B: Community transfer to central collection point:	19491
Service Level C: Organised transfer to central collection points and/or kerbside collection:	1427
Service Level D: Mixture of Service Level B and Service Level C:	0
Total Serviced households as per the National Domestic Waste Collection Standards:	20918

2.3.5 WASTE DISPOSAL FACILITIES

MaLM has one operational waste disposal facility, namely:

- Makhado Landfill site (municipal landfill) (Waste management license: 12/9/11/L423/5 (Makhado Local Municipality, 2017)).

The permit/waste management license of the site could not be obtained and is not available on the South African Waste Information Centre (SAWIC).

2.3.6 MAKHADO LANDFILL SITE

The Makhado Landfill site that was licensed in 2011, is located on Portion 1 of the farm Rietvly No. 276-LS and has a total area of 20 hectares (Makhado Local Municipality, 2017). Operation of the site was to commence in July 2017, through appointment of a private contractor (Makhado Local Municipality, 2017). The site was reportedly designed for a 50-year lifespan (Makhado Local Municipality, 2017). From telephonic communication with the Community Services Department of the Makhado Local Municipality on 25 October 2019 Cells 1 and 2 of 20 cells have been developed. The department stated that they estimate that 7% of the available airspace has been used to date. It is not known whether the landfill cells were constructed as Class B cells in accordance with R.636 for it to be legally compliant.

The location of the Makhado Landfill site is shown in the figure below.

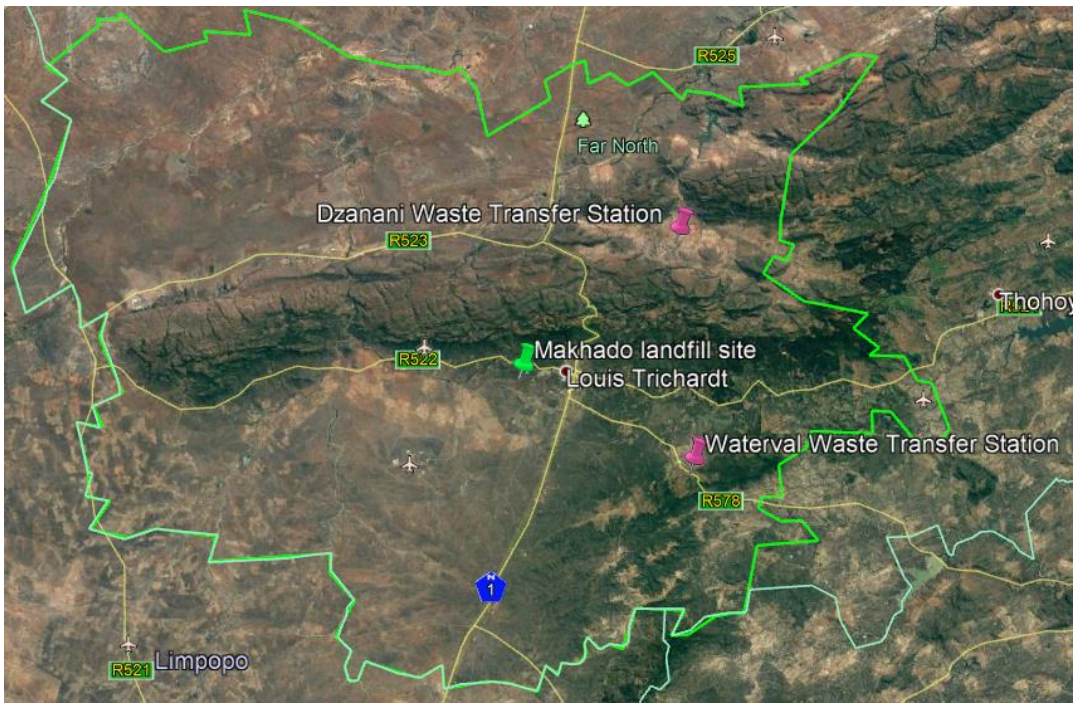


Figure 2-2: Location of Makhado Landfill Site and the Dzanani and Waterval Waste Transfer Stations

2.3.7 WASTE TRANSFER STATIONS

The Municipality has two waste transfer stations:

- Dzanani Waste Transfer Station; and
- Waterval Waste Transfer Station.

The locations of the transfer stations are shown in Figure 2-2 above.

2.3.8 CHALLENGES

The following challenges pertaining to waste management in the MaLM were noted in the 2017 IWMP:

- Garden refuse was at the time being disposed of at the Vondeling landfill, which was already filled to capacity. No further processing of the garden refuse was occurring. A feasibility study to determine the feasibility of composting the garden refuse was required.
- A large quantity of recyclable material was going to the landfill site, which should have been going directly to recycling companies, i.e. transportation cost of the material to and from the landfill to the recycling companies was unnecessary.
- A large number of households and indigent households did not receive a free basic refuse removal service.
- Illegal dumping of waste was common.
- The Municipality had a shortage of personnel for education and awareness, street cleaning, waste collection and for the proper management of waste management facilities.

- There was a lack of information about the generation, collection and disposal of hazardous waste (includes health care risk (medical) waste and industrial waste) within the Municipality.

2.4 SUMMARY OF STATUS QUO

2.4.1 WASTE DISPOSAL SITES

Within the Musina and Makhado Local Municipalities, there are two municipal landfill sites which accept general waste and garden refuse, including:

- Musina landfill; and
- Makhado landfill.

Although it is unknown whether the respective landfill cells were constructed as Class B cells in accordance with R.636 for it to be legally compliant, the status of each of the landfills is summarised in the table below.

Table 2-8: Status of existing landfills in Musina and Makhado Local Municipalities

LANDFILL SITE	STATUS	AIRSPACE REMAINING	PLANS FOR FUTURE DEVELOPMENT
Musina landfill	Active	Unknown	Municipality applied for MIG funding to extend the cell which was commissioned in April 2019.
Makhado landfill	Active	93%	18 cells still to be developed in future.

2.4.2 WASTE TRANSFER STATIONS

There are currently no transfer stations in the Musina Local Municipality. There are two transfer stations in the Makhado Local Municipality:

- Dzanani Waste Transfer Station; and
- Waterval Waste Transfer Station.

2.4.3 HAZARDOUS WASTE DISPOSAL SITE

There are no hazardous waste disposal sites in existence in Limpopo. The nearest hazardous waste disposal site to the SEZ is the Class A (High Hazardous) Holfontein Waste Disposal Facility owned by EnviroServ Waste Management (Pty) Ltd in Gauteng. This facility is located more than 400 kilometres from the proposed Musina-Makhado SEZ.

2.5 OTHER DEVELOPMENTS IN THE AREA

As the environmental impact of waste generated by the proposed SEZ cannot be considered in isolation, it is important to take note of two other proposed developments in the area, including the ECO Industrial Estate and the Antonvilla Industrial development sites in Musina.

The locations of the existing waste disposal and transfer facilities in relation to the proposed Musina-Makhado and planned Antonvilla SEZs are shown in Figure 2-2 below.

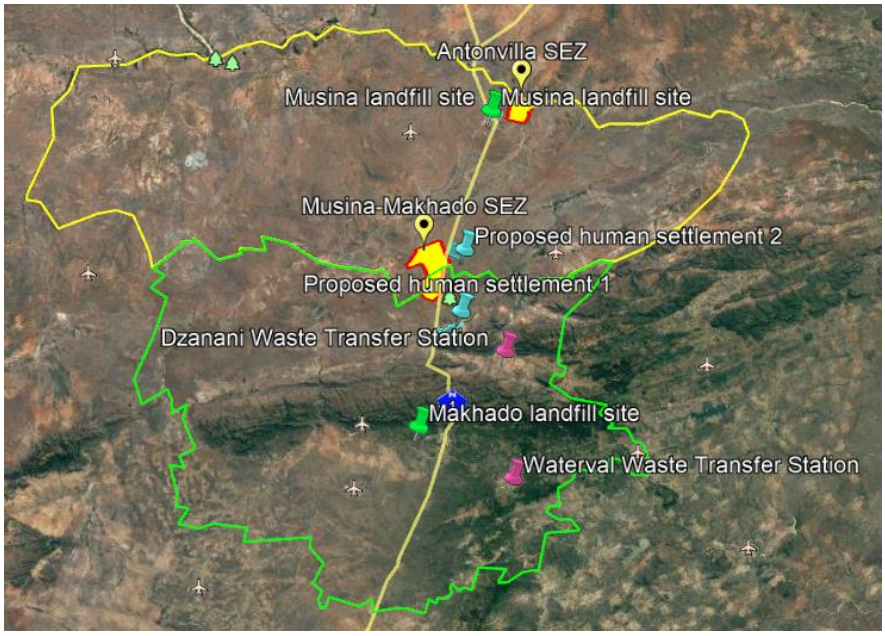


Figure 2-3: Location of the existing waste disposal and transfer facilities in relation to the proposed Musina-Makhado SEZ and planned Antonvilla SEZ site

3 ESTIMATED WASTE GENERATION AND IDENTIFIED OPTIONS FOR THE MANAGEMENT OF THE WASTE TO BE GENERATED BY THE PROPOSED MUSINA-MAKHADO SEZ

This section of the report discusses the expected types and estimated volumes of waste that will be produced within the Musina-Makhado SEZ. This section of the report was obtained from the Internal Master Plan prepared for the SEZ by iX Engineers, dated September 2019 (iX Engineers, 2019).

3.1 EXPECTED WASTE TYPES

The expected waste types are discussed under the following headings:

- Construction phase; and
- Operational phase.

3.1.1 CONSTRUCTION PHASE

As per the Internal Master Plan by iX Engineers, (iX Engineers, 2019), the following waste streams are expected to be generated during the construction phase of the project.

Table 3-1: Potential waste streams during construction phase (iX Engineers, 2019).

SOURCE	POTENTIAL WASTES STREAMS
Accommodation camps	Food, paper, cardboard, packaging materials, plastics, textiles and leather, wood, glass, metal and medical wastes.
Site offices	Paper, cardboard, plastic, metal, wood and small amounts of food waste, ink cartridge, glass, fluorescent lights.
Construction Works	Wood, plastic, metal, steel materials, concrete and cement wastes, plumbing fixtures and piping, insulation material, packaging material (cardboard, paper, plastic), mortar and plaster, asphalt, welding slugs, rubber, used tyres, used batteries, used paint containers, oils, varnishes, thinners, adhesives, electrical and electronic wastes, oily rags, contaminated soil, mercury containing wastes (viz., fluorescent bulbs, broken mercury switches, batteries or thermostats)

The following table indicates, for each type of waste, whether it is hazardous or non-hazardous, recyclable or non-recyclable and biodegradable or non-biodegradable.

Table 3-2: Classification of construction phase wastes (iX Engineers, 2019)

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Paper and cardboard	NHZ	RC	BD
Wood	NHZ	RC (also re-usable)	BD
Electrical and electronic wastes	NHZ & HZ	RC & NRC	
Glass	NHZ	RC	
Metal	NHZ	RC	
Plastic	NHZ	RC	
Rubber	NHZ	RC	
Used tyres	NHZ	RC	
Waste food	NHZ (usually)	NRC (some can be composted)	BD
Concrete	NHZ	RC	
Waste type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Plaster, cement, mortar, other civil wastes	NHZ	NRC (some might be recyclable)	
Plumbing wastes	NHZ	NRC	
Textile and leather	NHZ	NRC	
Medical		NRC	BD & NBD
Sludge from wastewater treatment		NRC	BD
Contaminated soil		NRC	
Empty containers of paints, oils, varnishes, thinners, adhesives, etc.		NRC	
Used batteries		RC	

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Oily rags		NRC	
Welding slugs		NRC	

3.1.2 OPERATIONAL PHASE

As per the Internal Master Plan by iX Engineers, (iX Engineers, 2019), the following waste streams are expected to be generated during the operational phase of the project.

Table 3-3: Potential wastes during operation phase (iX Engineers, 2019)

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
Logistics	On-board garbage	Plastic Cargo residues, paper products, rags, glass, metal, bottles, crockery Food waste
	Logistics warehouse	Packaging waste (wooden/plastic pallets, polyethylene, paper and cardboard) Residual dry bulk product
	Container repair activities	Metal wastes
	On-site vehicle maintenance	Used oil residue Used filters Used tyres Oily rags Packaging Used oil drums
	General container loading/unloading	Soil contaminated from accidental spills/leaks from trucks/front end loaders

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
	Other	Fluorescent light bulbs Used tyres Containers of paints, adhesives, resins, oil Drums containing oily residues Used mercury dry cell batteries Used lead batteries Used Ni-Cd batteries Oil-contaminated materials Used aerosol and coolant canisters Materials containing asbestos Electrical and electronic wastes
Metals	Machining operation (turning, drilling, threading, grinding, etc.)	Metal scraps from cutting works, welding slugs, sanding dust (which may contain heavy metals from paints)
	Metal part cleaning and stripping (removal of scale polishing of metal, removal of oil based soils, organic soils)	Abrasives
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
	Surface treatment and plating	Spent process solutions Filter cakes Quench oil tank clean-up waste Spent salt bath Wastewater treatment sludge (potentially containing metal hydroxides and carbonates) Vent scrubber wastes Ion-exchange resin reagents (brine, HCl, NaOH)
	Painting activity (spray painting, resin application)	Toxic and ignitable thinners Toxic paint wastes Paint sludge Oil and solvent-contaminated rags Empty cans containing paint and thinner residues Contaminated paint booth filters
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
Petrochemicals	Maintenance activities	Fuel oil
		Light oil Lube oil
	Other	Sludge from refining process Accidental discharges during abnormal operations
Building Materials	Storage	Broken/waste storage materials Packaging materials
Food Processing	Raw material preparation	Rinds, seeds Skins, bones, feathers, blood Other contaminated objects

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
	Processing (chopping, cutting, slicing, dicing, milling, pulping, emulsification, homogenisation, centrifugations, filtration)	Off-spec products, i.e., poor quality (too coarse or fine) product with loss of nutritional/sensory characteristics Agglomerates Waste off-cuts Separated solids (e.g. after clarification of liquids) Press residues (e.g. fruit juice extraction)
	Processing (fermentation, enzyme technology)	Spent biomass
	Processing: Extrusion Dehydration Baking and Roasting Frying	Strip down residues Heat transfer surface film build-up Write-off oven contents if process interruption exceeds product buffering capacity Contaminated fat, particulates
	Preservation/ stabilisation (blanching, pasteurisation, sterilisation)	Under-blanched food wastage Food spoilt due to overheating Heat transfer surface film build-up
	Packing and storage	Glass Cardboard Aluminium foils Plastic containers
Tools and Machinery	Die-casting	Metal scraps Waste oil

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
	Machining and welding	Unusable welding rods Soaked rags Metal chips Welding slags Sanding dust (which may contain heavy metals from paints) Cutting fluid
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves
	Plating and finish treatment	Wastewater with traces of heavy metals Spent acids and alkaline
Transportation and Automotive	Machining operation (turning, drilling, threading, grinding, etc.)	Water stream contaminated with oil and chemical additives like chlorine, sulphur, creosols and alkalis Metal scraps from cutting works, welding slugs, sanding dust (which may contain heavy metals from paints)
	Metal part cleaning and stripping (removal of scale polishing of metal, removal of oil-based soils, organic soils)	Abrasives

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves
	Surface treatment and plating	Spent process solutions Filter cakes Quench oil tank clean-up waste Spent salt bath Wastewater treatment sludge (potentially containing metal hydroxides and carbonates) Vent scrubber wastes Ion-exchange resin reagents (brine, HCl, NaOH)
	Painting activity (spray painting, resin application)	Toxic and ignitable thinners Toxic paint wastes Paint sludge Oil and solvent-contaminated rags Empty cans containing paint and thinner residues Contaminated paint booth filters
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
Other	Office and accommodation	Food wastes from cooking Expired food items Spoilt/rotten meat, fish, vegetables, fruits, etc. Leftover food Paper and cardboard

INDUSTRY TYPE	POTENTIAL SOURCE	POTENTIAL WASTE STREAMS
		Packaging materials Plastics Textiles and leather Wood Glass Medical wastes

The table below indicates, for each type of waste listed in the table above, whether it is hazardous or non-hazardous, recyclable or non-recyclable and biodegradable or non-biodegradable.

Table 3-4: Classification of operation phase waste streams (done in terms of GNR634 of 2013) (iX Engineers, 2019)

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Paper and cardboard waste	NHZ	RC	BD
China clay waste (broken crockery)	NHZ	RC	

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Electrical and electronic wastes	NHZ & HZ	RC & NRC	
Glass	NHZ	RC	
Insulation linings	NHZ	RC	
Metal wastes (scraps, chips, shavings, etc.)	NHZ	RC	
Plastic waste	NHZ	RC	
Rubber	NHZ	RC	
Used tyres	NHZ	RC	
Rinds, seeds	NHZ	NRC	BD
Food waste from kitchen and mess	NHZ (usually)	NRC (some can be composted)	BD
Abrasives	NHZ	NRC	
Broken/waste storage materials	NHZ	NRC	
Plumbing wastes	NHZ	NRC	
Rags – uncontaminated	NHZ	RC	
Rags – contaminated	HZ	NRC	
Textiles and leather	NHZ	NRC	
Used casting sand	NHZ	NRC	
Printing cartridges		RC	

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Spent catalyst		RC	
Used bag house filters		RC	
Used batteries (Pb, Hg-dry cell, Ni-Cd)		RC	
Used filters		RC	
Sludge from wastewater treatment		NRC	BD
Agglomerates from food industry		NRC	BD
Clarified solids from food industry		NRC	BD
Contaminated fat and particulates		NRC	BD
Food contaminated with thermophilic bacteria		NRC	BD
Food spoiled due to overheating		NRC	BD
Improperly treated product		NRC	BD
Medical wastes		NRC	BD & NBD
Contaminated soil		NRC	
Unused containers of paints, oils, varnishes, thinners, adhesives, etc.		NRC	
A/C units containing either ODS as coolant or non-ODS with high GWP		NRC	
Carburettor cleaners		NRC	
Filter cakes		NRC	
Ion-exchange resin reagents		NRC	

WASTE TYPE	HAZARDOUS OR NON-HAZARDOUS	RECYCLABLE OR NON-RECYCLABLE	BIODEGRADABLE OR NON-BIODEGRADABLE
Materials containing asbestos		NRC	
Waste type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Paint sludge		NRC	
Sludge from refining process		NRC	
Sludge from wastewater treatment		NRC	
Spent salt bath		NRC	
Tank clean-up waste/sludge		NRC	
Unusable welding rods		NRC	
Vent scrubber wastes		NRC	
Wastes potentially containing mercury		NRC	
Welding slugs		NRC	
Wood	NHZ	RC (also re-usable)	BD

3.2 ESTIMATED EXPECTED WASTE GENERATION RATE FOR THE PROPOSED MUSINA-MAKHADO SEZ

The Internal Master Plan prepared for the SEZ by iX Engineers, dated September 2019 (iX Engineers, 2019) states that it is difficult to estimate waste generation rates for each of the individual planned industries in the conceptual stage of the SEZ development and that information on industrial waste generation figures is not easily obtainable as it is mostly seen as sensitive or as confidential information.

Therefore, iX Engineers used the following approaches to estimate waste generation rates.

3.2.1 APPROACH 1

Hazardous and non-hazardous waste masses were estimated based on the employee/residents headcount with the following conservative assumptions:

- Every person generates approximately 1.6 kg of non-hazardous domestic waste per day;
- Industrial/commercial non-hazardous waste generation is 2.0 kg per person per day;
- Generation of hazardous waste is taken as 5% of the non-hazardous waste mass; and
- Total personnel number for EMSEZ development reaches approximately 53 000 people.

This approach yielded the following waste mass estimates.

Table 3-5: Waste mass estimates

WASTE TYPE	GENERATION PER YEAR (TONNES)
Hazardous waste	2 008
Non-hazardous industrial waste	40 150
Municipal solid waste (garbage)	30 113
Total	72 721

3.2.2 APPROACH 2

Waste generation rates for different industry zones/stands available for similar size developments were obtained. These are presented in the table below.

Table 3-6: Waste generation estimates based on industry zones (iX Engineers, 2019)

ZONES/STANDS IN EMSEZ	WASTE GENERATION FACTOR, kg/EMPLOYEE-DAY	MAXIMUM EMPLOYEES	WASTE GENERATION TONNES A DAY	WASTE GENERATION TONNES A YEAR
Thermal Power Plant	4.05	4 079	16.52	6 030
High Vanadium Steel Plant	4.05	6 500	26.33	9 609
Silicon Managanese Plant	6.27	6 690	41.95	15 310
High Managnese Steel Plant	4.05	7 000	28.35	10 348

ZONES/STANDS IN EMSEZ	WASTE GENERATION FACTOR, kg/EMPLOYEE-DAY	MAXIMUM EMPLOYEES	WASTE GENERATION TONNES A DAY	WASTE GENERATION TONNES A YEAR
Ferromanagan ese Plant	4.05	5 752	23.30	8 503
Ferrochrome Plant	4.05	4 000	16.20	5 913
Coke Plant	4.05	1 879	7.61	2 778
Cement Plant	4.05	2 017	8.17	2 982
Stainless Steel Plant	4.05	7 000	28.35	10 348
Light Industrial Processing	4.05	3 500	14.18	5 174
Support Uses (sewerage treatment plant, water treatment plant, coal washery, refractories factory, administrative centre, logistics centre, machinery zone, fuel and gas storage facilities, guest lodge)	4.17	4 583	19.11	6 976
Total	-	53 000	230.05	86 590

From the above two comparisons, total waste generation (hazardous and non-hazardous) for the proposed Musina-Makhado SEZ will range between approximately 72 721 to 86 590 tonnes per annum (iX Engineers, 2019).

3.3 PROPOSED OPTIONS FOR WASTE MANAGEMENT AT THE PROPOSED MUSINA-MAKHADO SEZ

iX Engineers proposed the following options for the management of waste generated by the Musina-Makhado SEZ.

3.3.1 OPTION A

Waste accumulated at the construction sites, operating industries and public areas will be collected by either third party waste transportation contractors (or a newly established EMSEZ utility company) and delivered directly to the recycling, treatment and disposal facilities (e.g. Musina or Makhado landfills or Holfontein or Vlakfontein Hazardous Waste Management Facilities in Benoni and Vanderbijlpark in Gauteng, respectively). Commercial recyclable collectors may have their own direct arrangements with waste generators for the selected waste streams (e.g. office paper, aluminium cans, e-waste, etc.). No centralised waste management area (WMA) will be established in the EMSEZ complex and all waste will be driven outside the EMSEZ once collected.

3.3.2 OPTION B

A centralised Waste Management Area (WMA) will be established within the boundaries of EMSEZ and some waste could be brought to the WMA for accumulation and temporary storage (general waste and small volumes of hazardous waste). The WMA could serve as a waste depot and will provide a more flexible solution for recyclables and difficult waste streams that cannot currently be treated and disposed of at the existing facilities.

The following options are, however, relevant with regard to the disposal of hazardous waste from the subject industries.

3.3.2.1 Option B1:

For hazardous waste, since the long-hauling of hazardous waste, i.e. fly ash, slag sludge, etc. to the existing Holfontein and Vlakfontein hazardous waste management facilities in Gauteng, might not be feasible in the medium to long term due to the distance and severe transport cost; a close by integrated hazardous waste management facility of approximately 3 000 ha (with 40 years lifespan) (i.e. for the disposal/treatment of hazardous waste i.e. ash, slag, sludge etc), outside the EMSEZ complex needs to be established. The facility will have to be licensed in terms of Section 45 of the National Environmental Management Waste Act, Act 59 of 2008 (NEMWA). The licensing process will be a separate process from the WMP, and will have to follow a full Environmental Impact Assessment process for its establishment, meaning that the need, site selection process from a few candidate sites to be identified, detail investigations on the most suitable identified site (which could include the following detailed studies viz Geohydrological Assessment, Geotechnical Assessment, Heritage, Archaeology and Palaeontology Assessment; Ecology (Fauna & Flora) Assessment; Wetland Assessment and Delineation; Social Baseline Assessment, Economic Assessment; Visual Assessment; Traffic Assessment; Blast and Vibration Assessment (if required); Air Quality Assessment; Noise and Ground Vibration Assessment), needs to be conducted. This process should start as soon as possible. Should 2/3 of the waste stream be recycled as indicated by the EMSEZ, only 1 000 ha facility would be required. The cost to design and construct a full-size integrated hazardous waste management

facility could cost approximately R1.2 billion. The facility can be developed in a phased manner to alleviate initial cost, i.e. establish a 200 ha facility for approximately R250 000 000.00 and with time develop the remainder.

3.3.2.2 Option B2

Since each and every plant owner will be responsible to manage the waste generated within their respective plants, their responsibility will be to establish their own disposal facility for the disposal of their industrial hazardous waste they generate (if in large quantities, and as an option in the short term, until the outside "to be established integrated waste management facility" mentioned above will be established). The same authorisation requirements (mentioned above for the establishment of an integrated hazardous waste management facility outside the EMSEZ complex) will apply for the hazardous waste disposal facility developed at the respective plants, where a need for such a facility is identified, i.e. full EIA and WML application. Delta BEC is of the opinion that this is not a viable option due to the effort and cost associated with the licensing and developing of a hazardous waste landfill, and the economies of scale required.

3.3.3 OPTION C

This option follows the approach in Option A, but instead of taking the waste outside the EMSEZ, develop a waste management facility (includes landfill, treatment facilities, etc.) inside the boundaries of EMSEZ and use it as both a centralised waste management area and a treatment facility. With the current layout, this option seems almost impossible. Delta BEC is of the opinion that this is not a viable option due to spatial restrictions and the high value of the land within the proposed SEZ.

3.3.4 RECOMMENDATION

iX Engineers (iX Engineers, 2019) recommended Option B (centralised WMA for general and low volumes of hazardous waste) with a combination of Options B1 and B2 for the management of larger volumes of hazardous waste.

iX Engineers (iX Engineers, 2019) also stated that should negotiations for the expansion of the Musina landfill not be successful for the disposal of general waste, a new landfill facility should be established in close vicinity to the EMSEZ complex. iX Engineers (iX Engineers, 2019) stated that the activity inter alia entails site identification, funding application, rezoning, possible property purchasing and transfer, full Environmental Impact Assessment with specialist investigations required by the authorities, design in terms of National Norms and Standards for Disposal of Waste to Landfill (promulgated in August 2013) and a construction period of 10-12 months. iX Engineers (iX Engineers, 2019) indicated that they anticipate that the cost estimate to design and construct a Class B general landfill facility of 35 ha (full 35 ha development) will be approximately R42 000 000.00, depending on the availability of in-situ material available on site and whether the landfill will have enough airspace for at least 50 years.

Delta BEC does not agree with the recommended approach. The above approach requires further investigation and refinement.

4 IMPACT ASSESSMENT AND MITIGATION MEASURES

It is anticipated that the proposed Musina-Makhado SEZ development will impact on the environment during the construction and operational phases of the development. For the purposes of this EIA application, relating to the clearance of a site, it was deemed important to consider all possible impacts of the SEZ to ensure that the context of the overall development and subsequent operation is fully described.

4.1 CONSTRUCTION PHASE

During the construction phase, it is anticipated that the development will have impacts related to the following aspects in terms of waste generation and management:

- Organic waste generation (due to clearance of vegetation);
- General waste generation; and
- Construction waste generation.

The potential impacts related to each of the above aspects are shown below:

- Organic waste generation:
  - Short-term increase in organic waste;
  - Soil pollution (leachate);
  - Groundwater pollution (leachate);
  - Air pollution (smoke, if set alight);
- General waste generation:
  - Increased general waste generation due to construction workers;
  - Soil pollution (leachate);
  - Groundwater pollution (leachate);
  - Odours;
- Construction waste generation:
  - Increased construction waste generation;
  - Compromised aesthetics;
  - Windblown litter; and
  - Generation of dust.

The significance of the above-mentioned impacts has been assessed by taking into account the potential status, intensity, extent, duration and probability of occurrence thereof (refer to Table 4-1).

The **status** of the impact refers to whether the impact will have a positive, neutral or negative effect on the environment. The **intensity** of the impact refers to the magnitude of the impact in terms of natural, cultural and social functions. The **extent** of the impact is provided to indicate whether the impact would be limited to the footprint of the development, local area and surroundings, regional impact, national impact or global impact. The **duration** of the impact indicates the lifetime of the impact in terms of *short term (0-3 years), medium to short term (3-10 years),*

medium term (10-30 years), long term (more than 30 years) and *permanent* impact. The **probability** of occurrence is described as *improbable, unlikely, possible, highly probable* and *definite*.

Table 4-1: Scoring criteria

Score	Rating	Description
Intensity (I) – defines the magnitude of the impact		
16	**High**	*Natural, cultural and social functions and processes are altered to extent that they permanently cease. Impact affects the continued viability of the systems / components and the quality, use, integrity and functionality of the systems / components permanently ceases and are irreversibly impaired (system collapse). Rehabilitation and remediation often impossible. If possible, rehabilitation and remediation often unfeasible due to extremely high costs of rehabilitation and remediation.* Impact may cause: ▪ Loss of human life. ▪ Deterioration in human health. ▪ High impacts to ecosystems and environment resulting in: - Critical / severe local scale (or larger) modification / degradation and / or collapse. - Critical / severe local scale (or larger) modification (reduction in level) of ecosystem services and / or loss of ecosystem services.
8	**Moderately-High**	*Natural, cultural and social functions and processes are altered to extent that they are severely impaired and may temporarily cease. Impact affects the continued viability of the systems/components and the quality, use, integrity and functionality of the systems / components are severely impaired and may temporarily cease. High costs of rehabilitation and remediation, but possible.* Impact may cause: ▪ Loss of livelihoods. ▪ Individual economic loss. ▪ Moderately-high impacts to ecosystems and environment: - Large local scale (or larger) modification / degradation and / or collapse. - Large local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services.
4	**Moderate**	*Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a modified way. Impact alters the quality, use and integrity of the systems / components but the systems / components still continue to function but in a moderately modified way (integrity and functionality impaired but major key processes / drivers somewhat intact / maintained).* Moderate impacts to ecosystems and environment: ▪ Moderate local scale (or larger) ecosystem modification / degradation and / or collapse. ▪ Moderate local scale (or larger) modification (reduction in level) of ecosystem services and/or loss of ecosystem services.
2	**Moderately-Low**	*Affected environment is altered, but natural, cultural and social functions and processes continue albeit in a slightly modified way. Impact alters the quality, use and integrity of the systems / components but the systems / components still continue to function, although in a slightly modified way. Integrity, function and major key processes / drivers are slightly altered but are still intact / maintained.* Moderately-low impacts to ecosystems and environment: ▪ Small but measurable local scale (or larger) ecosystem modification / degradation. ▪ Small but measurable local scale (or larger) modification (reduction in level) of ecosystem services and / or loss of ecosystem services.
1	**Low**	*Impact affects the environment in such a way that natural, cultural and social functions and processes are not affected.* Negative change to onsite characteristics but with no impact on: ▪ Human life. ▪ Human health.

Score	Rating	Description
		▪ Local water resources, local ecosystem services and / or key ecosystem controlling variables. ▪ Threatened habitat conservation / representation. ▪ Threatened species survival.
Extent (E) – relates to the extent of the impact		
5	**Global**	The scale / extent of the impact is global / worldwide.
4	**National**	The scale / extent of the impact is applicable to the Republic of South Africa.
3	**Regional**	Impact footprint includes the greater surrounding area within which the site is located (e.g. between 20 - 200km radius of the site).
2	**Local**	Impact footprint extends beyond the cadastral boundary of the site to include the areas adjacent and immediately surrounding the site (e.g. between a 0 - 20km radius of the site).
1	**Site**	Impact footprint remains within the boundary of the site.
Duration (D) – relates to the duration of the impact		
5	**Permanent**	The impact will continue indefinitely and is irreversible.
4	**Long-term**	The impact and its effects will continue for a period in excess of 30 years. However, the impact is reversible with relevant and applicable mitigation and management actions.
3	**Medium-term**	The impact and its effects will last for 10 - 30 years. The impact is reversible with relevant and applicable mitigation and management actions.
2	**Medium-short**	The impact and its effects will continue or last for the period of a relatively long construction period and / or a limited recovery time after this construction period, thereafter it will be entirely negated (3 – 10 years). The impact is fully reversible.
1	**Short-term**	The impact and its effects will only last for as long as the construction period and will either disappear with mitigation or will be mitigated through natural process in a span shorter than the construction phase (0 – 3 years). The impact is fully reversible.
Probability (P) – relates to the likelihood of the impact occurring		
1	**Definite**	More than 75% chance of occurrence. The impact is known to occur regularly under similar conditions and settings.
0.75	**Highly Probable**	The impact has a 41 - 75% chance of occurring and thus is likely to occur. The impact is known to occur sporadically in similar conditions and settings.
0.5	**Possible**	The impact has a 10 - 40% chance of occurring. This impact may / could occur and is known to occur in low frequencies under the similar conditions and settings.
0.2	**Unlikely**	The possibility of the impact occurring is low with less than 10% chance of occurring. The impact has not been known to occur under similar conditions and settings.
0.1	**Improbable**	The possibility of the impact occurring is negligible and only under exceptional circumstances.

The significance of the impacts was ranked as per the following.

Table 4-2: Impact significance ranking

	Class	Description
+	Any value	Any positive / beneficial 'impact', i.e. where no harm will occur due to the activity being undertaken.
–	Low 0 - 4.9	A low impact has no permanent impact of significance. Mitigation measures are feasible and are readily instituted as part of a standing design, construction or operating procedure.
	Moderately Low 5 – 7.9	Mitigation is possible with additional design and construction inputs.
	Moderate 8 – 12.9	The design of the site may be affected. Mitigation and possible remediation are needed during the construction and / or operational phases. The effects of the impact may affect the broader environment.
	Moderately High 13 – 17.9	Generally unacceptable unless offset / compensated for by positive gains in other aspects of the environment that are of critically high importance (i.e. national or international importance only). Strict conditions and high levels of compliance and enforcement are required. The potential impact will affect a decision regarding the proposed activity and requires that the need and desirability for the project be clearly substantiated to justify the associated ecological risks.
	High 18 - 26	Permanent and important impacts likely to be a fatal flaw. Impacts should be avoided and limited opportunity for offset / compensatory mitigation.
Status		Denotes the perceived effect of the impact on the affected area.
Positive (+)		Beneficial impact.
Negative (-)		Deleterious or adverse impact.
Neutral (/)		Impact is neither beneficial nor adverse.
It is important to note that the status of an impact is assigned based on the *status quo* – i.e. should the project not proceed. Therefore, not all negative impacts are equally significant.		

The assessment of the significance of each of the identified impacts in the construction phase, as well as the proposed mitigation measures, is shown below.

Table 4-3: Impact significance during construction

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
Organic waste generation	On-site chipping of vegetation for removal to composting yards	-	Without	8	3	4	1	15
		-	With	1	2	1	0.1	0.4

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
General waste generation	Recycling and disposal of the remaining waste fraction in a Class B lined landfill	-	Without	16	3	4	1	23
		-	With	2	1	3	0.2	1.2

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
Construction waste generation	Sorting builders' rubble on site and transporting it to a builders' rubble crushing facility	-	Without	16	3	4	1	23
		-	With	2	2	1	0.2	1

The results of the high-level impact assessment are summarised below.

Table 4-4: Significance of impacts in construction phase

ASPECT	IMPACTS	MITIGATION MEASURE	SIGNIFICANCE (NO MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
Organic waste generation	Short-term increase in organic waste. Soil pollution (leachate). Groundwater pollution (leachate). Air pollution (smoke) if set alight.	On-site chipping of vegetation for removal to composting yards.	Moderately high	Low
General waste generation	Increased general waste generation due to construction workers. Soil pollution (leachate). Groundwater pollution (leachate). Odours.	Waste minimisation, reuse, recycling, and disposal of the remaining waste fraction in a Class B lined landfill.	High	Low
Construction waste generation	Increased construction waste generation. Compromised aesthetics. Windblown litter.	Sorting builders' rubble on site and transporting it to a builders' rubble crushing facility. Using as fill material during	High	Low

	Generation of dust.	rehabilitation of quarries.		

4.2 OPERATIONAL PHASE

During the operational phase, it is anticipated that the development will have impacts related to the following aspects in terms of waste generation and management:

- General waste generation;
- Hazardous waste generation; and
- General and hazardous waste facility operation.

The impacts related to each of the above aspects are shown below:

- General waste generation:
  - Increased general waste generation due to work force of SEZ;
  - Soil pollution (leachate);
  - Groundwater pollution (leachate);
  - Odours;
- Hazardous waste generation:
  - Increased hazardous waste generation from industries in the SEZ;
  - Soil pollution (leachate);
  - Groundwater pollution (leachate);
- General and hazardous waste facility operation:
  - Soil pollution (leachate);
  - Groundwater pollution (leachate);
  - Dust;
  - Odours;
  - Breeding of flies and rodents;
  - Air pollution (smoke) if set alight;
  - Health risks associated with spreading of diseases and inhaling of hazardous fumes;
  - Windblown litter; and
  - Aesthetics.

The assessment of the significance of each of the identified impacts in the operational phase, as well as the proposed mitigation measures, is shown in the following table.

Table 4-5: Operational phase impact significance

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
General waste generation	Recycling and disposal of the remaining waste fraction in a Class B lined landfill	-	Without	16	3	4	1	23
		-	With	2	1	3	0.2	1.2

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
Hazardous waste generation	Disposal in a Class A lined landfill	-	Without	16	3	4	1	23
		-	With	2	1	3	0.2	1.2

Aspect	Mitigation Measures	Status	Mitigation	Intensity (I)	Extent (E)	Duration (D)	Probability (P)	Significance (I+E+D)xP
General and hazardous waste facility operation	Operation in line with the facilities' waste management licenses and all relevant legislation	-	Without	16	3	4	1	23
		-	With	1	1	3	0.2	1

The results of the high-level impact assessment are summarised below.

Table 4-6: Significance of impacts in operational phase

ASPECT	IMPACTS	MITIGATION MEASURE	SIGNIFICANCE (NO MITIGATION)	SIGNIFICANCE (WITH MITIGATION)
General waste generation	Increased general waste generation due to construction workers. Soil pollution (leachate). Groundwater pollution (leachate). Odours.	Waste minimisation, reuse, recycling, and disposal of the remaining waste fraction in a Class B lined landfill.	High	Low
Hazardous waste generation	Increased hazardous waste generation from	Waste minimisation.	High	Low

	industries in the SEZ. Soil pollution (leachate). Groundwater pollution (leachate).	Use as feedstock for other processes. Treatment/disposal in Class A lined landfill (or Class B landfill – depending on waste classification and license conditions).		
General and hazardous waste facility operation	Soil pollution (leachate). Groundwater pollution (leachate). Dust. Odours. Breeding of flies and rodents. Air pollution (smoke) if set alight. Health risks associated with spreading of diseases and inhaling of hazardous fumes. Windblown litter. Aesthetics.	Operation in line with facilities' waste management licenses, best practice standards and relevant legislation.	High	Low

5 RECOMMENDATIONS AND CONCLUSION

The following must be taken into account when considering recommendations regarding the approach to be taken to ensure protection of the environment during development and operation of the proposed Musina-Makhado SEZ:

- There are existing municipal waste disposal facilities within the two municipality areas within an acceptable transport distance with the potential to be upgraded to accommodate general waste from the SEZ and the associated human settlements. The availability of sufficient disposal capacity (airspace) as well as the legal compliance of the two alternative landfills are still to be investigated.
- The potential mass of industrial and hazardous waste to be generated by the SEZ is expected to be high. Currently there are no hazardous waste disposal facilities (with legally compliant Class A liners) in the Limpopo province to accommodate the hazardous waste. The existing facilities that can accommodate hazardous waste are more than 400 km from the proposed SEZ site. Due to the volumes involved, rail transport would most likely be required to transport the waste to the existing hazardous waste sites in Gauteng, which would greatly increase the carbon footprint of the SEZ. Due to the high capital investment required for development of rail transfer facilities on both ends, rail transport will only be a viable option for use as a long-term solution.
- The SEZ Internal Masterplan compiled by iX Engineers (iX Engineers, 2019) identified a potential site for the development of an industrial and hazardous waste disposal facility in close proximity to the SEZ site. No detailed studies have been conducted to inform the selection of this site. Should this development of a local Class A hazardous waste disposal facility be the preferred option, it would make strategic sense for the facility also to be provided with Class B lined cells for disposal of general waste. This option, despite that fact that it can also be used to serve other industrial developments in the surrounding area will however, also require high capital investment that would only make it viable as a long-term solution.
- The significance of the potential impacts on the environment, due to the generation and management of waste during the construction and operational phases of the SEZ, including the risk of pollution of groundwater, pollution of soil and negative impacts on air quality, is high.
- If waste generated within the SEZ is not managed appropriately, it could have major impacts on the environment, and more specifically socio-economic impacts related to human and animal health and agriculture in general due to high reliance on groundwater in the area, amongst others.
- Waste management is regulated by the National Environmental Management: Waste Act (Act 59 of 2008), as amended and all Regulations and norms and standards published in effect thereof as well as the National Waste Management Strategy (2011), which has been updated and is currently in draft (2019).

- The Integrated Waste Management Plans of the municipalities are outdated and must be updated, taking cognisance of the proposed industrial development in the area, such as the Musina-Makhado SEZ, the Antonvilla SEZ and the ECO Industrial Estate.

Taking the above into account, the following high-level recommendations are made:

- The potential for the reduction, re-use, recycling, treatment and disposal of waste exists and requires detailed feasibility studies to be undertaken to ensure that such activities are financially viable and sustainable in the long term. Waste reduction must, as per the Waste Management Hierarchy adopted in the National Waste Management Strategy, receive priority attention as part of the integrated waste management plans for the district and local municipalities, and, in particular, for the SEZ.
- The Integrated Waste Management Plans of the district and local municipalities must be updated, taking cognisance of the proposed industrial developments in the area, such as the Musina-Makhado SEZ, the Antonvilla SEZ and the ECO Industrial Estate.
- The need for and viability of legally compliant expansion of the existing municipal general waste disposal facilities must be investigated further by means of a feasibility study.
- The most technically viable and financially feasible way in which to deal with hazardous waste generated in the SEZ, including rail transport to hazardous waste disposal facilities in Gauteng or the need for the development of a hazardous waste disposal facility in close proximity to the SEZ must be investigated further by means of a feasibility study. This feasibility study should include a proper investigation in terms of the siting of a local hazardous waste facility that is also to serve other industrial developments in the area – should that be the preferred option.
- The planning of waste facilities for the SEZ must comply with the applicable policy and legislative framework that require the licencing of all waste activities, subject to triggering of listed activities. This entails detailed feasibility studies regarding the site and the assessment of alternative sites. It also entails undertaking a basic assessment or environmental impact assessment process if environmental authorisation is required.
- The environmental impacts of the potential waste disposal facilities must be mitigated by ensuring compliance to the Waste Classification and Management Regulations (R.634) and the associated norms and standards, National norms and standards for the assessment of waste for landfill disposal (R.635), and National norms and standards for disposal of waste to landfill (R.636). The facilities must also be operated in compliance with the Minimum Requirements for Waste Disposal by Landfill, 2nd edition (DWAF, 1998).

6 REFERENCES

Department of Environmental Affairs. (2006). *Guidelines for the development of Integrated Waste Management Plans (IWMPS's).* Pretoria: Department of Environmental Affairs.

DWAF. (1998). *Minimum Requirements for Waste Disposal by Landfill.* Pretoria: DWAF.

iX Engineers. (2019). *EMSEZ - Internal Master Planning: Extract of Land Use & Infrastructure.* Pretoria: iX Engineers.

Makhado Local Municipality. (2017). *Draft Integrated Waste Management Plan (IWMP).* Makhado: Makhado Local Municipality.

Musina Local Municipality. (2018). *FINAL DRAFT INTEGRATED DEVELOPMENT PLAN.* Musina: Musina Local Municipality.

Statistics SA. (2019, October 23). *Stats SA*. Retrieved from Musina: http://www.statssa.gov.za/?page_id=993&id=musina-municipality

Yes Media. (2020, August 25). *Makhado Local Municipality*. Retrieved from Municipalities of South Africa: https://municipalities.co.za/demographic/1132/makhado-local-municipality

APPENDIX A: EMSEZ INTERNAL MASTER PLAN

EMSEZ – Internal Master Planning

Extract of Land Use & Infrastructure

SUBMITTED BY:

iX engineers (Pty) Ltd, MCC and Hoimor

on 10 September 2019.

Eastwood Office Park, Protea House
270 Lynwood Service Road, Lynwood Ridge
Pretoria, South Africa
0081

Tel: +27 (0) 12 745 2000 | Fax: +27 (0) 12 745 2001

Contact Person(s): Mr Hans Karemaker | Email: hans.k@ixengineers.co.za

Mr Willie Human | Email: willie.h@ixengineers.co.za

Mr Jonathan Royston | Email: jonathan.r@ixengineers.co.za

Contents

Executive Summary

This report defines the meaning of the services, External Bulk services, Internal Bulk services and Internal services. The phasing of the SEZ implementation including timelines planned start and completion dates.

The EMSEZ Land Use and billing process, the South African Energy Metallurgic Base (Pty) Ltd (SAEMB) operation team and the responsibilities within the EMSEZ. The non-industrial township development and land use, land parcels and water and electricity demand.

Plant capacity and land portions required by each investor, the administrative area and the makeup of buildings within the area are listed. The billing process model and the operation procedure are outlined which includes:

- Logistics,
- Water (potable and process) and sanitation
- Energy
- Transport
- Environmental,
- Safety.

The details and guidelines for the above processes are listed within the document.

Abbreviations

Abbreviation	Description
ANPR	Automatic number plate recognition
EIA	Environmental Impact Assessment
EMP	Environmental management plan
EMSEZ	Energy Metallurgical Special Economic Zone
EPC	Engineering Procurement Construction
FEED	Front end engineering design
HR	Human Resources
ICT	Information and Communication Technologies
ITB	Invitation of bidder
MMSEZ	Musina Makhado Special Economic Zone
MMSOC	Musina Makhado State Owned Company
SAEMB	South African Energy Metallurgical Base
REL	Rear end loader
SARS	South African Revenue Service
SDP	Site Development Plan
SEZ	Special Economic Zone
SOC	State Owned Company
SOE	State Owned Enterprise
Tpa	Ton per annum
Mpta	Million ton per annum

1. Services

1.1. External Bulk Services

Also commonly known as **Bulk Services.** The responsibility of the SOC, SOE's, National, Provincial, local government and Local Municipality to provide. Include water reservoirs and distribution networks, electrical installations and distribution networks, sewerage treatment works and mains, roads and storm water.

1.2. Internal Bulk Services

The scope of work for internal bulk services include, internal transport rail, roads with surfacing and kerbs, stormwater structures and junction boxes, water, including process irrigation and sewerage systems, sub-soil drains, sleeves, electrical reticulation, gas internal system, bulk earthworks, infrastructure, solid waste and industrial waste, rail, shunting yards and fencing, ICT and fiber network, process and sewer treatment plants, The internal bulk services will be shown on the internal EMSEZ land use layout plan

1.3. Private Investment

Will be the services required by the individual land leaser (plant owners/investor) depending on the operations undertaking. This could include, industrial security, industrial automation, drive technology, conveyor technology, power utilities, transportation and logistics, machinery and plant construction, high pressure technologies, mining systems, oil & gas downstream, refining, process water, industrial waste, etc. The internal services will be shown on the Site Development Plan (SDP).

1.4. Cost Estimate of Services

The total cost estimates for the tree scenarios mentioned above are shown in Table 1 below.

In terms of the Operating Agreement entered into, the following responsibilities for funding are defines:

- External Bulk Services – Government of South Africa
- Internal Bulk services – Operator
- Internal services and plant – Private Investors

Table 1: **Cost Estimates Summary**

MMSEZ Summary of External & Internal Bulk Services and Private Investment.			
1. External Bulk Services		**Estimated Amount**	**Comments**
Rail Upgrade		R 24,485,500,000.00	Pyramid to Musina
Road Upgrade		R 6,800,000,000.00	Polokwane to Musina
Zim Bulk water supply		R 12,730,000,000.00	
Additional Land		R 24,000,000.00	3000 ha for waste material + 1000 ha for non-industrial land
Power Installation		R 12,000,000,000.00	Transmission lines upgrade, relocating lines, substation & switching station
Sub Total		**R 56,039,500,000.00**	
2. Internal Bulk Services		**Estimated Amount**	**Comments**
Rail Sidings		R 1,032,099,675.00	
Internal Roads		R 562,572,671.76	
Water treatment and supply		R 3,660,536,719.86	
Power Distribution		R 9,000,000,000.00	
Non- Industrial		R 1,300,000,000.00	
Technology input		R 587,940,000.00	New fiber optic network & 5G network, etc.
Bonded Area		R 10,500,000,000.00	
Logistics Centre		R 7,500,000,000.00	
Administrative Centre		R 6,000,000,000.00	
Sub Total		**R 40,143,149,066.62**	
3. Private Investment	**US$ Million**	**Estimated Amount**	**Comments**
Thermal power plant	$3,750.00	R 56,250,000,000.00	
Coal washery	$150.00	R 2,250,000,000.00	
Coke plant	$759.09	R 11,386,350,000.00	
Heat recovery power generation	$214.19	R 3,212,850,000.00	
High vanadium steel plant	$500.00	R 7,500,000,000.00	
High Manganese steel	$600.00	R 9,000,000,000.00	
Ferromanganese plant	$150.00	R 2,250,000,000.00	
Silicon manganese plant	$266.00	R 3,990,000,000.00	
Cement Plant	$145.00	R 2,175,000,000.00	
Refractories factory	$90.00	R 1,350,000,000.00	
Stainless steel plant	$2,400.00	R 36,000,000,000.00	

Ferrochrome plant	$1,500.00	R 22,500,000,000.00	
Lime plant	$66.00	R 990,000,000.00	
Vanadium-titanium magnetite project	$4,780.00	R 71,700,000,000.00	
Processing zone	$650.00	R 9,750,000,000.00	
Machinery zone	$500.00	R 7,500,000,000.00	
Sub Total	**$16,934.28**	**R 247,804,200,000.00**	

2. Phasing

2.1. Definition

Each project phase is goal-oriented and ends at a milestone. Reaching these milestones means the project progresses. Each phase can be divided into sub-phases. Typical project phases are Project Initiation, Basic Engineering, Early works, Detail Engineering, Procurement, Construction and Close out.

2.2. Initiation Phase

The project initiation is the creation of the project that entails the definition of the project's purpose, primary and secondary goals, timeframes and timelines of when goals are expected to be met. The initiation covers most of the planning including the master planning of the project. The duration of the initiation should be +/- 12 months to be completed subject to the EIA process, December 2019.

2.3. Basic Engineering

Basic Engineering is a basis of detail design and engineering development for construction. In many cases this package may also be called as front-end engineering design (FEED) and used as an invitation of Bidder (ITB) or tender package for the EPC Contract. The Basic engineering packages will be designed by the plant owner/operator and reviewed and approved by iX engineers, to conform with South African Compliance. This Phase will run for 18 months concurrently with the Early Works Phase.

2.4. Early works and Internal Bulk Infrastructure

Early works is a generic description for site preparation works that might take place prior to work under the main construction contract. This will include the internal bulk services, (ref: 1.2). The Early works programme will run for 24 months. Starting in 2020, 6 months into the Basic Engineering Design Phase. Will be complete at end of Year 3. (2021)

2.5. Detail Engineering Designs

Detail engineering are studies which creates a full definition of every aspect of a project. Detail engineering follows Front End Engineering Designs (FEED) and Basic

Engineering previous steps on the engineering process for a project development, it contains in detail diagrams and drawings for construction , civil works, instrumentation , control system, electrical facilities, management of suppliers, schedule of activities, cost , procurement of equipment , economic evaluation and also environmental impact before starting of construction of a project. The Detail engineering Package will run for 18 months and finish at the end of year 3 (2021)

2.6. Procurement

Procurement is the process of finding and agreeing to terms, and acquiring goods, services, or works from an external source, often via a tendering or competitive bidding process. Procurement is used to ensure the buyer receives goods, services, or works at the best possible price when aspects such as quality, quantity, time, and location are compared. Corporations and public bodies often define processes intended to promote fair and open competition for their business while minimizing risks such as exposure to fraud and collusion. The procurement Process will run for 6 months, finishing at year 3,5 (Mid 2022).

2.7. Construction Phase

The construction phase will cover all land leased by investors to construct plants for operations, commencing 2020 pending EIA approval.

- Early works and internal Bulk infrastructure: Commencing construction beginning of 2020, planned to be completed end of 2021
- Phase 1 of plant construction: Commencing construction beginning 2022 and completing 2026.
- Phase 2 of plant construction: Commencing construction 2026 and completing 2029
- Phase 3 of plant construction: Commencing construction 2029 and completing 2031
- All plants to be implemented will form part of the SDP and Master Plan.

2.8. Planned plant capacity

Table 2: Planned plant capacity

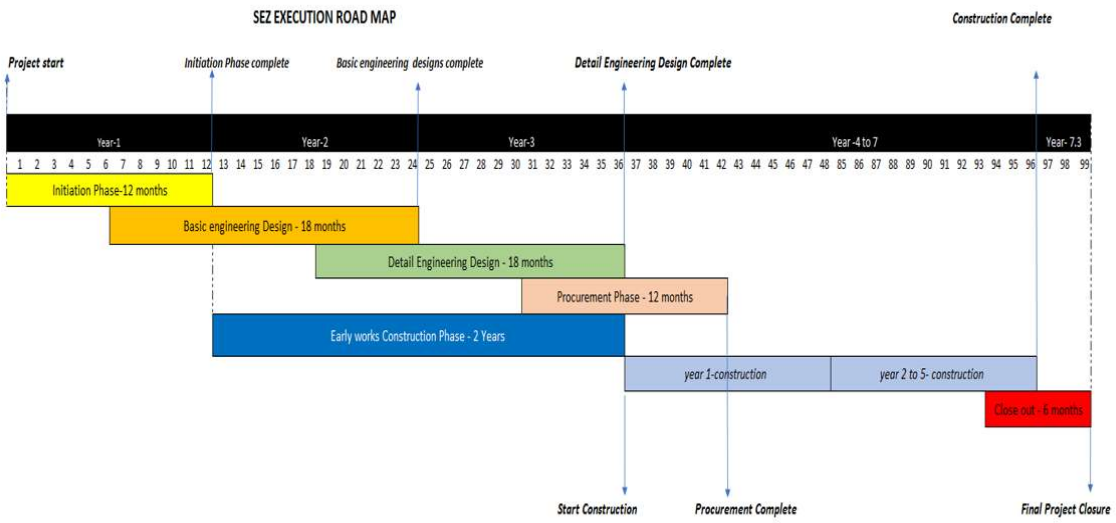
No.	Plants	Total planned capacity 10k tpa
1	Coal- fired power plant	3300
2	Coal washery	2000
3	Coking chemical plant	300
	Heat Recovery power generation	390

No.	Plants	Total planned capacity 10k tpa
4	High Vanadium Steel plant	100
5	High Manganese steel Plant	100
6	Ferromanganese Alloy plant	50
7	Silicon Manganese plant	50
9	Cement Plant	200
10	Refectories factory	50
11	Stainless steel plant: 200 series stainless steel	300
12	Ferrochrome Alloy Plant	300
13	Limes plant: metallurgical lime	100
14	Vanadium-Titanium Magnetite	1000
20	Sewage Treatment Plant	14
21	Water Treatment Plant	30

2.9. Close Out

Close out is the process of signing off all erected plants and structures and certification by authorities. This process will take 6 months for phase 1 and will be completed in Year 9, if all goes according to plan.

Figure 1: **High level schedule**



2.9.1. Closure fund

Broadly speaking, there are various methods that will be deemed acceptable for financial provision under the proposed regulation. These are one of, or a

combination of, a trust, a premature closure guarantee, or a deposit into an account specified by the Minister, to whom all interest accrues. This provision must be audited regularly to ensure alignment with the annually assessed liabilities at all times, with a period of 30 days to remedy any deficit.

In light of the difficulty of quantifying actual costs, as well as the stipulations regarding financial provision, it is believed that a philosophy of regular contributions to a moderate risk rehabilitation fund, with capital guarantees in place, makes financial sense and can help to provide efficiently for any growth in the closure liability.

2.10. General Assumptions

- Hours per year is 7200h/a.
- The market destination of final product:
    - China - 70%
    - South Africa – max 10%
    - Rest of Africa (mostly SADC incl DRC – 20%
- Water Treatment facilities:
    - Industrial & Domestic Plant – 385.7 Ml/day
    - Process & sewage treatment plant - 140 Ml/day
- Lease period = 99 plus 30 years
- Water discharged into Sand river – max 9Ml/day treated to RSA / DWS Standards. A process to further re-use will be investigated during detail design.
- Mopane Train station – layout revised and now better impact.

3. Land Use EMSEZ

The Land belongs to the community, the land will be leased from the community. The SOC will negotiate the land lease agreement (already completed).

The Land portions listed in the table below:

Table 3: **Land portions of the different plants**

No.	Plants	Land Size in Hectare
1	Coal- fired power plants:	600
2	Coal washery	Included in 1
3	Coking chemical plant	420

No.	Plants	Land Size in Hectare
4	Heat Recovery power generation	Included in plants
5	High Vanadium Steel plant	130
6	High Manganese steel Plant	280
7	Manganese Ferro alloy plant	Included in 13
8	Silicon Manganese plant	Included in 13
9	Domestic Waste Site	4
10	Cement Plant	108
11	Refractories factory	Included in 10
12	Stainless steel plant: 200 series stainless steel	300
13	Ferrochrome Alloy Plant: ferrochrome	500
14	Limes plant: metallurgical lime	160
15	Vanadium-Titanium Magnetite	1000
16	Administrative Centre	110
17	Logistic Centre	50
18	Bonded area	100
19	Machinery zone	400
20	Processing zone	400
21	Sewage Treatment Plant	20
22	Water Treatment Plant	10
23	Environmental Conservation Area	2020
24	Fuel Storage	6
25	Gas Storage	2
26	Water Reservoir	TBC
27	Eco Village changed to Visitors lodge	TBC
TOTAL		**4740**

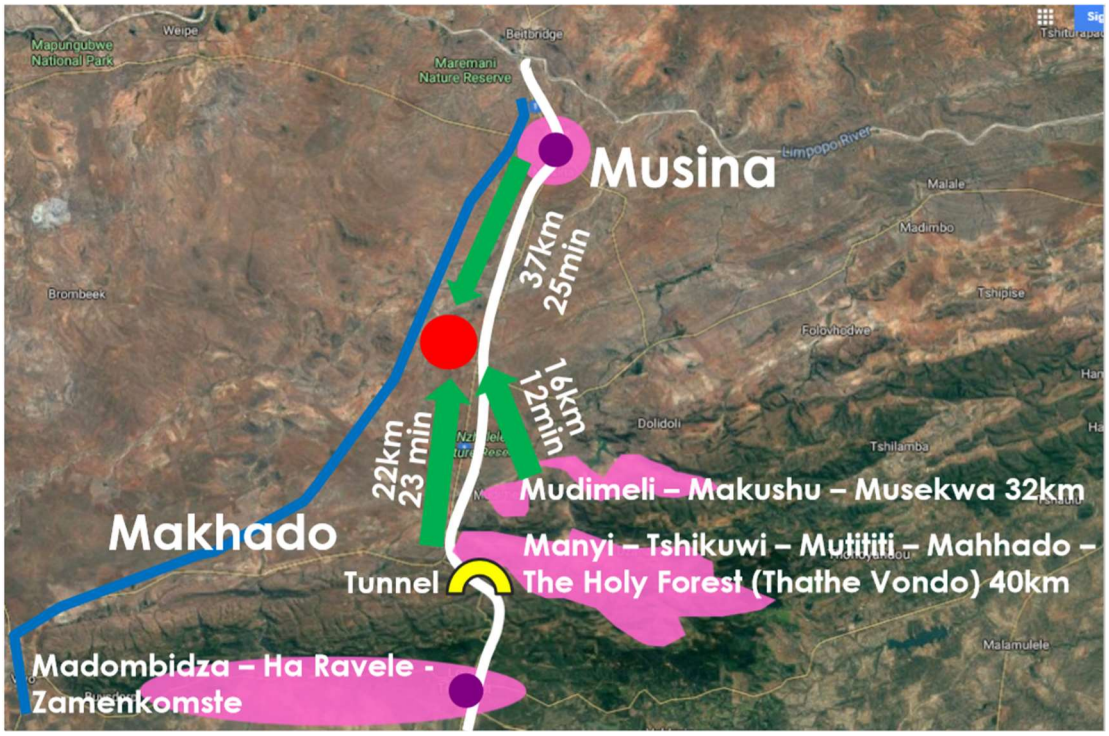
Administrative center will include:

- Security buildings
- Weigh bridge buildings

- Entrance and Exit gates
- Fire station
- Medical clinic
- Data center
- Office blocks
- Canteen and recreation center
- Maintenance workshops
- Customs control offices

It must be note that additional land of about 3 000 ha will be needed for storing plant waste material (e.g. power station ash) and additional land of about 1 000 ha for establishing the residential area. See Figure 2 below for potential areas earmarked to use for residential areas.

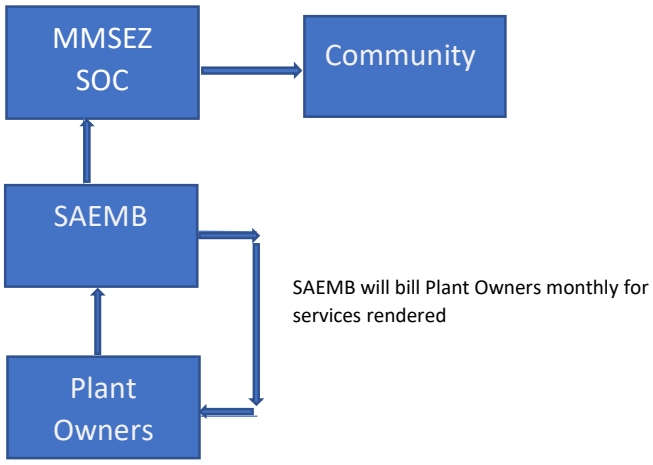
Figure 2: **Potential residential areas close to Makhado.**



All waste during phase one can be dealt with on the existing sites.

4. Operation Process

Figure 3: **Operation process**



4.1. The SAEMB (SEZ Operator) will bill the Plant owner monthly for the following services rendered:

- Revenue is made up of the following income streams (SAEMB) for capital, operating and maintenance responsibility:
    - Potable water purification and distribution;
    - Process water treatment & distribution;
    - Electricity distribution;
    - Environmental management fee including a rehabilitation fund;
    - Municipal waste collection
    - Rates (refuse) & taxes (property) payable to the municipality
    - Operator levy to all investors for the maintenance of roads, storm water, security and other non-met red service utilities;
    - Sanitation (sewerage) collection & treatment,
    - Industrial waste management, and
    - Land lease to all investors.

- The SAEMB will enter into Service Level Agreements and pay the applicable service rates to the service providers and Local Municipalities monthly for the following services:
    - Municipal waste collection or fee at landfill site

- Taxes payable applicable to the municipality
- Bulk service providers e.g. water and electricity
- Land lease cost to SOC

- The SOC will pay the community for the following:
  - Land lease

5. Operations

Special economic zone is geographically delimited area, which is physically secured, has single management and administrative unit. They are designed to help stimulate both foreign and domestic investment boost exports and create new employment opportunities.

The operations should begin in 2025, with plants coming online at different intervals. The SAEMB Operation & Maintenance team will consist of, Operations Board of Directors, Operations General Manager, Technical Manager, Secretary/Receptionist, SHERQ Manager, Safety Officers, Environmental Officer, Financial Manager, Debtors Clerk, Creditors Clerk, Risk Control Officer, Fire Chief, 4 Firemen, Cleaning team Supervisor, 4 Janitors, Logistics Manager, Logistics Officer, HR Manager, HR Admin, Legal advisor, 2 Marketing Specialist, ITC Specialist and ITC Support.

This team will manage and maintain the SEZ facilities, this will cover items within the Zone and the perimeter fence. Control measures will cover:

- Manage the access control to the plant, permit issuing for employers, employees, vehicle permits and visitors, security, badging of personnel and record keeping. This will entail the use of ANPR systems (automatic number plate recognition), facial recognition and other advanced technology.
- Weigh bridges monitoring and control, including custom officials.
- Manager all technical aspects electrical, storm water, roads, fencing, gates.
- Manage safety compliance, site inductions, safety training, monitor HSE.
- Monitor compliance, spillages, air quality, solid waste, litter, hazardous materials.
- Cleaning of roads, spillages, grass cutting verges, cleaning of offices, ablution blocks etc.
- Internal Medical station support, for medical conditions and accidents.
- Perimeter fence monitoring and control, weigh bridge monitoring and control.
- Maintenance of the road reserves, repairs to potholes
- Filling, switchboard, appointments, control accounts and payments

- Manage overall financial transactions, new investor relationships
- ITC and Surveillance support and monitoring.
- Billing and coordination.

Major repairs and maintenance that cannot be handled by the internal team will be outsourced locally, from external service provides. Equipment for maintenance and repairs will be supplied by the SAEMB operations fleet.

6. Non-Industrial Zone - Land Use

6.1. Township Development Strategy

The land required for township development will be zoned for commercial and residential use. The Land Use Scheme sets out the various Use Zones applicable to land and buildings in the Cities and list the purpose for which such land may and may not be used, and the purpose for which such land and buildings may only be used with consent of the Council.

The land will belong to the SOC and land parcels will be leased to approved tenants, for commercial and residential use. This process will be agreed with the SOC. Design and development of the bulk infrastructure will be the scope of the SOC.

The labour figures for the project are indicated in the table below:

***Table 4*: Total Labour figures of the EMSEZ site.**

Executives	Professionals	Regular Staff	Total Labour
6 994	4 842	41 964	53 800
85%	85%	95%	Local
15%	15%	5%	China

The detail per plant is indicated in the attached spreadsheet called “Total summary of planning design technical economy parameters of South African Energy Metallurgical Special Economic Zone Projects” attached as Annexure A.

The Township Development was planned to use the following assumptions in the table below:

Table 5: **Township development assumptions**

Description	Buildings no	Size m^2	Total Size m^2
Commercial District			
Office Buildings	6	5,000	30,000
Government Offices	1	5,000	5,000
5 Star Hotel	1	20,000	20,000
3 Start Hotel	1	20,000	20,000
Shopping Malls, Supermarket & Farmers Market	5	12,000	60,000
Congress centre, worship, etc	6	5,000	30,000
Smart Buildings	1	5,000	5,000
Sub Total			**170,000**
Living Service Area (Residential)			
Large size erf	801	400	320,400
Medium size erf	3204	200	640,800
Apartment Blocks	500	400	200,000
Sub-Total			**1,161,200**
Miscelaneous			
Hospital x 1	1	20,000	20,000
School x 4	4	7,500	30,000
Musseum			
Gymnasium x 2	2	5,000	10,000
Central Plaza			
Parking (Basement)		40,800	40,800
Parking (Open)		32,500	32,500
Sub-Total			**133,300**
Total			**1,464,500**

6.2. Infrastructure Demand

The demand for which the capacity of the infrastructure should be based on is listed in the table below. Assumptions and Clarifications these demands can be seen in the section that follows.

Table 6: **Capacity of the infrastructure**

Desciption	Water Demand kL/day	Sewer Demand kL/day	Electricity Demand kwh/day
Commercial District			
Office Buildings	150	120	16,438
Government Offices	25	20	2,740
5 Star Hotel	180	144	35,616
3 Start Hotel	180	144	35,616
Shopping Malls, Supermarket & Farmers Market	300	240	39,452
Congress centre, worship, etc	150	120	19,726
Smart Buildings	35	28	2,740
Sub Total	**1,020**	**816**	**152,329**
Living Service Area (Residential)			
Large size erf	801	641	40,050
Medium size erf	2,243	1,794	80,100
Apartment Blocks	1,000	800	25,000
Sub-Total	**4,044**	**3,235**	**145,150**
Miscelaneous			
Hospital	200	160	12,200
Schools	270	216	16,438
Musseum			
Gymnasiums	240	192	5,479
Central Plaza			
Parking (Basement)			
Parking (Open)			
Sub-Total	**710**	**568**	**34,118**
Total	**5,774**	**4,619**	**331,597**

6.3. Existing Mine

The existing mine in the middle of the EMSEZ site is currently not operational. The following options should be investigated namely:

- Take over the responsibility of the mine rehabilitation and use it for a storage dam.
- Leave it as it is for the owner to rehabilitate.

7. External Bulk Infrastructure requirements

External bulk services are the responsibility of the Musina Makhado State-Owned Company (SOC) and it includes the supply of the following:

- Upgrading of existing roads to the SMSEZ.
- Building of new interchanges from the N1 national road.
- Upgrading and installation of existing and new railway lines.
- Providing of bulk water up to the boundaries of the EMSEZ site.
- Providing of electricity/substation(s)/switch station(s) to the boundaries of the SMSEZ and relocating an existing 132kVA line.
- Telecommunication/data facilities up to the border of the EMSEZ site.
- Bulk services require a ten-year implementing planned process.
- It is foreseen that all machinery and equipment will last beyond 30 years.

7.1. Transport

7.1.1. Roads

The R525 needs to be upgraded to make provision for two new entries as part of the inbound traffic to the Northern side of the SMSEZ site. One is for truck access with weigh bridges, parking and security check points and one for staff and visitors access drop off zone with security gates and parking for busses, taxis and cars. The pickup of staff and visitors inside the EMSEZ site is a separate system operated by the operator. Servitudes of 50 m will be registered for all the roads inside the EMSEZ site. An exit is planned for all outbound material and products that will leave on trucks at the southwestern side of the EMSEZ site.

A new interchange between the R525 and the N1 northeast of the EMSEZ site are planned to make provision for the inbound traffic into the EMSEZ site. The filling station and e-toll station close to this interchange need to be investigated and dealt with. Another interchange at the southeast side of the EMSEZ site will make provision for the outbound traffic.

It is foreseen that all resources from Tubatse/Steelpoort to the EMSEZ will be transported by road trucks. Vehicle size of the trucks will be double 40 feet containers on the truck and one on a trailer.

A road (ring road) is planned on the boundary of the EMSEZ site which will be fenced off to give access to security personal all around the site. For more detail see drawing no. 300875-GE-DAL-001 (Proposed Master Layout Plan) attached as Annexure B.

7.1.2. Rail

Transnet will be responsible to handle the main bulk handling of all the material. Electric locomotives will run up to Polokwane where after diesel locomotives will be used up to Mopane station and inside the EMSEZ site. Some rail sections need to be double rails and electrified which need further investigation?

It is planned to upgrade and expand the existing Mopane railway station and to give each internal site in the EMSEZ site access to rail transport. Servitudes of 33m for all the railway lines will be registered inside the EMSEZ site. For more detail see drawing no. 300875-GE-DAL-001 (Proposed Master Layout Plan) and drawing no 300875-GE-DAL-002 (Proposed Zones Layout Plan). The total planned bulk transport tonnage is about 45,5 Mtpa. The new design will make sure that the upgrade and expansion of the Mopane rail station will not have any effect on the neighbor mine. It is foreseen that 70% of the final products will go to China, 20 to South Africa and 10% to the rest of Africa.

7.1.3. Airstrip

It is confirmed that there will be no air strip built at the EMSEZ site. Airstrips at the neighbor towns can be used and must be investigated. A helicopter landing pad will be built close to the central industrial area to handle the evacuation of people in an emergency.

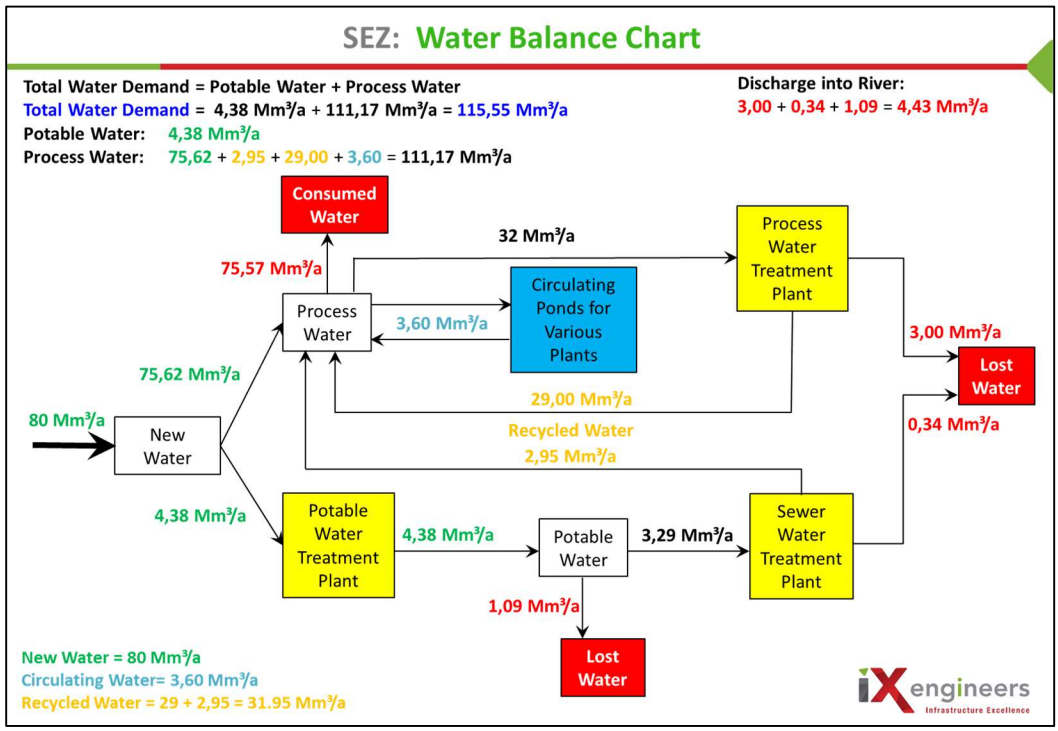
7.2. Water

7.2.1. Water Supply

Due to the shortage of water in the Limpopo area it is foreseen to get water from Zimbabwe. Water studies completed by AECOM and SMEC and socio-economic impact assessment study done by DEMACON were used to determine the shortfall and water requirements for the EMSEZ site as well as water requirements around the site due to expansions of the Musina and Makhado local municipalities involved as well as the potential influx of people due to the economic growth in the area. Water will be provided up to the boundary of the different site inside the EMSEZ site. Water connection points with meters for process and potable water will be installed where the different investors will connect when they develop their own individual site.

According to the latest information received from the operator and different investors, it is planned to supply 80 Mm^3/a of new water to the EMSEZ site. The schematic water balance of the EMSEZ site is shown in Figure 4 below.

Figure 4: EMSEZ site water balance



Water for the fire system is included in the process water. We don't need a separate system for fire water.

The wastewater in the process mainly include production wastewater, production sewage and domestic sewage. The production wastewater and sewage will be drained into the production wastewater conditioning tank for pretreatment through the drainage pipeline network. After being treated it is drained into the integrated water treatment system where it goes through the process of coagulation-settling-filtration and then the water is reused for production with zero discharge to the outside.

Domestic sewage after being treated are used for watering plants and the rest is discharged outside.

Circulating water without pollution (cooling water, etc.) will be continuously replenished with fresh (new) water.

7.2.2. Water Demand

The water demand for the MMSEZ as well as new mines in the area and the growth of the two municipalities involved are presented in Table 7 below.

Table 7: Water demand for the MMSEZ site.

Description	Aecom Report Values Base Date 2010		Phase 1 2020		Phase 2 2030		Phase 3 2040	
	Water Required (million m3/a)	Water Balance (million m3/a)	Water Required (million m3/a)	Water Balance (million m3/a)	Water Required (million m3/a)	Water Balance (million m3/a)	Water Required (million m3/a)	Water Balance (million m3/a)
Option 1: Demand of the MMSEZ, new mines servicing SEZ and 2x Mun Domestic needs			**93.24**		**126.69**		**132.54**	
Options 2: Total catchment (Sand & Nzhelele) deficit excluding ALL interventions				**-96.75**		**-152.60**		**-167.65**
Options 3: Total catchment (Sand & Nzhelele) deficit excluding Possible interventions				**-45.29**		**-101.14**		**-116.19**
Options 4: Total catchment (Sand & Nzhelele) deficit including ALL interventions				**-45.29**		**-33.68**		**-48.73**

It is recommended in the absence of a detail study to prepare in the Master Planning phase for Option 1 which is the demand of the MMSEZ including the new mines planned servicing SEZ and 2x Mun Domestic needs only. This means water transfer capacity of:

- Phase 1 demand for year 2020 – 2029: 95 Mm^3/ annum
- Phase 2 demand for year 2030 – 2039: 127 Mm^3/ annum
- Phase 3 demand for year 2040 – 2049: 133 Mm^3/ annum

7.2.3. Water Storage

A storage dam with 7 days capacity is planned at the southern area of the EMSEZ site on top of the hill in that area which is the highest point of the EMSEZ site.

7.2.4. Water Treatment

There are four water treatment plants planned for the EMSEZ site. The first treatment plant is to treat process water received from Zimbabwe in terms of microbiology, the second plant to treat process water recycled from the different plants, the third plant will treat potable water to the different sites in the EMSEZ site and the forth plant will treat sewer water that will be recycled back to the process treatment plant. Refer to Figure 3 above for more detail.

7.2.5. Storm Water

The existing natural flood water course will be diverted via a new proposed storm water canal through the EMSEZ site. It is proposed to install a new industrial storm water treatment plant in the northern boundary of the site to make sure that there is no contamination of ground water taking place.

7.3. Electricity

The master plan is based on an Investor developing a power plant within the EMSEZ proving power to the EMSEZ. The plan is based on two phases namely 1) demand during construction will be supplied by Eskom and 2) as soon as the internal power plant is constructed it will carry on supplying the internal demand of the different plants. The total planned demand is shown in Figure 5 below.

Figure 5: Power requirement

From the graph the internal power plant will be able to export energy after year nine. The SOC will also make provision to provide electricity/substation(s)/switch station(s) to the boundaries of the SMSEZ and relocating an existing 132kVA line.

1MVA is required during the construction phase to be provided from Eskom.

Eskom are planning to upgrade the current network of 132kVA to a 400kVA in 2024.

7.4. Communication/data

Bulk communication and data facilities will be provided by the SOC either via fiber or satellite feed. This will be done to a central communication tower/connection point. LEDA to confirm if they have an ITC masterplan for the province?

8. Internal Bulk Infrastructure requirements

8.1. Transport

8.1.1. Roads

All internal roads will be the responsibility of the internal investors of the different plants. These roads will tap off from the existing roads provided by the investor. The detail of these roads is currently not available. This will become available as soon as the individual investors comes on board.

8.1.2. Rail

All internal rails will be the responsibility of the internal investors of the different plants. These rails will tap off from the existing rails provided by the investor. The detail of these rails is currently not available. This will become available as soon as the individual investors comes on board.

8.2. Water

8.2.1. Water Supply

Both process and potable water will be supplied from the connection points installed by the SOC at their site boundary. All water will be supplied from the main water storage dam through the different treatment plants. Recyclable water will be recycled to the different treatment plants.

8.2.2. Storm Water

Storm water from the different sites inside the EMSEZ site will be channeled into the main storm water canal that is running through the site.

8.3. Electricity

Electricity will be supplied from the power station built in the EMSEZ site to the different investor's sites substation(s)/transformers/switching gear via either overhead cables (above 88kVA) or with underground cables (if below 88kVA).

8.4. Communication/data

The different investors will connect their data/communication transport lines to the bulk connection point provided by the SAEMB nominated service provider.

8.5. Fire & Rescue Services

Fire and rescue services will be included in the residential area as well as inside the EMSEZ site to deal with chemical and electrical fire, Hazchem or other emergency situations.

8.6. Implementation

The power station phasing may include all ground works where after some of the equipment can be installed in a modular/phased approach.

9. Internal Services

Internal services will include communication, data, water, sewer and power reticulation inside the different plants, office blocks, workshops and residential areas.

10. Logistics

10.1. Inbound

It is planned that all inbound transport of material will take place either via rail or truck road transport. Access to all site were planned for both methods. Weighbridges will be installed to weigh all incoming and outgoing material. It is planned to upgrade the existing Mopane railway station with a shunting yard to cater for 50 trains per day with each 50 wagons per train and 300 road trucks per day (at full capacity in phase 3) with enough parking area for the road trucks.

Provision were made for bulk fuel and gas storage facilities in the northern area of the EMSEZ site.

A bonded area was provided where al final products can be stored, administrated, inspected, weighed, checked, sealed and loaded for export or local use. Weighbridge(s), administration center and allocated areas will be established to cater for each of the different investors to avoid double handling.

The total inbound and outbound tonnage of materials are shown in the table below. Possible sources of bulk material inbound is provided in annexure E.

Table 8: **Inbound and Outbound tonnages.**

No.	Project	Final agreed external cargo transport volume by railway for planning（10k tpa）	
		In	Out
1	Thermal power plant	330	Ash dump
		495	Ash dump
2	Coal washery		
3	Coke plant	140	Internal
		140	Internal
		140	Internal
	Heat recovery power generation		
4	High vanadium steel plant	Internal supply	50
		Internal supply	50
5	High Manganese steel	60	50
		60	50
6	Ferromanganese plant	20	10
		75	45
		75	45
7	Silicon manganese plant	30	25
		30	25
8	Domestic waste Site		
9	Cement Plant	160	100
		160	100
10	Refractories factory	21	Internal
		32	Internal
11	Stainless steel plant	Internal	100
		Internal	100
		Internal	100
12	Ferrochrome plant	70	5
		247	25
		153	10
13	Lime plant	220	Internal
14	Vanadium-titanium magnetite project	379	50
		379	50
		758.2	Internal
		379	Internal
15	SEZ administrative center		
16	Logistics center		
17	Bonded area		

No.	Project	Final agreed external cargo transport volume by railway for planning（10k tpa）	
		In	Out
18	Machinery zone		
19	Processing zone		
20	Sewage treatment plant		
21	Industrial & domestic water plant		
23	Fuel storage		
24	Gas Storage		
25	Water Reservoir		
26	Eco Village changed to Visitors lodge		
	TOTAL	**4 552.96**	**1 090.00**

10.2. Outbound

The train inbound and outbound facilities will be the same. All trains will come in and out on the same rail tracks/path. Enough rail lines will be provided to handle the volume and shunting required and planned.

A bonded area was provided where al final products can be stored, administrated, inspected, weighed, checked, sealed and loaded for export or local use. Depending on the final products or materials, it can be taken out of the EMSEZ site (bonded area) either by train or road trucks in sealed containers. An exit only for final products will be provided at the southwest side of the EMSEZ site. Therefore, all materials will flow from the north side to the south side of the EMSEZ site. The total outbound tonnage is indicated in Table 7 above.

10.3. Custom Control model

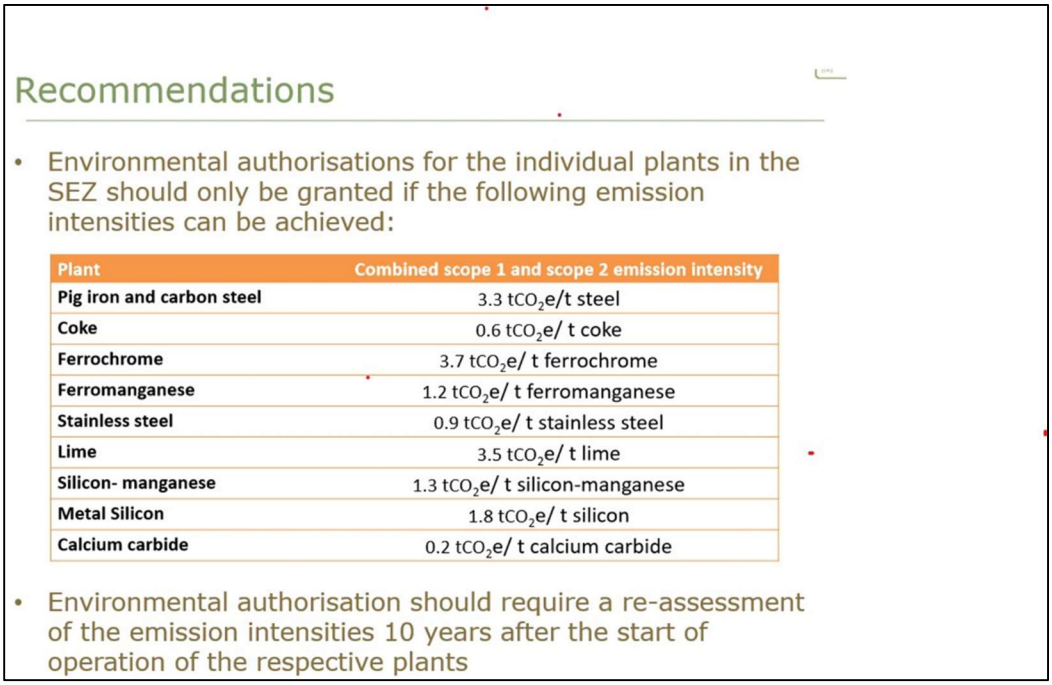
The custom control (SARS) system/model still needs to be designed in close partnering with the Customs Department, taking lessons learnt from similar operations in South Africa (COEGA, Saldanha, etc) as well as Globally in consideration.

11. Environmental management

11.1. Emission targets

Due to global warming, emissions will play a very important role in the approval of the EIA application. The international guidelines for emissions targets for the different plants planned at the EMSEZ site are spelled out in Figure 6 below.

Figure 6: **Maximum Emission Targets**



Recommendations

- Environmental authorisations for the individual plants in the SEZ should only be granted if the following emission intensities can be achieved:

Plant	Combined scope 1 and scope 2 emission intensity
Pig iron and carbon steel	3.3 tCO_2e/t steel
Coke	0.6 tCO_2e/ t coke
Ferrochrome	3.7 tCO_2e/ t ferrochrome
Ferromanganese	1.2 tCO_2e/ t ferromanganese
Stainless steel	0.9 tCO_2e/ t stainless steel
Lime	3.5 tCO_2e/ t lime
Silicon- manganese	1.3 tCO_2e/ t silicon-manganese
Metal Silicon	1.8 tCO_2e/ t silicon
Calcium carbide	0.2 tCO_2e/ t calcium carbide

- Environmental authorisation should require a re-assessment of the emission intensities 10 years after the start of operation of the respective plants

Currently the emissions provide in the attached spreadsheet called "Total summary of planning design technical economy parameters of South African Energy Metallurgical Special Economic Zone Projects" (Annexure A) cannot now be compared with the guidelines presented in Figure 6 above. It is recommended that all emission targets provided by the operator and different investors are recalculated (emissions, mass balances, etc.) during the individual EIA process where the different investors do their own EIA application for each different site inside the EMSEZ site. The SAEMB and MMSOC will need to compare the guidelines with the information received from the plant operators.

11.2. Plant EIA process

The National Environmental Management Act No. 107 of 1998 will apply. Every investor is responsible to compile an EIA report and get approval for each of the different plants that are planned to be constructed. The operator is also responsible to get an EIA done and approved for the whole EMSEZ site. No activity may go ahead without EIA approval!

11.3. EMP

An environmental management plan (EMP) needs to be compiled which spell out all environmental activities and procedures that need to be followed. This plan includes milestones of critical activities, mitigation actions, responsible people, etc.

There are currently about 200ha of wetlands and 150ha of Baobab trees. To mitigate this offset land were provided in the northern and southern areas of the original EMSEZ site. It must still be determined if the current land earmarked will be enough?

11.4. Building Heights

The heights of the different buildings as well as the heights of the plants that have high smokestacks are presented in the table below.

Table 9: **Heights of buildings and Stacks**

No.	Project	Maximum height (m)	
		Plant	Stacks
1	Thermal power plant	80	210
2	Coal washery	15	N/A
3	Coke plant	25	80
4	Heat recovery power generation	25	N/A
5	High Vanadium Steel plant	25	38
6	High Manganese steel	25	38
7	Ferromanganese plant	25	38
8	Silicon manganese plant	25	38
9	Domestic Waste Site	13	N/A
10	Cement Plant	32	38
11	Refractories factory	13	N/A
12	Stainless steel plant	25	38
13	Ferrochrome plant	25	38
14	Lime plant	15	N/A
15	Vanadium-titanium magnetite project	25	38
16	SEZ administrative center	13	N/A
17	Logistics center	13	N/A
18	Bonded area	13	N/A
19	Machinery zone	18	N/A
20	Processing zone	25	N/A
21	Sewage treatment plant	10	N/A
22	Industrial & domestic water plant	10	N/A
23	Environmental Conservation Area	N/A	N/A
24	Fuel storage	13	N/A
25	Gas Storage	13	N/A

26	Water Reservoir	21	N/A
27	Eco Village changed to Visitors lodge	13	N/A

11.5. Monitoring & control

The prevailing wind direction is from the southeastern side of the EMSEZ site. Environmental monitoring is compulsory and form part of the environmental law. Typical issues like emissions, dust fall out, sound, visual, water quality, etc. must be monitored and annual reports must be provided to the applicable authorities. If there are critical issues that does not comply with the law and regulations limits, it must be reported immediately to the authorities.

11.6. Rehabilitation

Like the rehabilitation fund model that applies in the mining industry, it is foreseen that a similar process should be followed at this project. Each investor needs to contribute yearly to a rehabilitation fund in order when everything close after the life span of the project each investor would need to rehabilitate their own site to get it back to the state it was before the development.

11.7. Waste Management Infrastructure and Resources Demands

The waste generation figures to be produced by the relevant industry needs to be calculated based on norms in the industry. The planning, infrastructure equipment and resource requirements and needs will be based on these figures. Refer to annexure D for more detail report.

11.7.1. Introduction

The respective industry will have to make provision for a waste management service to be rendered in terms of the waste hierarchy as set out in Section 16(1)(a)-(c) of NEMWA.

11.7.2. Waste Disposal Requirements

General and low quantities of industrial hazardous waste will be taken off site to the closest suitable and authorised landfill (transferred from a centralised WMA within the EMSEZ complex). This can be either to an integrated hazardous waste management facility in the case of hazardous waste, (of which the closest existing facility is in Gauteng – Holfontein or Vlakfontein or a “to be identified suitable site on a property close-by to the EMSEZ complex that need to be purchased for the establishment of the integrated hazardous waste management facility following the waste management licensing an EIA process – the latter option in the medium to long term), or in the case of general waste (i.e. domestic waste, garden waste, builders waste, business waste, non-hazardous industrial waste etc) to the existing Makhado - and/or Musina landfills.

Since each and every plant owner will be responsible to manage the waste generated within their respective plants, their responsibility will be to establish their own disposal facility for the disposal of their industrial hazardous waste they generate (if in large quantities, and as an option in the short term, until the outside "to be established integrated waste management facility" will be established). This will be specifically important for the power station industrial ash, which at this stage is the only waste stream known to be generated in large quantities as part of their operations.

The following is however evident with regards to the **disposal of general waste** from the subject industries:

- The additional waste generated from the industry to be disposed of at the local Makhadu – and/or Musina municipality's landfill will fasten the depletion of the respective municipality's landfill airspace. It might be necessary to establish the available airspace at the existing municipality's landfill to determine its lifespan with the additional waste to be disposed of. In the case of the establishment of a new general integrated waste management facility close by (as an option) could take up to 6-years to establish and should this be the option to go for, planning needs to start for the establishment of the waste management facility.

- The activity *inter alia* entails site identification, funding application, rezoning, possible property purchasing and transfer, full Environmental Impact Assessment with specialist investigations required by the authorities, design in terms of National Norms and Standards for Disposal of Waste to Landfill (promulgated in August 2013) and a construction period of 10-12 months (depending on the availability of material and flexible membrane liners. **It is anticipated that the cost estimate to design and construct a Class B landfill facility (since the site will be used only for General waste) of 35 Ha (full 35 Ha development) will be approximately R42,000,000.00,** depending on the availability of *in situ* material available on site. The landfill development can be done in phases to enlighten the cost initially. ***Please note that this option is only applicable for the disposal of General Waste from the EMSEZ complex, should it not be possible to make use of the Makhadu or Musina General landfills.***

The following is however evident with regards to the **disposal of hazardous waste** from the subject industries:

- **Option 1:** For Hazardous Waste, since the long-hauling of hazardous waste i.e. ash, slag sludge etc to the existing Holfontein and Vlakfontein hazardous waste management facilities in Gauteng, might not be feasible in the medium to long

term due to the distance and severe transport cost; therefore a close by integrated hazardous waste management facility of approximately 3000 Ha (with 40 years lifespan) (i.e. for the disposal/treatment of hazardous waste i.e. ash, slag, sludge etc), outside the EMSEZ complex needs to be established. The facility will have to be licensed in terms of Section 45 of the National Environmental Management Waste Act, Act 59 of 2008 (NEMWA). The licensing process will be a separate process from the WMP, and have to follow a full Environmental Impact Assessment process for its establishment, meaning that the need, site selection process from a few candidate sites to be identified, detail investigations on the most suitable identified site (which could include the following detailed studies viz Geohydrological Assessment, Geotechnical Assessment, Heritage, Archaeology and Palaeontology Assessment; Ecology (Fauna & Flora) Assessment; Wetland Assessment and Delineation; Social Baseline Assessment, Economic Assessment; Visual Assessment; Traffic Assessment; Blast and Vibration Assessment (if required); Air Quality Assessment; Noise and Ground Vibration Assessment), needs to be conducted. This process should start as soon as possible. Should 2/3 of the waste stream be recycled as indicated by the EMSEZ, only 1000 Ha facility would be required. The cost to design and construct a full size integrated hazardous waste management facility could cost approximately R1,2 billion. The facility can be developed in a phased manner to alleviate initial cost i.e. establish a 200Ha facility for approximately R250,000,000 and with time develop the remainder.

- **Option 2:** Since each and every plant owner will be responsible to manage the waste generated within their respective plants, their responsibility will be to establish their own disposal facility for the disposal of their industrial hazardous waste they generate (if in large quantities, and as an option in the short term, until the outside "to be established integrated waste management facility" mentioned above, will be established). The same authorization requirements (mentioned in the above bullet for the establishment of an integrated hazardous waste management facility outside the EMSEZ complex) will apply for the hazardous waste disposal facility developed at the respective plants, where a need for such a facility is identified i.e. full EIA and WML application.

A combination of option 1 and 2 is recommended. In other words, each plant owner needs to make provision and establish its own hazardous disposal facility on their respective premises. This is specifically important in the short term and for those industries generating large volumes of industrial hazardous waste, for example the power station (ash disposal facility). Industries which generate small volumes of industrial waste, can make provision for a storage facility only on their

premises, from where the waste can be taken to the centralised WMA and then taken off site to either Holfontein or Vlakfontein existing hazardous waste management facilities. If decided to develop an integrated hazardous waste management facility close-by to the EMSEZ complex in the longer term, these waste streams can be taken to this facility for disposal.

11.7.3. Waste Minimisation / Recycling Infrastructure Requirements

In order to ensure that waste is being recycled and the portion of waste to be landfilled kept to a minimum, it is recommended that a centralized waste management area be identified on the industrial property consisting of a bin area, the skip area and a recycling facility (consisting of an enclosed warehouse area where waste recyclables can be sorted). The non-recyclable bins will be collected and emptied by the municipality and the waste transported and disposed of at the municipal landfill site. The emptying of the skips for bulky waste will be done by the municipality and also transported to the municipality's landfill site for disposal. The industry will be responsible to sort the recyclable waste collected at the industry and further sorted at the recycling facility in the waste management area.

According to the NEMWA listed activities, only storage areas that have the through put capacity to store in excess of $100m^3$ of general waste at any one time, or to store in excess of $80m^3$ of hazardous waste at any one time, excluding the temporary storage of such waste, need to be licensed in terms of the NEMWA. Therefore, should the centralised waste management area/facility trigger a Category A listed activity, a basic assessment process set out in the Environmental Impact Assessment Regulations made under section 24(5) of the National Environmental Management Act, 1998 (Act 107 of 1998) as part of a waste management licence application contemplated in section 45 read with section 20(b) of this Act, must be conducted.

Should the waste management area at the subject industry have a throughput of not more than $100m^3$ waste per day at any time, a waste management license would not be required and should comply with the National Norms and Standards for the Storage of Waste, without having to obtain a waste management licence. One or two skips can be designated to hazardous waste which need to be emptied and collected as and when required by a Hazardous Waste Management company i.e. EnviroServ for direct disposal at their Holfontein facility in Benoni, Gauteng, or by Interwaste for direct disposal at their Vlakfontein facility in Vanderbijlpark. The subject industry needs to enter into contract agreements with various recycling companies to collect the recyclables on a weekly basis or as when required.

The capital cost for the establishment of a waste drop-off facility (containing a bin, skip/container area as well as an enclosed warehouse area for waste sorting) will be approximately R3,000,000.00 (15% VAT excluded).

11.7.4. Waste Collection Requirements

The collection of waste from the subject industry's waste management area needs to be incorporated into the existing waste collection service of the Municipality (for general waste collection). The subject industry needs to make arrangements for the collections and disposal of the hazardous waste as mentioned in the section above, as well as for the collection of the recyclable waste by recycling companies.

The Makhado and/or Musina Municipality will have to make provision to service the industry for their general waste collection and disposal needs and additional REL compactors may need to be purchased**. The price per 18m^3 REL compactor would be approximately R1 400,000.00 per vehicle (capex).** The number of vehicles will depend on the waste volumes to be generated and collected.

The price per 6m^3 skip will be R8 000 per skip and for 28m^3 Roll on Roll off containers will be R18 000 per container. The number to be purchased is dependent on the waste to be generated and collected. **It is anticipated that that 28m^3 container systems will be utilised and that provision need to be made for at least 2 containers which will then cost approximately R36,000.00. (Capex).**

The cost for collection and removal of bulk containers per month will be R4000. For the two containers the collection cost will be R8000.00 per month (Opex).

The industry needs to separate the waste at source in a recyclable and non-recyclable wheelie bin. The price of a wheelie bin is R700/bin and again it depends on the size of the industry and waste that will be generated, how many of these bins will be required. **Without any information currently available it is assumed that approximately 30 wheelie bins will be required which will then cost approximately R21,000.00 (capex).**

It is anticipated that 2 collections per week would be sufficient. R130 per bin/ collection = R1040 / month/bin. The collection cost will be R31 200 per month to collect and empty the 30 wheelie bins. (Opex).

11.7.5. Resource Demands

Staff resources that will be required to implement the waste management system would **include 8 general workers (runners) for waste collection, 1 security guard to control access at the recycling facility, 10-20 general workers at the recycling facility for waste sorting and 1 site supervisor/manager to manage and supervise operations at the waste management area and recycling facility and one Waste Management Control Officer (as statutory required in terms of Section 58 of**

NEMWA) to manage the entire waste management system at the industry. Salaries for these staff needs to be negotiated and within industry norms.

12. Health and Safety

12.1. Health & Safety Management Plan

The whole EMSEZ site will operate under the Occupational Health & Safety Act. The operator and investors would need to comply with this act. This would apply for the construction as well as the operating phases.

During construction the EMSEZ Operator will appoint competent Safety Management Team to monitor and control the construction operation and enforce the safety procedures as set out in the act.

Please note that the old mine resort under the jurisdiction of the Department of Mineral Resources and Energy (DMRE)

where the Mine Health and Safety Act applies until the decommissioned mine has been properly closed and the DMRW has relinquished jurisdiction. This duality of control must be borne in mind when the SEZ SOC purchases/leases the mine land and incorporates it into the SEZ.

12.2. Safety

The whole EMSEZ site will operate under the Occupational Health & Safety Act. The Occupational Health & Safety Act (85 of 1993) will apply. The operator and individual investors would need to comply with this act.

Each investor construction site will have its own safety officer and safety representatives. Each site will have a permit to work from the Department of Labour, a baseline risk assessment and safety file in place before commencement of any works. The safety file will be approved by the Operator Safety Management team.

ANNEXURE A

TOTAL SUMMARY OF PLANNING DESIGN TECHNICAL ECONOMY PARAMETERS OF SOUTH AFRICAN ENERGY METALLURGICAL SPECIAL ECONOMIC ZONE PROJECTS

EMSEZ

Total Summary of planning design technical economy parameters of South African Energy Metallurgical Special Economic Zone Projects

No.	Project	Total planned capacity 总规模	Capacity by Phases 分期规模			UOM 单位	Construction Period 建设周期	Process technology	Occupied Land Area 占地面积	Annual new water consumption 年新鲜水量	Final power consumption 年耗电	Comments on electricity usage 耗电批注	Annual power generation 年发电	Final Agreed External cargo transport volume by rail way for planning的矿运货量 （Million tpa）		Construction cargo (Million tpa)	Total Investment 总投资	Annual Output Value 年总产值	No.of workers 职工人数	Staff classification 岗位分工			Recommended Max Emissions 建议最大排放量	Particulate Matter Emission	SO_2 Emission	NOx Emission	Other emissions		Remarks
			Phase	Construction starting year	Capacity by Phase				Hectare	Million m^3	Million kwh		Million kwh	in 进	out 出	in 进	USD Million	USD Million		Executives	Professionals	Ordinary staff	$teCO_2$ /t	mg/m^3	mg/m^3	mg/m^3			
1	Thermal power plant 燃煤电厂	3300	phase1	2021	2*660	MW	4years	Ultra Supercritical Unit	620	4.42	120.78	1.00%	9,504.00	3.30	Ash dump	0.10	3750	1815	600	78	54	468		50	500	750			SA Air Quality Act, 2004
			phase2	2026	3*660	MW	4years			6.64	181.17		14,256.00	4.95	Ash dump	0.087			500	65	45	390		50	500	750			
2	Coal washery 洗煤厂	2000	phase1	2020	600	10kt pa	3years	Dense Medium Submersible Groove+Dense Medium Cyclone+Spiral Separator	100	0.24	17.64	50kWh/t for Steam coal washer or Metallurgical coal washer 2.94kwh/t for raw coal				0.000	150	540	300	39	27	234							
			phase2	2023	700	10kt pa	3years			0.28	20.58					0.000			350	46	32	273							
			phase3	2026	700	10kt pa	3years			0.28	20.58					0.000			350	46	32	273							
3	Coke plant 焦炭厂	300	demonstration	2020	100	10kt pa	3years	Heat recovery coke oven	400	0.04	81.76	81kWh/t		1.4	Internal	0.070	759.09	1140	560	73	50	437	0.60				H_2S 7 mg/m^3		SA Air Quality Act, 2004
			phase2	2023	100	10kt pa	3years			0.04	81.76			1.4	Internal	0.050			560	73	50	437	0.60				H_2S 7 mg/m^3		
			phase3	2026	100	10kt pa	3years			0.04	81.76			1.4	Internal	0.050			560	73	50	437	0.60				H_2S 7 mg/m^3		
3.1	余热发电厂 Heat recovery power generation	390	demonstration	2020	2*65	MW	3years	余热发电机组 Heat Recovery Steam Generator	0	0.91	36.34	3.88%	936.00			0.000	214.19	140.84	Included in item No 2					50	500	750			SA Air Quality Act, 2004
			phase2	2023	2*65	MW	3years			0.91	36.34		936.00			0.000								50	500	750			
			phase3	2026	2*65	MW	3years			0.91	36.34		936.00			0.000								50	500	750			
4	High vanadium steel plant 高钒钢	100	demonstration	2020	50	10K tpa	3years	Innovative technology	100	1.50	90.00	MCC - 150Kwh/T, 770kWh/t		Internal supply	0.50	0.020	500	1000	1300	169	117	1,014		30	500	500			SA Air Quality Act, 2004
			phase1	2021	50	10K tpa	3years			1.50	90.00			Internal supply	0.50	0.018			1200	156	108	936		30	500	500			
5	高锰钢 High Manganese steel	100	Demonstration	2020	50	10K tpa	3years	Patent technology	200	1.50	90.00	MCC - 150kWh/t, 770kWh/t		0.60	0.50	0.040	600	1800	2000	260	180	1,560		30	500	500			SA Air Quality Act, 2004
			phase2	2023	50	10K tpa	3years			1.50	90.00			0.60	0.50	0.035			2000	260	180	1,560		30	500	500			
6	Ferromanganese plant 锰铁厂	50	Demonstration	2020	10	10K tpa	3years	Blast furnace	50	0.09	30.00	Estimated as 300kwh/t for blast furnace process	64.80	0	0.1	0.035	300	1100	205	27	18	160	1.20	50	500	700			SA Air Quality Act, 2004
			phase2	2021	20	10K tpa	3years			0.18	60.00		291.60	0.75	0.45	0.020			410	53	37	320	1.20	50	500	700			
			phase3	2023	20	10K tpa	3years			0.18	60.00		291.60	0.75	0.45	0.020			410	53	37	320	1.20	50	500	700			
7	Silicon manganese plant 硅锰合金厂	50	phase1	2021	20	10K tpa	3years	Submerged arc furnace 33000KVA	100	0.6	780.00	3900kWh/t (Used same as for 6)		0	0	0.030	266	556	400	52	36	312	1.30	50	500	400			SA Air Quality Act, 2004
			phase2	2023	30	10K tpa	3years			0.87	1,170.00			0	0	0.030			600	78	54	468	1.30	50	500	400			
8	Domestic Waste Site									0	-																		
9	Cement Plant 水泥厂	200（clinker）	phase1	2021	100	10K tpa	3years	New dry process	30	0.4	103.00	MCC - 81kWh/t, 260kWh/t		1.60	1.00	0.02	145	180	300	39	27	234		50	250	1200			
			phase2	2023	100	10K tpa	3years			0.4	103.00			1.60	1.00	0.02			300	39	27	234		50	250	1200			
10	Refractories factory 耐火厂	50	phase1	2021	20	10K tpa	3years	Tunnel kiln firing	18	0.069	16.80	MCC - 84kWh/t, 260kWh/t		0.21	Internal	0.00	90	300	290	38	26	226		30	200		HF 50 mg/m^3		SA Air Quality Act, 2004
			phase2	2023	30	10K tpa	3years			0.104	25.20			0.32	Internal	0.00			439	57	40	343		30	200		HF 50 mg/m^3		
11	Stainless steel plant 不锈钢	300	phase1	2021	100	10K tpa	3years	Patent	300	4.00	200.00	MCC 150kWh/t 490kWh/t		Internal	1	0.04	2400	6000	1600	208	144	1,248	0.90	30	500	500			SA Air Quality Act, 2004
			phase2	2023	100	10K tpa	3years			4.00	200.00			Internal	1	0.04			1600	208	144	1,248	0.90	30	500	500			
			phase3	2026	100	10K tpa	3years			4.00	200.00			Internal	1	0.02			1600	208	144	1,248	0.90	30	500	500			
12	Ferrochrimme plant 铬铁厂	300	Demonstration	2020	30	10K tpa	3years	Submerged arc furnace 33000KVA	500	1.06	974.40	3500kWh/t Difference in phasing		0.7	0.05	0.04	1500	2900	632	82	57	493	2.90	50	500	400			SA Air Quality Act, 2004
			phase2	2021	170	10K tpa	3years			3.40	5,526.10			2	0.25	0.04			3481	453	313	2,715	2.90	50	500	400			
			phase3	2023	100	10K tpa	3years			1.55	3,248.00			2	0.1	0.02			2048	266	184	1,597	2.90	50	500	400			
13	Lime plant 石灰厂	100	phase1	2021	100	10K tpa	3years	Rotary kiln system	15	0.12	90.00	MCC - 39kWh/t 260kWh/t		2.2	1	0.038	330	835	650	85	59	507	2.50	50	400	500			SA Air Quality Act, 2004
14	Vanadium-titanium magnetite project 钒钛磁铁矿项目	1000（Treatment volume of vanadium-titanium magnetite concentrate）	Demonstration	2020	200	10K tpa	36months	Innovative technology	1000	6.78	294.69		346.71	3.79	0.5	0.030	4780	7400	2129	277	192	1,661		50	1200	350	NH_3 30 mg/m^3	机 1 x 10^{-5} $m\ g/m^3$	SA Air Quality Act, 2004
			phase1	2021	200	10K tpa	2years			6.78	294.69		346.71	3.79	0.5	0.025			2129	277	192	1,661		50	1200	350	NH_3 30 mg/m^3	机 1 x 10^{-5} $m\ g/m^3$	
			phase2	2023	400	10K tpa	2years			13.56	589.37		693.41	7.582	Internal	0.050			4258	554	383	3,321		50	1200	350	NH_3 30 mg/m^3	机 1 x 10^{-5} $m\ g/m^3$	
			phase3	2026	200	10K tpa	2years			6.78	294.69		346.71	3.79	Internal	0.025			2129	277	192	1,661		50	1200	350	NH_3 30 mg/m^3	机 1 x 10^{-5} $m\ g/m^3$	
15	EMSEZ administrative centre			2021			3years		200		58.50	100KWh/a				0.010	400	300	800	104	72	624							
16	Logistics centre			2021			3years		100		29.25	100KWh/a				0.005	500	600	1100	143	99	858							
17	Bonded area			2021			3years		400		117.00	100KWh/a				0.021	700	800	500	65	45	390							
18	Machinery zone			2021			3years		300		87.75	100KWh/a				0.015	500	600	2500	325	225	1,950							
19	Processing zone			2021			3years		600		175.50	100KWh/a			Internal	0.031	650	900	7500	975	675	5,850							
20	Process & sewage treatment plant 污水厂	14	phase1	2020	4.00	10k m^3/day	2years	先进工艺 / Advanced technology	20		0.16	MCC 2kWh/m 3, 45kWh/m 3				0.00	90	61	50	7	5	39							
			phase2	2023	5.00	10k m^3/day	2years				0.16					0.0005			50	7	5	39							
			phase3	2026	5.00	10k m^3/day	2years			2.27	0.16					0.0005			50	7	5	39							
21	Industrial & domestic water plant 工业与生活水厂	38.52	phase1	2020	12.84	10k m^3/day	2years	先进工艺 / Advanced technology	10		3.11	MCC - 45kWh/m3				0.01	100	110	120	16	11	94							
			phase2	2023	12.84	10k m^3/day	2years				3.11					0.01			120	16	11	94							
			phase3	2026	12.84	10k m^3/day	2years				3.11					0.01			120	16	11	94							
22	Fuel storage										-					0.0005													
23	Gas Storage										-					0.0005													
24	Water Reservoir										-					0.0002													
25	Eco Village changed to Visitors Lodge										-					0.0001													
	Sub total EMSEZ								5143	77.89	15,812.79		28,949.53	45.53	10.90	1.12	18,724.28	29,077.84	40,800	6,344	4,392	38,064.16	21.90						
	NON INDUSTRIAL ZONE																												
26	Commercial residential area			2021			3years		300	2.11	92.96					2.31	800	900	3500	455	315	2,730							
27	Living area			2021			3years		500		28.80					3.85	600	500	1500	195	135	1,170							
	Sub total Non-Industrial	-	-	-	-	-	-	-	800.00	2.11	120.96	-	-	-	-	6.15	1,400.00	1,400.00	5,000.00	650.00	450.00	3,900.00	-	-	-	-	-	-	-
	Grand Total								5,943.00	80.00	15,933.75		28,949.53	45.53	10.90	7.27	20,124.28	30,477.84	53,800.20	6,994.03	4,842.02	41,964.16							

COMPILED BY:

CONSTRUCTION WATER			m^3
Staff	110,000.00	200l	8,030,000.00
Concrete (m3)			900,000.00
General			100,000.00
TOTAL			9,030,000.00
Total recommended (Million m^3 /annum)			10.00

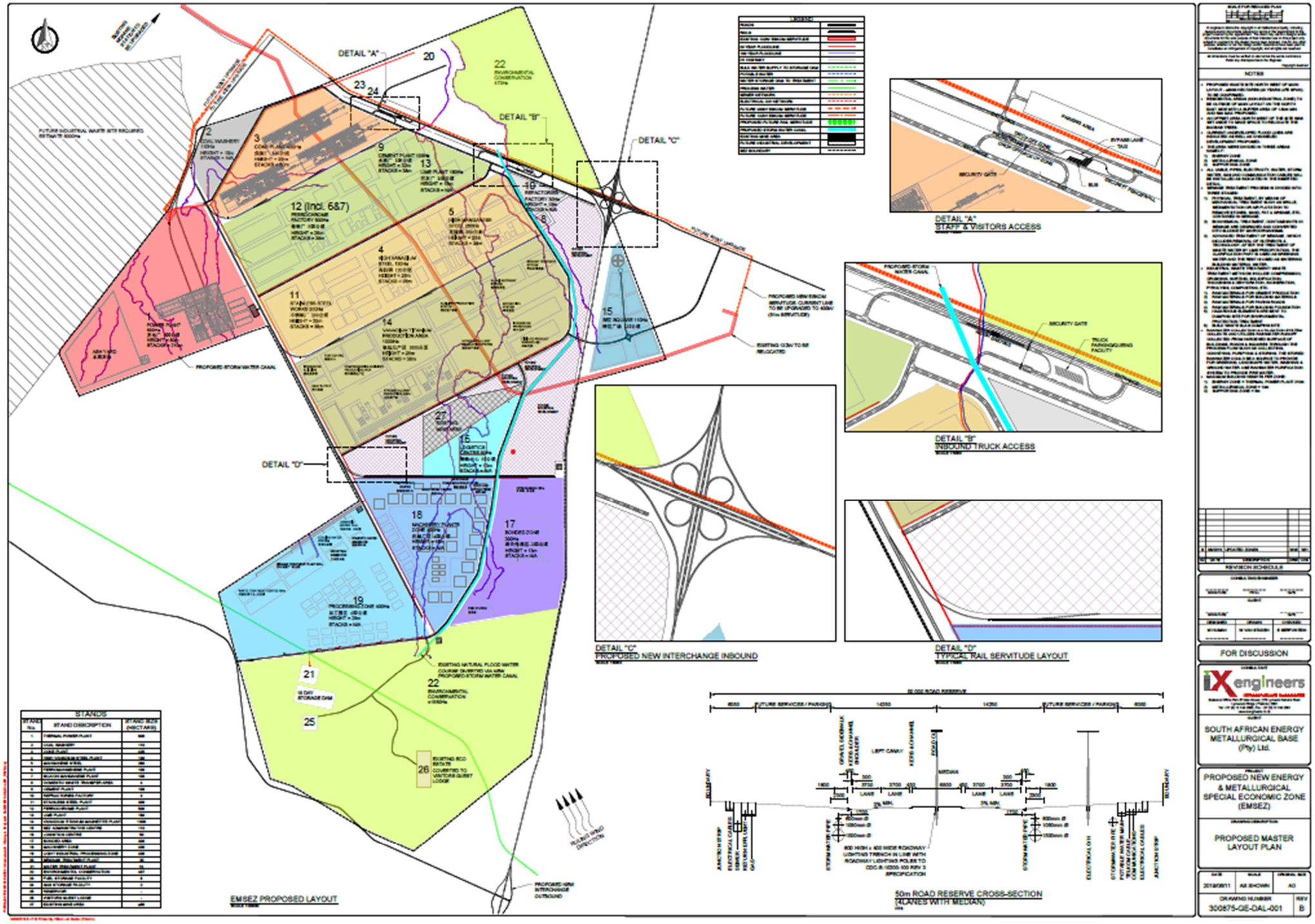
Total recommended (Million m^3 /annum)	Recommended	Annual new water 10k m^3
Construction (2020 - 2022)	10.00	903.00
Water for Phase 1 (2023 - 2025)	33.00	3,288.72
Water for Phase 2 (2026 - 2028)	67.00	6,626.37
Water for Phase 3 (2029 onwards)	80.00	7,999.55

Trains per day: 75.88 18.17

ANNEXURE B

DRAWING 00875-GE-DAL-001

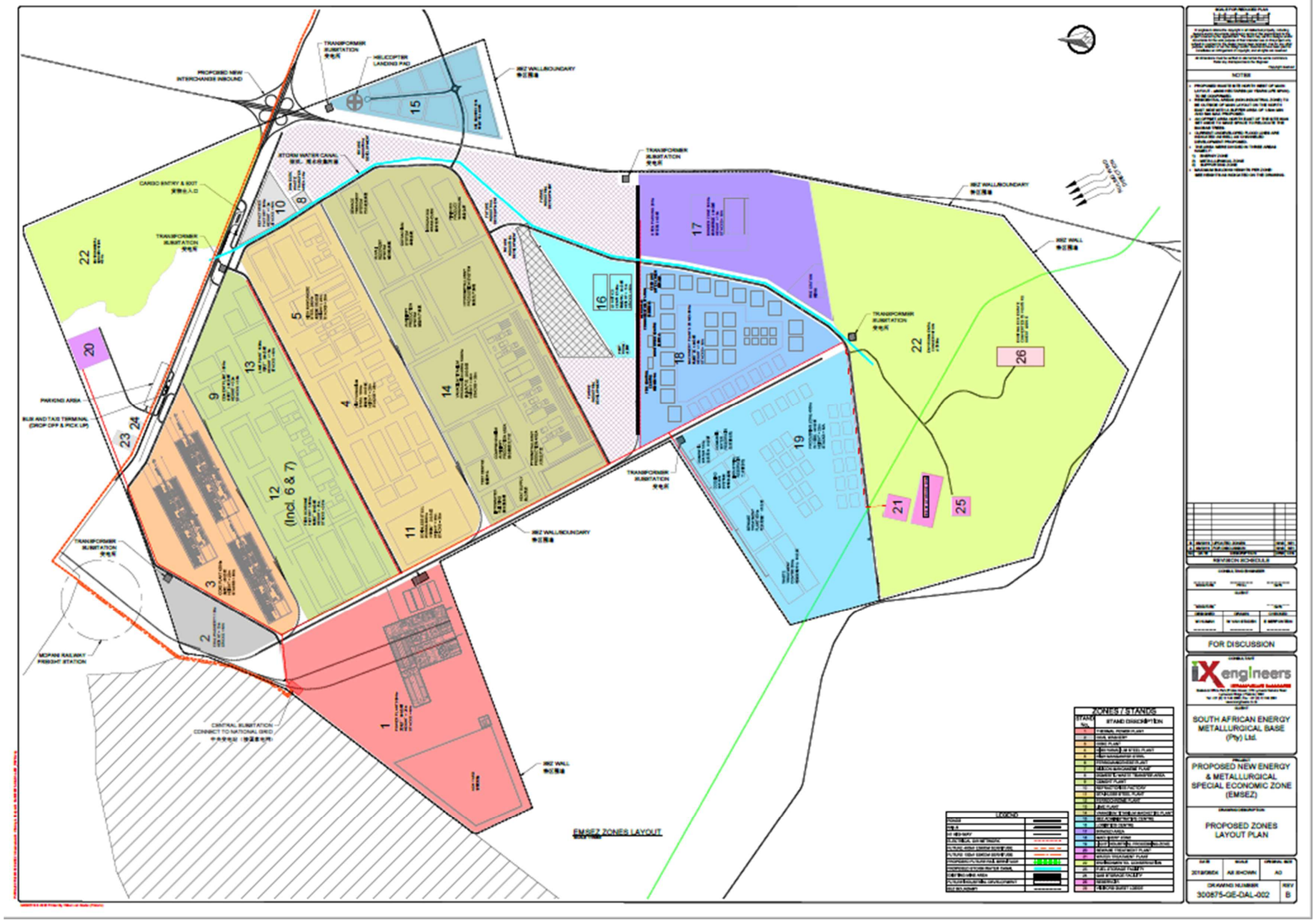
PROPOSED MASTER LAYOUT PLAN


DETAIL "A"
DETAIL "B"
DETAIL "C"
DETAIL "D"
DETAIL "A"
STAFF & VISITORS ACCESS
DETAIL "B"
INBOUND TRUCK ACCESS
DETAIL "C"
PROPOSED NEW INTERCHANGE INBOUND
DETAIL "D"
TYPICAL RAIL SERVITUDE LAYOUT
EMSEZ PROPOSED LAYOUT
50m ROAD RESERVE CROSS-SECTION
(4LANES WITH MEDIAN)
STANDS
NOTES
FOR DISCUSSION
SOUTH AFRICAN ENERGY METALLURGICAL BASE (Pty) Ltd.
PROPOSED NEW ENERGY & METALLURGICAL SPECIAL ECONOMIC ZONE (EMSEZ)
PROPOSED MASTER LAYOUT PLAN
300675-GE-DAL-001
B

ANNEXURE C

DRAWING 300875-GE-DAL-002

PROPOSED ZONES LAYOUT PLAN


PROPOSED NEW INTERCHANGE INBOUND
TRANSFORMER SUBSTATION
HELICOPTER LANDING PAD
IRIZ WALL/BOUNDARY
STORM WATER CANAL
CARGO ENTRY & EXIT
PARKING AREA
BUS AND TAXI TERMINAL (DROP OFF & PICK UP)
MOPANE RAILWAY FREIGHT STATION
CENTRAL SUBSTATION CONNECT TO NATIONAL GRID
IRIZ WALL
EMSEZ ZONES LAYOUT
ZONES / STANDS
LEGEND
NOTES
FOR DISCUSSION
SOUTH AFRICAN ENERGY METALLURGICAL BASE (Pty) Ltd.
PROPOSED NEW ENERGY & METALLURGICAL SPECIAL ECONOMIC ZONE (EMSEZ)
PROPOSED ZONES LAYOUT PLAN
DRAWING NUMBER
300875-GE-DAL-002

ANNEXURE D

EMSEZ – INDUSTRY WASTE MANAGEMENT MASTER PLANNING

EMSEZ – Industry Waste Management Master Planning

SUBMITTED BY:

iX engineers (Pty) Ltd

on 10 September 2019.

Eastwood Office Park, Protea House
270 Lynwood Service Road, Lynwood Ridge
Pretoria, South Africa
0081

Tel: +27 (0) 12 745 2000 | Fax: +27 (0) 12 745 2001

Contact Person(s): Mr Hans Karemaker | Email: hans.k@ixengineers.co.za

Mr Willie Human | Email: willie.h@ixengineers.co.za

Mr Gerrie Le Roux | Email: Gerrie.lr@ixengineers.co.za

List of Abbreviations

DEFF	Department of Environmental Affairs, Forestry and Fisheries
DWS	Department of Water Affairs and Sanitation
HCRW	Health Care Risk Waste
IWM	Integrated Waste Management
IWMP	Integrated Waste Management Plan
LEDET	Limpopo Department of Economic Development, Environment and Tourism
NEMA	National Environmental Management Act, Act No. 107 of 1998
NEMWA	National Environment Management: Waste Act, 2008
NEM:WAA	National Environmental Management: Waste Amendment Act, 2014.
NWMS	Draft Revised and Updated National Waste Management Strategy, 2019

GLOSSARY OF TERMS

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;

Business waste means waste that emanates from premises that are used wholly or mainly for commercial, retail, wholesale, entertainment or government administration purposes;

A landfill working Cell refers to the volume of waste generally placed during one working day and covered on all horizontal surfaces by cover soil;

Centralised Waste Management Area/Facility (WMA) means a facility that is used to accumulate and temporarily store waste before it is transported to a recycling, treatment or waste disposal facility.

Constitution means the Constitution of the Republic of South Africa, 1996.

Container as referred to in this document means a disposable or re-usable vessel in which waste is placed for the purposes of storing, accumulating, handling, transporting, treating or disposing of that waste, and includes bins, bin-liners and skips;

Decommissioning in relation to waste treatment, waste transfer or waste disposal facilities, means the planning for and management and remediation of the closure of a facility that is in operation or that no longer operates.

Department as referred to in this document means the Department of Department of Environmental Affairs, Forestry and Fisheries.

Disposal as referred to in this document means the burial, deposit, discharge, abandoning, dumping, placing or release of any waste into, or onto, any land.

Disposal Site Airspace or capacity is the total volume of space on a waste disposal site to be filled with waste and cover material.

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.

Environment as referred to in this document means the surroundings within which humans exist and that are made up of -

(i) the land, water and atmosphere of the earth.

(ii) micro-organisms, plant and animal life.

(iii) any part or combination of (i) and (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.

Gazette, when used in relation to-

(a) the Minister, means the *Government Gazette*; and

(b) the MEC, means the *Provincial Gazette* of the province concerned.

General waste means waste that does not pose an immediate hazard or threat to health or to the environment, and includes—

a) domestic waste.

b) building and demolition waste.

c) business waste: and

d) inert waste.

Groundwater means all waters flowing or existing under the ground surface.

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.

Health Care Risk Waste means waste capable of producing any disease and includes but is not limited to the following:

(a) laboratory waste;

(b) pathological waste;

(c) isolation waste;

(d) genotoxic waste;

(e) infectious liquids and infectious waste

(f) sharps waste;

(g) chemical waste; and

(h) pharmaceutical waste;

Industry includes commercial activities, commercial agricultural activities, mining activities and the operation of power stations.

Inert waste means waste that—

a) does not undergo any significant physical, chemical or biological transformation after disposal.

b) does not burn, react physically or chemically biodegrade or otherwise adversely affect any other matter or environment with which it may come into contact; and

c) does not impact negatively on the environment, because of its pollutant content and because the toxicity of its leachate is insignificant.

Industry Waste Management Plan is a plan which has been compiled to provide the most cost-effective and technically and environmentally acceptable solutions to the total waste management of the industry. It addresses the situation analysis and offer solutions to ensure responsible waste management. As such it addresses waste generation, waste minimisation and re-use, collection of all waste, disposal infrastructure (disposal facility requirements) and disposal according to environmentally sound practises and within the requirements of relevant legislation and regulations. A plan prepared in terms of Chapter 7, Section 27 or Section 28 of the National Environmental Management: Waste Amendment Act, 2014.

Licensing authority means an authority referred to in section 43 and that is responsible for implementing the licensing system provided for in Chapter 5.

MEC means the Member of the Executive Council of a province who is responsible for waste management in the province,

Minimisation when used in relation to waste, means the avoidance of the amount and toxicity of waste that is generated and, in the event where waste is generated, the reduction of the amount and toxicity of waste that is disposed of.

Minister as referred to in this document means the Minister of the Department of Environment, Forestry and Fisheries.

Municipality means a municipality established in terms of the Local Government: Municipal Structures Act, 1998 (Act No. 117 of 1998).

Municipal Systems Act means the Local Government: Municipal Systems Act, 2000 (Act No. 32 of 2000).

National Environmental Management Act means the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Operating Plan consists of drawings, descriptions and other documents regarding the operation of the waste disposal site, placement of waste, building daily cells and lifts, leach ate management,

waste disposal gas management and all other functions related to the operation of the waste disposal site;

Operator is the person or organisation responsible for the operation of the waste disposal site. The operator may be the owner, another public agency or private contractor.

Owner is the person or organisation that owns the property and/or facilities that constitute the waste disposal site.

Pollution has the meaning assigned to it in section 1 of the National Environmental Management Act.

Reclamation is the unauthorised separation of solid waste for recyclable materials and food for human consumption.

Recycle means a process where waste is reclaimed for further use, which process involves the separation of waste from a waste stream for further use and the processing of that separated material as a product or raw material.

Re-use means to utilise articles from the waste stream again for a similar or different purpose without changing the form or properties of the articles.

Site Feasibility is the initial step in the DEFF permitting/licensing process that establishes the basic site features and general feasibility for a fully permitted/licensed waste disposal site.

Solid Waste is waste of a solid nature generated by a person, business or industry.

Sorting is the authorised separation of solid waste materials for the purpose of recycling or disposal, either at the source of generation or at a solid waste management facility.

Storage means the accumulation of waste in a manner that does not constitute treatment or disposal of that waste.

Treatment means any method, technique or process that is designed to-

(a) change the physical, biological or chemical character or composition of a waste; or

(b) remove, separate, concentrate or recover a hazardous or toxic component of a waste; or

(c) destroy or reduce the toxicity of a waste,

in order to minimise the impact of the waste on the environment prior to further use or disposal.

Waste means—

(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance,

material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or

(b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered.

(ii) where approval is not required, once a waste is, or has been re-used, recycled or recovered.

(iii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or

(iv) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

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 premise.

Waste management activity means any activity listed in Schedule 1 or published by notice in the Gazette under section 19, and includes—

a) the importation and exportation of waste.

b) the generation of waste, including the undertaking of any activity or process that is likely to result in the generation of waste.

c) the accumulation and storage of waste.

d) the collection and handling of waste.

e) the reduction, re-use, recycling and recovery of waste.

f) the trading in waste.

g) the transportation of waste.

h) the transfer of waste.

i) the treatment of waste; and

j) the disposal of waste.

Waste Management facility is a place, infrastructure, structure or containment of any kind, wherein, upon or at, a waste management activity takes place and includes a waste transfer station, container yard, landfill site, incinerators, lagoons, recycling and composting facilities;

Waste management licence means a licence issued in terms of Section 49.

Waste management officer means a waste management officer designated in terms of Section 10;

Waste management services means waste collection, treatment, recycling and disposal services.

Waste minimisation programme means a programme that is intended to promote the reduced generation and disposal of waste.

Waste treatment facility means any site that is used to accumulate waste for the purpose of storage, recovery, treatment, reprocessing, recycling or sorting of that waste

1. OBJECTIVES

The purpose of this Integrated Industry Waste Management Plan (WMP) is to propose adequate resource and waste management practices for the construction and operation of the Energy Metalurgical Special Economic Zone (EMSEZ). The key objectives are to:

- Provide a framework through which all solid waste materials generated by the project (both during construction and operation) can be managed with the minimum environmental impact;
- Provide a regulatory framework for EMSEZ and its contractors to meet all applicable waste management legislative requirements i.e. National Environmental Management: Waste Act No. 59 of 2008 (NEMWA), Regulations, National Waste Management Strategy, National Norms and Standards, provincial legislation and municipal by-laws on waste.
- Align the WMP with the objectives and goals set in the National Waste Management Strategy and propose the necessary steps to give effect to the objectives of the waste management hierarchy with regards to the recycling and diversion of waste from landfilling; and
- Propose strategies to achieve the above in establishing the final resource and waste management plan.

In achieving the above objectives, the WMP will:

- Identify and classify the expected solid waste materials / resources from the construction and operations of EMSEZ;
- List typical solid waste generation rates for each industry types identified;
- Identify methods to minimize waste to be treated or disposed;
- Propose appropriate waste treatment and disposal options;
- Propose a waste management / exchange / tracking system to document all aspects of the resource and waste management;
- Ensure safe and proper treatment and disposal of all solid waste streams;
- Ensure management of waste on-site is in accordance with legislation; and
- Provide guidance and support to the design of the waste management facilities.

At this stage this plan must be regarded as a high level strategic planning document for the management of waste at EMSEZ, and must be updated at a later stage once more information on possible industries and waste materials have been established.

This will further assist in establishing what the best possible management structure will be to develop and operate SEZ, i.e.to assist with the opportunity for industrial symbiosis.

Industrial symbiosis, as mentioned above, involves a collective approach to competitive advantage through the physical exchange of materials, energy, water and/or byproducts, or the shared use of assets, logistics and expertise. It is an association between two or more industrial facilities, in which the services, utilities, wastes or by-products of one become the raw materials for another.

The objectives of industrial symbiosis are to help companies / industries to ensure implementation of the waste management hierarchy by the different generators in accordance with their general duty of waste management in section 16(1) of NEMWA**:**

- **Reduce** raw material and waste disposal costs;
- **Earn new revenue** from residues and by-products;
- **Divert waste** from landfill, **reduce carbon emissions as well as limit environmental impact; and**
- **Open up** new business opportunities.

As in the natural world, this type of industrial synergy brings advantages to both parties and is usually done for both commercial and environmental reasons. Some of the slag that is produced can *inter alia* be used in brick-making to assist with paving within the complex as well as in road building processes. The waste of one industry can become a resource for the next industry for example.

2. LEGISLATIVE REQUIREMENTS

THE SOUTH AFRICAN CONSTITUTION, 1996 (ACT 108 OF 1996)

Section 24 of the Bill of rights of the Constitution of South Africa clearly states that everyone has the right to:

(a) An environment that is not harmful to their health or well-being; and

(b) Should have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that:

(i) prevent pollution and ecological degradation;

(ii) Promote conservation; and

(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.

The Constitution places an emphasis on the need to have the environment protected for the benefit of present and future generations through reasonable legislative and other measures i.e. IWMP. It is within this provision that IWMPs must strive or come up with measures to uphold the rights of all citizens within the jurisdiction area and should enhance and promote environmental protection from any form of degradation as enshrined by the South African Constitution.

THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT: (ACT NO. 59 OF 2008)

Chapter 7, section 28 and section 29 of the Waste Act requires that certain persons or organs of state respectively must develop Integrated Waste Management Plans (IWMPs). Section 30 of the Waste Act outlines what the contents of Industry waste management plans should be, whilst section 31 provides for the notification of industry waste management plans. Section 33 provide the measures to be taken and Section 34 on the review of these industry waste management plans.

Other applicable policies and standards including municipal by-laws are listed below which should be considered when developing an IWMP:

REGULATIONS IN TERMS OF THE WASTE ACT:

On 13 August 2012, the Minister of Water and Environmental Affairs, the late Ms Edna Molema published under section 69(1)(t), (y) (aa) and (ee) of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (Waste Act) the National Waste Information Regulations, 2012 in Gazette No. 35583 for implementation on 1 January 2013.

Any person who conducts activities which are listed in Annexure 1 of the Regulations needs to register on the South African Waste Information System at www.sawic.org.za. The purpose of the national waste information regulations, 2012 is to regulate the collection of data and information to fulfil the objectives of the South African Waste Information System (SAWIS) as set out in section 61 of the Waste Act. The Industry should therefore comply with these regulations and follow the procedure and criteria to register on SAWIS (as required in Section 5 of the Regulations) and submit a quarterly report containing the information as prescribed in Annexure 2 of the Regulations, within 30 days of the end of a reporting period (as required in Section 8 of the Regulations).

Waste Classification and Management Regulations promulgated under the National Environmental Management: Waste Act, 2008 (NEM:WAA) (effective 23 August 2013): The Waste Classification and Management Regulations (WCMR) (developed in terms of section 69 of NEM:WA) will ultimately enable the improved and more efficient classification and management of waste. All wastes that were classified in terms of the "Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste in terms of the Department of Water Affairs" (2nd Edition, 1998; Department of Water Affairs and Forestry) or alternative classifications that were approved prior to the WCMR taking effect, must be re-classified and assessed within three years from the commencement of these Regulations.;

Norms and Standards for the Assessment of Waste for Landfill and the Norms and Standards for the Disposal of Waste to Landfill promulgated under the National Environmental Management: Waste Act, 2008 (NEM:WA) (effective 23 August 2013): The Norms and Standards for the Assessment of Waste for Landfill Disposal and the Norms and Standards for Disposal of Waste to Landfill were also published for immediate implementation. The purpose of the Norms and Standards for the Assessment of Waste for Landfill Disposal are to outline the requirements for the assessment of waste prior to the disposal to landfill and to advice on the total concentration and the leachable concentration threshold limits. The Norms and Standards for Disposal of Waste to Landfill seek to determine the requirements for the disposal of waste to landfill. They stipulate the containment barriers for the different landfill types and list the barrier requirements that must be included in an application for waste management licence for a landfill site or cell.

National Environmental Management: Waste Amendment Act 26 of 2014

The definition of waste was amended in the abovementioned Amendment Act as follows:

“waste” means-

(a) any substance, material or object, that is unwanted, rejected, abandoned, discarded or disposed of, or that is intended or required to be discarded or disposed of, by the holder of that substance, material or object, whether or not such substance, material or object can be re-used, recycled or recovered and includes all wastes as defined in Schedule 3 to this Act; or

(b) any other substance, material or object that is not included in Schedule 3 that may be defined as a waste by the Minister by notice in the Gazette,

but any waste or portion of waste, referred to in paragraphs (a) and (b), ceases to be a waste-

(i) once an application for its re-use, recycling or recovery has been approved or, after such approval, once it is, or has been re-used, recycled or recovered;

where approval is not required, once a waste is, or has been re-used, recycled or recovered;

(ii) where the Minister has, in terms of section 74, exempted any waste or a portion of waste generated by a particular process from the definition of waste; or

(iii) where the Minister has, in the prescribed manner, excluded any waste stream or a portion of a waste stream from the definition of waste.

The above implies that residue deposits and residue stockpiles falls under the definition of Waste under NEM: WAA and activities which involves these waste streams needs to be licensed under NEM: WAA accordingly. The NEM: WAA licensing procedure will apply to these activities, but the Minister of Mineral Resources is the licensing authority where a waste management activity involves residue deposits and residue stockpiles on a prospecting, mining, exploration or production area.

The Waste Management Listed Activities were also amended as part of the abovementioned Act as follows:

Important Definitions	
Importance of definitions	Definitions determine the scope of application of the NEM: WAA and its subsequent Regulations.
Facility	***"a place, infrastructure, structure or containment of any kind including associated structures or infrastructure, wherein, upon or at, a waste management activity takes place and includes a waste transfer facility, a waste storage facility, container yard, waste disposal facility, incinerators, lagoons, recycling, co-processing or composting facilities"***

Lagoon	***"the containment of waste in excavations and includes evaporation dams, earth cells, sewage treatment facilities and sludge farms"***
Temporary storage	***"a once off storage of waste for a period not exceeding 90 days"***
Category A Activities	
Regulation 3	A person who wishes to commence, undertake or conduct a waste management activity listed under this Category, **must conduct a basic assessment process set out in the EIA Regulations made under Section 24(5) of NEMA as part of a waste management licence application** contemplated in Section 45 read with Section 20(b) of the NEM: WAA.
Category A activities	**Storage of waste** (1) The storage of general waste in lagoons. **(Note: storage of general waste other than in lagoons – refer to Category C [i.e. no licence])** **Recycling or recovery of waste** (3) The recycling of general waste at a facility that has an operational area in excess of 500m^2, excluding recycling that takes place as an integral part of an internal manufacturing process within the same premises. (4) The **recycling of hazardous waste in excess of 500kg but less than 1 ton per day calculated as a monthly average**, excluding recycling that takes place as an integral part of an internal manufacturing process within the same premises. (5) **The recovery of waste including the refining, utilisation, or co-processing of waste** in excess of 10 tons but less than 100 tons of general waste per day or **in excess of 500kg but less than 1 ton of hazardous waste per day**, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises. **Treatment of waste** (6) The treatment of general waste using any form of treatment at a facility that has the capacity to process in excess of 10 tons but less than 100 tons. (7) **The treatment of hazardous waste using any form of treatment at a facility that has the capacity to process in excess of 500kg but less than 1 ton per day excluding the treatment of effluent, wastewater or sewage**. **Disposal of waste**

	(9) The disposal of inert waste to land in excess of 25 tons but not exceeding 25 000 tons, excluding the disposal of such waste for the purposes of levelling and building which has been authorised by or under other legislation. (10) The disposal of general waste to land covering an area of more than 50m^2 but less than 200m^2 and with a total capacity not exceeding 25 000 tons. (11) The disposal of domestic waste generated on premises in areas not serviced by the municipal service where the waste disposed exceeds 500kg per month. **Construction, expansion or decommissioning of facilities and associated structures and infrastructure** (12) The construction of a facility for a waste management activity listed in Category A of this Schedule (not in isolation to associated waste management activity). (13) The expansion of a waste management activity listed in Category A or B of this Schedule which does not trigger an additional waste management activity in terms of this Schedule. (14) The decommissioning of a facility for a waste management activity listed in Category A or B of this Schedule.
Category B Activities	
Regulation 4	A person who wishes to commence, undertake or conduct a waste management activity listed under this Category, **must conduct a scoping and environmental impact reporting process set out in the EIA Regulations made under Section 24(5) of NEMA as part of a waste management licence application** contemplated in Section 45 read with Section 20(b) of the NEM: WAA.
Category B activities	**Storage of hazardous waste** (1) The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage. **(Note: storage of hazardous waste other than in lagoons – refer to Category C [i.e. no licence])** **Reuse, recycling or recovery of waste** (2) The **reuse or recycling of hazardous waste in excess of 1 ton per day**, excluding reuse or recycling that takes place as an integral part of an internal manufacturing process within the same premises.

	(3) The recovery of waste including the refining, utilisation, or co-processing of the waste at a facility that processes in excess of 100 tons of general waste per day or in excess of 1 ton of hazardous waste per day, excluding recovery that takes place as an integral part of an internal manufacturing process within the same premises. **Treatment of waste** (4) The **treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment** excluding the treatment of effluent, wastewater or sewage. (5) The treatment of hazardous waste in lagoons, excluding the treatment of effluent, wastewater or sewage. (6) The treatment of general waste in excess of 100 tons per day calculated as a monthly average, using any form of treatment. **Disposal of waste on land** (7) The **disposal of any quantity of hazardous waste to land**. **(Note: definition of residue deposits and residue stockpiles as well as distinction between disposal and storage)** (8) The disposal of general waste to land covering an area in excess of 200m^2 and with a total capacity exceeding 25 000 tons. (9) The disposal of inert waste to land in excess of 25 000 tons, excluding the disposal of such waste for the purposes of levelling and building which has been authorised by or under other legislation. **Construction of facilities and associated structures and infrastructure** (10) The construction of a facility for a waste management activity listed in Category B of this Schedule (not in isolation to associated waste management activity).
Category C Activities	
Regulation 5	A person who wishes to commence, undertake or conduct a waste management activity listed under this Category, must comply with the relevant requirements or standards determined by the Minister listed below- (a) Norms and Standards for Storage of Waste, 2013; or (b) Standards for Extraction, Flaring or Recovery of Landfill Gas, 2013; or (c) Standards for Scrapping or Recovery of Motor Vehicles, 2013.

Category C activities	**Storage of waste** (1) The storage of general waste at a facility that has the capacity to store in excess of 100m3 of general waste at any one time, excluding the storage of waste in lagoons or temporary storage of such waste. (2) The **storage of hazardous waste at a facility that has the capacity to store in excess of 80m3 of hazardous waste at any one time**, **excluding the storage of hazardous waste in lagoons or temporary storage of such waste**. (3) The storage of waste tyres in a storage area exceeding 500m2. **Recycling or recovery of waste** (2) The sorting, shredding, grinding, crushing, screening or bailing of general waste at a facility that has an operational area in excess of 1000m^2. (4) The scrapping or recovery of motor vehicles at a facility that has an operational area in excess of 500m2. (5) The extraction, recovery or flaring of landfill gas.
Transitional provisions	• A person who lawfully conducts a waste management activity listed in this Schedule on the date of the coming into effect of this Notice may continue with the waste management activity until such time that the Minister by notice in a Gazette calls upon such a person to apply for a waste management licence. An application for a waste management activity which was listed under the previous Waste Management Activities List Notice which is no longer listed in terms of this Schedule and a decision on such an application is still pending on the date of coming into effect of this Notice, such an application will be considered withdrawn. If a situation arises where waste management activities, listed under the previous Waste Management Activities List Notice, are listed differently under the current list of waste management activities, and a decision on such an application is still pending, such an application will still be processed by the licensing authority in accordance with this Notice, except if it is an application for a waste management activity A 3(11) or waste management activity B 4(7) listed under the previous Waste Management Activity List Notice (i.e. the treatment of effluent, wastewater or sewage). • A person who submitted an application for a waste management licence for a waste management activity which is no longer listed in Category A or B but listed in Category C of this Schedule on the date

	of coming into effect of this Notice, must consider such an application for that activity withdrawn, and must comply with the requirements or standards for that waste management activity. • A person who lawfully conducted a waste management activity that is no longer listed in Category A or B, but listed in Category C of this Schedule, on the date of coming into effect of this Notice, may continue with the waste management activity for the duration stipulated in the permit or waste management licence until the expiry date of the permit or waste management licence where after such a person must comply with requirements or standards for that waste management activity. • An application submitted for a waste management activity A 3(11) or waste management activity B 4(7) listed under the previous Waste Management Activity List Notice (i.e. the treatment of effluent, wastewater or sewage) and is still pending on the date of coming into effect of this Notice, such an application will be considered by the relevant licensing authority and will be assessed and decided upon under the previous Waste Management Activities List Notice up to the construction phase of that facility. • A person who obtained a waste management licence for waste management activity A 3(11) or waste management activity B 4(7) listed under the previous Waste Management Activity List Notice (i.e. the treatment of effluent, wastewater or sewage) prior to the coming into effect of this Notice, must comply with the waste management licence conditions up to the completion of the construction phase and thereafter must comply with any applicable authorisation or legislation. • A person who submitted an application for a waste management licence for activity A 3(11) or B 4(7) listed under the previous Waste Management Activity List Notice (i.e. the treatment of effluent, wastewater or sewage) and such an application falls outside the revised thresholds for these activities under the NEMA Listing Notices, wherein a decision is still pending on the date of coming into effect of this Notice, must consider such an application withdrawn.

DRAFT REVISED AND UPDATED NATIONAL WASTE MANAGEMENT STRATEGY, 2019

The draft Government Gazette 42879 (Notice No. 1561) Strategy was published on 3 December 2019 by the DEFF. It is the requirement of the Waste Act to establish the National Waste Management Strategy (NWMS) and the review the strategy every five years. The draft was published to allow for comments. It is therefore not the final strategy. The National Waste Management Strategy (NWMS) and its review builds on the successes and lessons learnt from the implementation of the National Waste Management Strategy since 2011.

The NWMS provides government policy and strategic interventions in the waste sector that are intended to create an enabling environment for the projects identified during the 2017 Chemicals and Waste Phakisa. These projects contribute to the national goals of sustainable economic growth, job creation and social transformation.

The 3rd National Waste Management Strategy was drafted to improve the Circular Economy – an approach to minimising the environmental impact of economic activities by reducing, reusing, recycling and repurposing waste and processing waste as materials to manufacture other products. This minimises the need to extract virgin raw materials and the practice to dispose of waste, and includes all areas of value chain, ranging from product design, production to packaging, distribution, use and disposal.

Industries are required to align their Industry Waste Management Plans to the NWMS targets where possible in order to contribute to the attainment of the goals and targets set in the NWMS.

NATIONAL DOMESTIC WASTE COLLECTION STANDARDS, JANUARY 2011

The main purpose of these standards is to redress past imbalances in the provision of waste collection services, whereby it has become imperative that acceptable, affordable and sustainable waste collection services be rendered to all South Africans.

The provision of waste collection services will improve the quality of life of citizens and will ensure that citizens live in a clean and more acceptable environment. The lack of waste collection services or poor-quality waste collection services can result in a number of environmental and human health problems and therefore proper planning is crucial.

NATIONAL ENVIRONMENT MANAGEMENT ACT, (ACT 107 OF 1998) NEMA

NEMA is the mother of all environmental management Acts in South Africa. The purpose of NEMA is to uphold the provisions of section 24 of the Bill of rights (The Constitution of the Republic of South Africa). It aims to promote and uphold the rights of South African citizens to live in an environment that is not harmful to its health or well-being.

It places sustainable development at the centre of every development process that has the potential to have an impact on social, economic and environment whereby it requires the integration of social, economic and environmental factors in the planning, implementation and evaluation of decisions to ensure that development serves present and future generations.

Basel Convention This convention is an international treaty that controls the transboundary movements and disposal of hazardous waste (excluding the movement of radioactive waste) between nations and in particular to prevent the transfer of hazardous waste from developed to less developed countries.

Montreal Protocol: This protocol is an international agreement to the Vienna Convention for the Protection of the Ozone Layer and is centred on groups of halogenated carbons, which have been shown to play a role in ozone depletion. It provides a timetable on which the production of these substances must be phased out and eventually eliminated.

Rotterdam Convention: This convention is a treaty aimed at promoting shared responsibilities in relation to importation of hazardous chemicals. The responsibilities include the open exchange of information and calls on exporters of hazardous chemicals to use proper labelling, include directions on safe handling, and inform purchasers of any known restrictions or bans. Signatory nations can decide whether to allow or ban the importation of chemicals listed in the treaty, and exporting countries are obliged make sure that producers within their jurisdiction comply.

Stockholm Convention: This convention is an international environmental treaty on Persistent Organic Pollutants (POPs) that aims to eliminate or restrict the production and use of POPs

NATIONAL HEALTH ACT, 2003 (ACT 61 OF 2003)

The National Health Act 61 of 2003 provides a framework for a structured uniform health system within the Republic, taking into account the obligations imposed by the Constitution and other laws on the national, provincial and local governments with regard to health services; and to provide for matters connected therewith.

Section 32 of the Health Act (Act 61 of 2003) requires provincial Health MECs to assign environmental health functions to district and metropolitan municipalities. The definition of these functions in the Health Act includes environmental pollution control, waste management and water quality monitoring.

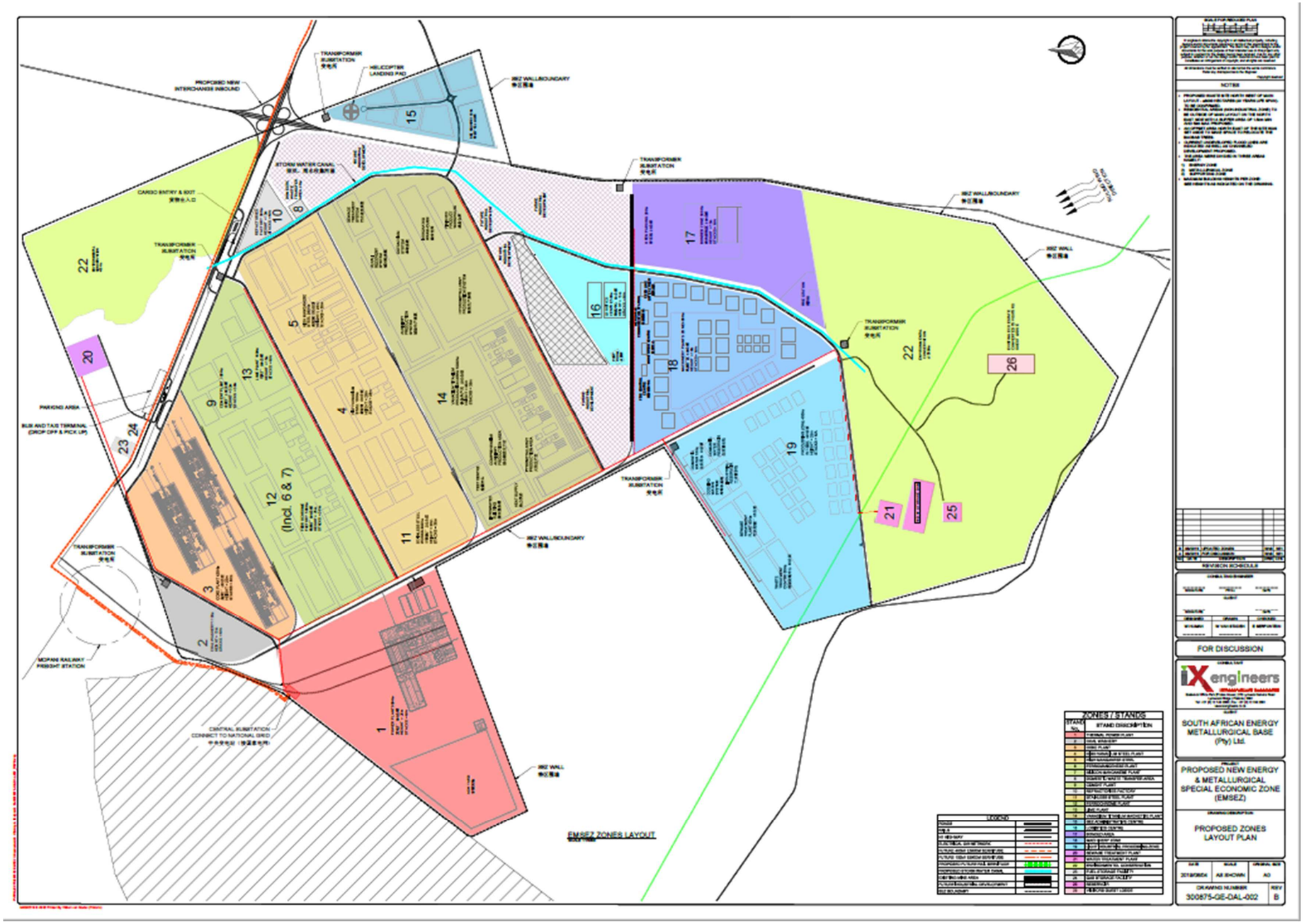
As a schedule B function in terms of the Constitution, municipalities are expected to continue to fund and provide the expanded definition of municipal health services (RSA 1996). The assignment and delegation of additional environmental health and management functions has led to recognition in the Health Act of the responsibility of the Provincial sphere to contribute towards meeting the additional financial burden. Many district municipalities are having difficulty in restructuring and implementing the new district-level arrangements envisaged by the Health Act for the financing and management of environmental health functions. Section 34 of the Health Act makes provision for transitional arrangements (RSA 2003) in which local municipalities are required to continue providing the services they provided before the Act, and until such time as a Service Level Agreement (SLA) is in place. In a number of districts, the EHS devolution process has not yet been finalised. District Municipalities cannot raise income from property rates and do not receive equitable share finance for their given environmental health function. It follows then that the Provincial Department of Health is required, through an SLA to assess and make available the resources needed to perform the required environmental health functions. Local municipalities who previously provided environmental health services are expected to continue to provide the finances for these posts which are required to be transferred to the District Level. Additional posts to address newly assigned and delegated functions need to be funded in terms of Section 32 of the Health Act through an SLA which a) describes the services; b) determines the resources that must be made available by the province and those by the municipality and c) sets performance and monitoring standards.

The National Health Act does not address the disposal of health care risk waste as such.

Draft regulations for the control of environmental conditions constituting a danger to health or a nuisance were published in GNR21 of 14 January 2000. In terms of the proposed regulations, registration is required for: concerns that to carry out a scheduled trade, including waste incineration, waste (including HCRW) disposal sites and waste collecting, sorting, treating or processing sites.

3. LOCATION OF WASTE STORAGE AREA WITHIN EMSEZ COMPLEX

The location of the Waste Management Storage Area is indicated as Zone 8 on the following layout plan:


PROPOSED NEW INTERCHANGE INBOUND
TRANSFORMER SUBSTATION
HELICOPTER LANDING PAD
IBIZ WALL/BOUNDARY
STORM WATER CANAL
CARGO ENTRY & EXIT
PARKING AREA
BUS AND TAXI TERMINAL (DROP OFF & PICK UP)
MOPANI RAILWAY FREIGHT STATION
CENTRAL SUBSTATION - CONNECT TO NATIONAL GRID
IBIZ WALL
EMSEZ ZONES LAYOUT
LEGEND
ZONES / STANDS
STAND NO.
STAND DESCRIPTION
NOTES
REVISION SCHEDULE
FOR DISCUSSION
engineers
SOUTH AFRICAN ENERGY METALLURGICAL BASE (Pty) Ltd.
PROPOSED NEW ENERGY & METALLURGICAL SPECIAL ECONOMIC ZONE (EMSEZ)
PROPOSED ZONES LAYOUT PLAN
DRAWING NUMBER
300875-GE-DAL-002
REV
B

4. WASTE CATEGORISATION

Waste is categorized as follows:

- General Non-Hazardous Waste including;
    - General Municipal Waste;
    - Inert Waste;
- Hazardous Waste.

General Non-Hazardous Waste

Guidelines for General non-hazardous waste is summarized as:

- The storage area should be readily accessible to the collection vehicle;
- The storage area should be designed to prevent the spread of fire, emission of airborne pollutants, odour and vectors throughout the area;
- Storage areas should be of adequate size and capacity to accommodate the required numbers of containers consistent with the waste generation routine and collection schedules;
- Containers should be marked and selected for the specific intended service and equipped with lids;
- Containers and storage areas should be cleaned and disinfected on a regular basis; and
- The waste material should be removed to the disposal site at the earliest opportunity, as the waste is generated and in line with any prevailing health and safety regulations.

Hazardous Wastes

If hazardous wastes are generated as a result of operations, accidental spills or discovery of contaminated soils or ground water, a Remedial Action Plan (RAP) will be developed as appropriate and wastes removed according to the Waste Management Plan. The RAP will encompass the recommendations of the Contaminated Soils and Ground Water Plan.

The following guidelines shall apply for hazardous wastes:

- Hazardous waste storage areas shall be designed to have spill containment systems;
- Hazardous waste must be stored under roof cover to be protected from rain and storm water so as to prevent generation of (hazardous) effluent;
- Hazardous waste storage areas shall be protected to avoid run off to and from the storage area and have facilities to monitor and pre-treat any run off;
- Containment curbs shall be maintained around the loading and unloading area;
- Containers and storage tanks shall be comprised of suitable / compatible material to permanently contain the hazardous waste and have an identification label;
- Storage facilities shall be inspected regularly for leakage;
- The storage facilities for volatile substances shall be covered;

- The surface impoundment used to store hazardous wastes shall be adequately lined and leakage monitoring and detection systems installed;
- The storage areas shall be tarred or cemented, fenced, marked and illuminated;
- Hazardous wastes shall not be stored in the storage area more than 90 days.
- At the expiry of the storage time-limit, hazardous waste must be removed and transported to the hazardous waste facility in Benoni, Gauteng province for disposal. If hazardous waste is taken out of South Africa, it should be done in accordance with the provisions of the Waste Export Regulations, GNR 22 of 21 January 2020, which incorporates the Basel Convention into South African law.

EMSEZ must implement an integrated waste management hierarchy of prevention, reduction, reuse, recycling, recovery, treatment, and as a last option, landfill disposal. This is why the approach to re-use one industry's waste as the feedstock for another's raw material becomes very important in the design model of EMSEZ. The waste hierarchy is prescribed in section 16(1)(a)-(c) of the National Environmental Management: Waste Act, 2008 (NEMWA) as part of the minimum requirements of the waste generator's general duty of waste management. It entails the legal obligation to (i) avoid, (ii) reduce, (iii) re-use, (iv) recycle, (v) recover, (vi) treat toxicity and volumes; and (vii) dispose of waste in that sequence. These are not simply voluntary waste best practices, but legal binding obligations on all future SEZ operators.

Figure 1:: Waste Management Hierarchy.

5. WASTE CLASSIFICATION

Waste Types

This WMP addresses both construction and operational waste from the EMSEZ development. The construction activities will generate similar waste types across the EMSEZ development. The operational phase of EMSEZ will however generate various industry specific solid wastes depending on the industry types operating in the zone. During certain periods of time the construction and operation activities will be performed in parallel due to EMSEZ's phased approach to development.

In this section, solid wastes generated from both phases are identified and classified / characterised.

5.1.1 Construction Phase

Solid wastes during the construction phase typically originate from the on-site construction works, site offices and accommodation camps. The forecast of waste streams for the construction phase of the EMSEZ development is presented in Table 1.

Table 1: Potential Solid Wastes during Construction Phase

Source	Potential Solid Wastes Types
Accommodation camps	Food, paper, cardboard, packaging materials, plastics, textiles and leather, wood, glass, metal and medical wastes
Site offices	Paper, cardboard, plastic, metal, wood and small amounts of food waste, ink cartridge, glass, fluorescent lights.
Construction Works	Wood, plastic, metal, steel materials, concrete and cement wastes, plumbing fixtures and piping, insulation material, packaging material (cardboard, paper, plastic), mortar and plaster, asphalt, welding slugs, rubber, used tyres, used batteries, used paint containers, oils, varnishes, thinners, adhesives, electrical and electronic wastes, oily rags, contaminated soil, mercury containing wastes (viz., fluorescent bulbs, broken mercury switches, batteries or thermostats)

The solid wastes identified in the above table are segregated and listed in the next table. Each of the wastes is then classified as hazardous (HZ) or non-hazardous (NHZ), recyclable (RC) or non-recyclable (NRC), biodegradable (BD) or non-biodegradable (NBD).

Waste classifications are presented in Table 2 below.

Table 2: Classification of Construction Phase Wastes

Waste Type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Paper and cardboard	NHZ	RC	BD
Wood	NHZ	RC (also re-usable)	BD
Electrical and electronic wastes	NHZ & HZ	RC & NRC	NBD
Glass	NHZ	RC	NBD
Metal	NHZ	RC	NBD
Plastic	NHZ	RC	NBD (few are)
Rubber	NHZ	RC	NBD
Used tyres	NHZ	RC	NBD
Waste food	NHZ (usually)	NRC (some can be composted)	BD
Concrete	NHZ	RC	NBD

Waste Type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Plaster, cement, mortar, other civil wastes	NHZ	NRC (some might be recyclable)	NBD
Plumbing wastes	NHZ	NRC	NBD
Textile and leather	NHZ	NRC	NBD
Medical	HZ	NRC	BD & NBD
Sludge from wastewater treatment	HZ	NRC	BD
Contaminated soil	HZ	NRC	NBD
Empty containers of paints, oils, varnishes, thinners, adhesives, etc.	HZ	NRC	NBD
Used batteries	HZ	RC	NBD
Oily rags	HZ	NRC	NBD
Welding slugs	HZ	NRC	NBD

5.1.2 Operational Phase

The following industry types have been identified for development in the EMSEZ:

- Logistics
- Specialty Metals (extrusion, rolling, casting)
- Downstream Petrochemicals (plastics)
- Non-Bulk Building Material Storage
- Food Processing and Packaging
- Tools and Machinery
- Other (accommodation for 53,000 workers, retail and office spaces serving the EMSEZ community).

These industries will generate both Hazardous and Non-Hazardous solid wastes. The wastes could be recyclable or non-recyclable. The waste types expected from each of the above-mentioned industry types is presented in Table 3.

Table 3: Potential Solid Wastes during Operation Phase

Industry Type	Potential Source	Potential Solid Waste
Logistics	On-board garbage	Plastic Cargo residues, paper products, rags, glass, metal, bottles, crockery, Food waste
	Logistics warehouse	Packaging waste (wooden/plastic pallets, polyethylene, paper and cardboard) Residual dry bulk product
	Container repair activities	Metal wastes
	On-site vehicle maintenance	Used oil residue Used filters Used tyres Oily rags Packaging Used oil drums
	General container loading/ unloading	Soil contaminated from accidental spills / leaks from trucks / front end loaders
	Other	Fluorescent light bulbs Used tyres Containers of paints, adhesives, resins, oil Drums containing oily residues Used mercury dry cell batteries Used lead batteries Used Ni-Cd batteries Oil contaminated materials Used aerosol and coolant canisters Materials containing asbestos Electrical and electronic wastes
Metals	Machining operation (turning, drilling, threading, grinding, etc.)	Metal scraps from cutting works, welding slugs, sanding dust (which may contain heavy metals from paints)

Industry Type	Potential Source	Potential Solid Waste
	Metal part cleaning and stripping (removal of scale polishing of metal, removal of oil based soils, organic soils)	Abrasives
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves
	Surface treatment and plating	Spent process solutions Filter cakes Quench oil tank clean-up waste Spent salt bath Wastewater treatment sludge (potentially containing metal hydroxides and carbonates) Vent scrubber wastes Ion-exchange resin reagents (brine, HCl, NaOH)
	Painting activity (spray painting, resin application)	Toxic and ignitable thinners Toxic paint wastes Paint sludge Oil- and solvent-contaminated rags Empty cans containing paint and thinner residues Contaminated paint booth filters
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
Petrochemicals	Maintenance activities	Fuel oil

Industry Type	Potential Source	Potential Solid Waste
		Light oil Lube oil
	Other	Sludge from refining process Accidental discharges during abnormal operations
Building Materials	Storage	Broken/ waste storage materials Packaging materials
Food Processing	Raw material preparation	Rinds, seeds Skins, bones, feathers, blood Other contaminated objects
	Processing (chopping, cutting, slicing, dicing, milling, pulping, emulsification, homogenisation, centrifugations, filtration	Off-spec products, i.e., poor quality (too coarse or fine) product with loss of nutritional / sensory characteristics Agglomerates Waste off-cuts Separated solids (e.g., after clarification of liquids) Press residues (e.g., fruit juice extraction)
	Processing (fermentation, enzyme technology)	Spent biomass
	Processing: Extrusion Dehydration Baking and Roasting Frying	Strip down residues Heat transfer surface film build-up Write-off oven contents if process interruption exceeds product buffering capacity Contaminated fat, particulates
	Preservation / stabilization (blanching, pasteurisation, sterilisation)	Under-blanched food wastage, Food spoilt due to overheating Hear transfer surface film build-up
	Packing and storage	Glass Cardboard Aluminium foils Plastic containers

Industry Type	Potential Source	Potential Solid Waste
Tools and Machinery	Die-casting	Metal scraps Waste oil
	Machining and welding	Unusable welding rods Soaked rags Metal chips Welding slags Sanding dust (which may contain heavy metals from paints) Cutting fluid
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves
	Plating and finish treatment	Wastewater with traces of heavy metals Spent acids and alkaline
Transportation and Automotive	Machining operation (turning, drilling, threading, grinding, etc.)	Water stream contaminated with oil and chemical additives like chlorine, sulphur, creosols and alkalis Metal scraps from cutting works, welding slugs, sanding dust (which may contain heavy metals from paints)
	Metal part cleaning and stripping (removal of scale polishing of metal, removal of oil-based soils, organic soils)	Abrasives

Industry Type	Potential Source	Potential Solid Waste
	Casting and moulding	Sand Bag house dust and spent shot Refractories Drums Metal scraps and shavings Rags Gloves
	Surface treatment and plating	Spent process solutions Filter cakes Quench oil tank clean-up waste Spent salt bath Wastewater treatment sludge (potentially containing metal hydroxides and carbonates) Vent scrubber wastes Ion-exchange resin reagents (brine, HCl, NaOH)
	Painting activity (spray painting, resin application)	Toxic and ignitable thinners Toxic paint wastes Paint sludge Oil- and solvent-contaminated rags Empty cans containing paint and thinner residues Contaminated paint booth filters
	Office and warehouse	Paper Printing cartridges Pallets (plastic and/or wooden) Packaging materials (paper, cardboard, plastic, wood)
Other	Office and Accommodation	Food wastes from cooking Expired food items Spoilt / rotten meat, fish, vegetables, fruits, etc. Leftover food Paper and cardboard

Industry Type	Potential Source	Potential Solid Waste
		Packaging materials Plastics Textiles and leather Wood Glass Medical wastes

The solid wastes identified in the above table are segregated and listed in the next table. Each of the wastes is then classified as hazardous (HZ) or non-hazardous (NHZ), recyclable (RC) or non-recyclable (NRC), biodegradable (BD) or non-biodegradable (NBD).

Waste characteristics are presented in Table 4.

Table 4: Classification of Operation Phase Wastes (done in terms of GNR634 of 2013)

Waste Type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Paper and cardboard waste	NHZ	RC	BD
China Clay waste (broken crockery)	NHZ	RC	NBD
Electrical and electronic wastes	NHZ & HZ	RC & NRC	NBD
Glass	NHZ	RC	NBD
Insulation linings	NHZ	RC	NBD
Metal wastes (scraps, chips, shavings, etc.)	NHZ	RC	NBD
Plastic waste	NHZ	RC	NBD (few are)
Rubber	NHZ	RC	NBD
Used tyres	NHZ	RC	NBD
Rinds, seeds	NHZ	NRC	BD
Food waste from kitchen and mess	NHZ (usually)	NRC (some can be composted)	BD
Abrasives	NHZ	NRC	NBD
Broken / waste storage materials	NHZ	NRC	NBD
Plumbing wastes	NHZ	NRC	NBD
Rags – uncontaminated	NHZ	RC	NBD (mostly)

Waste Type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Rags – Contaminated	HZ	NRC	NBD
Textiles and leather	NHZ	NRC	NBD
Used casting sand	NHZ	NRC	NBD
Printing cartridges	HZ	RC	NBD
Spent catalyst	HZ	RC	NBD
Used bag house filters	HZ	RC	NBD
Used batteries (Pb, Hg-dry cell, Ni-Cd)	HZ	RC	NBD
Used filters	HZ	RC	NBD
Sludge from wastewater treatment	HZ	NRC	BD
Agglomerates from food industry	HZ	NRC	BD
Clarified solids from food industry	HZ	NRC	BD
Contaminated fat and particulates	HZ	NRC	BD
Food contaminated with thermophilic bacteria	HZ	NRC	BD
Food spoiled due to overheating	HZ	NRC	BD
Improperly treated product	HZ	NRC	BD
Medical wastes	HZ	NRC	BD & NBD
Contaminated soil	HZ	NRC	NBD
Unused containers of paints, oils, varnishes, thinners, adhesives, etc.	HZ	NRC	NBD
A/c units containing either ODS as coolant or non-ODS with high GWP	HZ	NRC	NBD
Carburettor cleaners	HZ	NRC	NBD
Filter cakes	HZ	NRC	NBD
Ion-exchange resin reagents	HZ	NRC	NBD
Materials containing asbestos	HZ	NRC	NBD

Waste Type	Hazardous or Non-Hazardous	Recyclable or Non-Recyclable	Biodegradable or Non-Biodegradable
Paint sludge	HZ	NRC	NBD
Sludge from refining process	HZ	NRC	NBD
Sludge from wastewater treatment	HZ	NRC	BD
Spent salt bath	HZ	NRC	NBD
Tank clean-up waste / sludge	HZ	NRC	NBD
Unusable welding rods	HZ	NRC	NBD
Vent scrubber wastes	HZ	NRC	NBD
Wastes potentially containing mercury	HZ	NRC	NBD
Welding slugs	HZ	NRC	NBD
Wood	NHZ	RC (also re-usable)	BD

6. WASTE QUANTIFICATION

It is difficult to estimate waste quantities for each of the individual industries at this conceptual stage of the EMSEZ development. Information on industrial waste generation figures are not easily obtainable as it is mostly seen as sensitive of confidential information.

No specific information could be obtained and therefore the following approaches were explored:

1. Estimate hazardous and non-hazardous waste volumes based on the employee/residents headcount with the following conservative assumptions:
    a. Every person generates approximately 1.6 kg of non-hazardous domestic waste per day;
    b. Industrial/commercial non-hazardous waste generation is 2.0 kg per person per day;
    c. Generation of hazardous waste is taken as 5 % of the non-hazardous waste volume; and
    d. Total personnel number for EMSEZ development reaches approximately 53,000 people.

These numbers are indicative and typical for household and industrial waste generation. This approach provides a high-level estimate (Table 5) which will be compared with other data.

Table 5: Waste Quantity Estimates based on Headcount

Waste type	Generation per year, tones
Hazardous waste	2,008
Non-hazardous Industrial waste	40,150
Municipal solid waste (garbage)	30,113

Waste type	Generation per year, tones
Total	***72,721***

2. Waste generation rates for different industry zones/stands available for similar size developments were obtained and are presented in Table 6.

Table 6: Waste Quantity Estimates based on Industry Zones

Zones/Stands in EMSEZ	Waste generation factor, kg/employee/day	Maximum employees	Waste generation tons a day	Waste generation tons a year
Thermal Power Plant	4.05	4079	16.52	6,030
High Vanadium Steel Plant	4.05	6500	26.33	9,609
Silicon Managanese Plant	6.27	6690	41.95	15,310
High Managnese Steel Plant	4.05	7000	28.35	10,348
Ferromanaganese plant	4.05	5752	23.30	8,503
Ferrochrome Plant	4.05	4000	16.20	5,913
COKE Plant	4.05	1879	7.61	2,778
Cement Plant	4.05	2017	8.17	2,982
Stainless Steel Plant	4.05	7000	28.35	10,348
Light Industrial Processing	4.05	3500	14.18	5,174
Support Uses (Seweage treatment plant, Water Treatment plant, Coal Washery, refractories factory, Administrative Centre, Logistics centre, Machinery Zone, fuel and gas storage facilities, guest lodge)	4.17	4583	19.11	6,976
Total	**-**	***53000***	***230.05***	***86,590***

The following summary can be made regarding the waste generation based on the comparison of several high-level estimates for EMSEZ construction and operation phases:

- As mentioned at the beginning of this paragraph waste generation figures is highly dependent on the types of industries and the products manufactured as well as the methods utilised in the manufacturing process.
- From the above two comparisons one can see the total waste generation range between approximately 72,721 to 86,590 tons per annum, from the lowest to the highest;
- The figures indicated are based on the full development.

As mentioned elsewhere in the report, the development of EMSEZ will be done in phases therefore all the expected waste would not necessarily be generated at once during operational development. Therefore, the exact quantities of waste generated at any given time during development cannot be determined at the conceptual stage.

Disposal of the maximum forecasted waste quantity of 86,590 tons per year would require a volume of 1,732,000m³, equating to an area of approximately 44ha should the total height of the landfill be 4m. This calculation does not take any re-use, reclamation, recycling or resource sharing into account.

This information is purely indicative to highlight the extent of waste management required with the development EMSEZ.

This waste quantification exercise should be elaborated on and reviewed once more information regarding the waste industries and the type and quantities of waste generated are more readily available.

7. PROPOSED EMEZ WASTE MANAGEMENT PROCESS

Waste Management Strategy

The basic principles of the WMP include prioritization and promotion of waste minimization through source reduction and diversion from conventional disposal to re-use, and recycling. It further supports the principle of industrial symbiosis whereby one industry's waste becomes another's raw material for his production process.

Practical opportunities to implement waste minimization will be sought during the construction and operation of different developments within the EMSEZ master plan. Decisions regarding the implementation of these methods will be made based on environmental, economic, technical and logistical factors.

The over-arching principles of the waste management strategy are as follows and must be implemented:

- Waste generators are responsible for the management of their waste on-site and shall develop and implement the proper controls for ensuring Duty of Care compliance, in particular:
  - Conduct waste identification and classification;
  - Ensure that only qualified and licensed third-party waste management contractors are engaged in managing waste;
  - Implement effective lifecycle tracking of waste, whether it is re-used, treated or disposed; and
  - Take part in sharing information regarding their waste resources with a view of implementing the principle of industrial symbiosis through a possible Resource Management Program.
- Ensure proper segregation of waste streams at source to promote recycling and avoid mixing hazardous and non-hazardous waste; and

- Develop and/or implement a continual improvement and source-based waste minimization program.
- EMSEZ is to provide an oversight of waste management practices to:
  - Ensure compliance with all applicable legal and regulatory requirements and international best practices in all stages of the development;
  - Ensure that waste management hierarchy principle is adhered to and waste minimization is promoted through source reduction and diversion from disposal to re-use, recycling and resource recovery;
  - Ensure adequate waste storage, treatment and disposal capacity is in place and available prior to generation of major waste volumes at construction and operation phases of the development; and
  - Conduct inspections on waste management facilities and audits to ensure compliance,
  - Obtain independent third party certification of waste management systems (e.g. ISO 14001).

The WMP, appropriately implemented, shall minimize overall EMSEZ environmental footprint and enhance the sustainable construction and operation of the EMSEZ Master Plan development.

Waste Management Options

Various options should be considered for the waste management in EMSEZ. For instance, wastes can be collected and transported by third party operators, or they could fulfill the function themselves, or as a third alternative a utility company could be established to deliver the services.

Based on the preliminary analysis of the forecasted waste streams and volumes and available or the lack of waste management infrastructure, the following options are proposed for waste management in the EMSEZ:

Option A: Waste accumulated at the construction sites, operating industries and public areas will be collected by either third party waste transportation contractors (or a newly established EMSEZ utility company) and delivered directly to the recycling, treatment and disposal facilities (e.g., Musina or Makhado landfills or Holfontein or Vlakfontein Hazardous Waste Management Facilities in Benoni and Vanderbijlpark in Gauteng, respectively). Commercial recyclable collectors may have their own direct arrangements with waste generators for the selected waste streams (e.g. office paper, aluminum cans, e-waste, etc.). No centralized waste management area (WMA) will be established in the EMSEZ complex and all waste will be driven outside the EMSEZ once collected.

Option B: Same as Option A but a centralized Waste Management Area (WMA), will be established within the boundaries of EMSEZ and some waste could be brought to the WMA for accumulation and temporary storage (General waste and small volumes of hazardous waste). The WMA could serve as a waste depot and will provide a more flexible solution for recyclables and "difficult" waste streams that cannot currently be treated and disposed off at the existing facilities.

The following options is however relevant with regards to the **disposal of hazardous waste** from the subject industries:

- **Option B1:** For Hazardous Waste, since the long-hauling of hazardous waste i.e. ash, slag sludge etc to the existing Holfontein and Vlakfontein hazardous waste management facilities in Gauteng, might not be feasible in the medium to long term due to the distance and severe transport cost;

therefore a close by integrated hazardous waste management facility of approximately 3000 Ha (with 40 years lifespan) (i.e. for the disposal/treatment of hazardous waste i.e. ash, slag, sludge etc), outside the EMSEZ complex needs to be established. The facility will have to be licensed in terms of Section 45 of the National Environmental Management Waste Act, Act 59 of 2008 (NEMWA). The licensing process will be a separate process from the WMP, and have to follow a full Environmental Impact Assessment process for its establishment, meaning that the need, site selection process from a few candidate sites to be identified, detail investigations on the most suitable identified site (which could include the following detailed studies viz Geohydrological Assessment, Geotechnical Assessment, Heritage, Archaeology and Palaeontology Assessment; Ecology (Fauna & Flora) Assessment; Wetland Assessment and Delineation; Social Baseline Assessment, Economic Assessment; Visual Assessment; Traffic Assessment; Blast and Vibration Assessment (if required); Air Quality Assessment; Noise and Ground Vibration Assessment), needs to be conducted. This process should start as soon as possible. Should 2/3 of the waste stream be recycled as indicated by the EMSEZ, only 1000 Ha facility would be required. The cost to design and construct a full size integrated hazardous waste management facility could cost approximately R1,2 billion. The facility can be developed in a phased manner to alleviate initial cost i.e. establish a 200Ha facility for approximately R250,000,000 and with time develop the remainder.

- **Option B2:** Since each and every plant owner will be responsible to manage the waste generated within their respective plants, their responsibility will be to establish their own disposal facility for the disposal of their industrial hazardous waste they generate (if in large quantities, and as an option in the short term, until the outside "to be established integrated waste management facility" mentioned above, will be established). The same authorization requirements (mentioned in the above bullet for the establishment of an integrated hazardous waste management facility outside the EMSEZ complex) will apply for the hazardous waste disposal facility developed at the respective plants, where a need for such a facility is identified i.e. full EIA and WML application.

Option C: Same as Option A but instead of taking the waste outside EMSEZ, develop a waste management facility (includes landfill, treatment facilities etc) inside the boundaries of EMSEZ and use it as both a centralised waste management area and a treatment facility. **With the current layout this option seems almost impossible.**

Option B (centralised WMA for general and low volumes of hazardous waste) with a combination of option B1 and B2 for the management of larger volumes of hazardous waste is recommended. In other words, each plant owner needs to make provision and establish its own hazardous disposal facility on their respective premises. This is specifically important in the short term and for those industries generating large volumes of industrial hazardous waste, for example the power station (ash disposal facility). Industries which generate small volumes of industrial waste, can make provision for a storage facility only on their premises, from where the waste can be taken to the centralised WMA and then taken off site to either Holfontein or Vlakfontein existing hazardous waste management facilities. If decided to develop an integrated hazardous waste management facility close-by to the EMSEZ complex in the longer term, these waste streams can be taken to this facility for disposal.

Should negotiations for the expansion of the Musina landfill not be successful for the disposal of general waste, a new landfill facility should be established in close vicinity to the EMSEZ complex.

- The activity *inter alia* entails site identification, funding application, rezoning, possible property purchasing and transfer, full Environmental Impact Assessment with specialist investigations required by the authorities, design in terms of National Norms and Standards for Disposal of Waste to Landfill (promulgated in August 2013) and a construction period of 10-12 months. **It is anticipated that the cost estimate to design and construct a Class B general landfill facility of 35 Ha (full 35 Ha development) will be approximately R42,000,000.00,** depending on the

availability of *in situ* material available on site. The landfill will have enough airspace for at least 50 years, based on the volumes given elsewhere in the report.

Roles and Responsibilities

Throughout the life of the project, there will be multiple entities responsible for the management of the various waste materials. At the moment EMSEZ will assume overall accountability for ensuring the guidance in this plan is carried out. The management might stay with EMSEZ, or a Utility Company might be established, to take over the waste management of EMSEZ.

However, the responsibility of managing waste does not only lie with EMSEZ but also with the various contractors and industries. Each of them will have to establish and implement individual waste management plans and proper engineered designed infrastructure in line with the requirements of the regulating authority and the requirements as set out in this WMP.

The possible nominated stakeholders are listed below:

- Construction Contractors;
- Operating Industries;
- Utility Company (possibly managing public services and areas in EMSEZ); and,
- Waste Management Service Providers.

It is the responsibility of each nominated undertaker to use this WMP to develop detailed procedures for each of the management and monitoring requirements outlined in this document.

Clearly defined roles and responsibilities are critical to successfully implementing the WMP and maintaining compliance. Early and effective communication helps to establish good relationships between waste management personnel, contractors, subcontractors and third-party service providers. EMSEZ will assign responsibilities and make parties accountable for their responsibilities.

The waste management organizational structure is provided in Table 7. Roles and responsibilities may be adapted or added as required should other roles and responsibilities become apparent after consultation with stakeholders.

Table 7: WMP Roles and Responsibilities

Role	Responsibility
EMSEZ	• Develop and coordinate overall waste management strategy; • Retain accountability for delivery of waste facilities and infrastructure, including centralised WMA; • Ensure compliance with all applicable legal and regulatory requirements and international best practices in all stages of the development; • Provide assurance of compliance with legislation and project policies; • Ensure that waste management hierarchy principle is adhered to and waste minimization is promoted through source reduction and diversion from disposal to re-use, recycling and resource recovery;

Role	Responsibility
	• Encourage efficient use of resources through waste minimization, re-use and recycling; • Monitor and inspect contractors, subcontractors and third-party services waste management activities and infrastructure to ensure conformance with project waste management policies and strategies; • Conduct inspections on the WMA and audits to ensure compliance waste generators, third party waste management contractors for transport; • Ensure adequate waste storage, treatment and disposal capacity is in place and available prior to generation of major waste volumes at construction and operation phases of the development; • Compile and submit waste management reports to regulatory agencies; • Identify, inspect and approve third-party service providers for off-site waste diversion, treatment and disposal services; and • Undertake regular audits with respect to the management of waste. Audits will evaluate performance by comparing monitored KPI values against baseline benchmarks/conditions and plans.
Construction Contractors, Operating Industries	• Manage the on-site activities in compliance with the WMP; • Ensure all necessary waste management-related permits and approvals required by the authorities, have been obtained; • Hire and manage the contractors, subcontractors and EMSEZ approved third-party service providers for off-site waste diversion, treatment and disposal services; and • Provide all necessary resources for personnel orientation, including induction and training materials.
EMSEZ Utility company	• Manage waste accumulated in the public areas; • Hire and manage the contractors, subcontractors and EMSEZ approved third-party service providers for off-site waste diversion, treatment and disposal services; or • Provide all necessary equipment and resources for personnel orientation, including induction and training materials to deliver the service themselves.
Operator of WMA (Third-Party)	• Follow proper manifesting procedures; • Provide evidence of approval by regulatory authorities to accept, store, treat or dispose of waste; • Provide general and site-specific waste management training, and safety training of staff as required; • Provide and manage waste and recyclables storage containers within the WMA;

Role	Responsibility
	• Coordinate off-site transportation and drivers; • Supervise and provide on-site vehicles and drivers; • Manage and operate the weighbridge installed at the WMA; • Provide the necessary waste management equipment and apparatuses as required to fulfil their regulatory requirements; • Oversee and operate the WMA; • Provide project and regulatory waste tracking and documentation; and • Engage the services of approved third-party recycling and disposal companies who shall agree to accept project recyclables and waste materials.
Third-Party Waste Transporters	• Follow proper manifesting and transportation procedures for both non-hazardous and hazardous wastes; • Take responsibility of waste materials once possession thereof has been taken. • Notify EMSEZ and the waste generator if all or part of a transfer is lost in transit.
Third-Party Waste Receivers	• Follow proper manifesting procedures; • Provide evidence of approval by regulatory authorities to accept, store, treat or dispose of waste.

On-Site Waste Management

Waste Reduction

Waste minimization/reduction refers to avoiding or reducing waste volumes generated and / or reducing the toxicity of project generated waste. Implementing waste minimization practices during construction and operational phases of the EMSEZ project can reduce potential environmental impacts, makes it safer and easier to handle, store, transport and dispose of wastes. Waste minimization/reduction includes the "4 R's": Reduce, Reuse, Recycle and Recover.

(a) Construction Phase

The key to reducing construction waste on-site is to plan and design with reduction of waste in mind. Some the methods that can be applied include the following:

- Off-site & pre-fabricated assembly;
- Pre-cast & modular concrete; and
- Design for de-construction to facilitate re-use and recycling.

The last item listed above takes the life-cycle approach. A more comprehensive way to describe this is at the hand of the 10 elements of the Delft Ladder for reduction of wastes during the construction process.

Table 8: The Delft ladder

The 10 steps	Description
Prevention	Design for recycling (DFR) and recovery in mind, based on a predetermined lifespan
Reuse on constructions	DFR, oversizing, selective dismantling, reprocessing, return system*
Reuse of building elements	DFR, selective dismantling, reprocessing, return system*
Reuse of materials	DFR, selective dismantling, reprocessing, return system*, leaching and content of contaminants
Useful application as residue	Quality equal to reference (with regard to leaching)
Immobilisation with useful application	Leaching and content contaminants
Immobilisation without useful application	Dumping conditions
Incineration with energy generation	Emission limitations
Incineration	Emission limitations
Dumping	Dumping conditions

**The return system refers to building materials that are returned to the supplier and processed, allowing them to be reused.*

Waste elimination and minimization is the first step in managing and minimizing and construction waste. Examples of waste elimination could be durable modular metal formwork which could be reused thus eliminating wood waste associated with formwork. As for minimization construction products can be selected on the basis of it being designed and manufactured to be shipped with minimal packaging thereby minimizing waste.

As EMSEZ is a new development it is not foreseen that reclaimed construction wastes will come from the project site itself from the onset of the project. Construction and demolition waste that have already been processed, such as crushed concrete from other construction activities, can be utilised in for instance as road-based gravel in EMSEZ. Excavated material with suitable characteristics can also be reused as layer works or backfill material.

Wood waste produced at construction sites can be reused for manufacturing other products or could be chipped and used as mulch, composting bulking agent, animal bedding, and fuel. Even dry walling could be recycled for remanufacture of dry walling.

The most important factor in the reuse and reclamation of constructions waste is to keep the different wastes separate to avoid cross-contamination and thereby lowering the possibility of reuse. Different wastes should be stored separate and collected and reprocessed for reuse.

(b) <u>Operational Phase</u>

The 4 R approach is of utmost importance during the operational and is in line with the views of the National Environmental Management Waste Act, Act 59 of 2008) (NEMWA).

The following strategies should be implemented as deemed appropriate based on technical, safety and economic practicality.

- Reduce: Reduce the volumes and hazard of waste produced. Examples of strategies which can be applied to achieve this include:
  - Purchase material in bulk to reduce container waste and the frequency of possible spillage when handling;
  - Segregate waste types to optimize reduction and recycling options (separate storage);
  - Minimise leaks and spills to reduce contaminated soil and water;
  - Establish maintenance schedules that are consistent with equipment manufacturers instructions;
  - Develop inventory control methods to ensure quantities of materials are completely utilized;
  - Use less hazardous alternatives to toxic products; and
  - Use vendors who accept the return of their spent products.
- Reuse: Refers to the reuse of materials without the need for processing. Examples of strategies which can be applied include:
  - Reuse pallets (wood and plastic);
  - Require vendors to supply material in reusable containers where possible; and
  - Return unused materials to vendors (similar to the return system in construction phase).
- Recycle: refers to the processing of materials to allow them to be reused again. Typical waste types which can be recycled include:
  - Aerosol containers;
  - Automotive equipment;
  - E-waste;
  - Flammable liquids;
  - Fluorescent lamps:
  - Glycol;
  - Metal scrap;
  - Solvents;
  - Spent batteries;
  - Tyres; and
  - Waste lube oil.

On-site recycling of waste could entail significant infrastructure, management and training. Off-site recycling involves minimal project infrastructure in comparison but results in increased waste transportation requirements. It is envisaged at this stage that the EMSEZ project will use external outlets and service

providers for waste recycling, but the first step of segregating should already take place preferably on-site at source.

Good housekeeping and regular analysis of how certain waste streams are generated is fundamental to source-based waste minimisation and the process of continual improvement. Avoiding waste accumulation, preventative maintenance, regular clean up and low waste packaging of inputs along with regular analysis of amounts of waste being generated will facilitate waste reduction and potentially elimination.

On-site Waste Segregation

Waste segregation practiced at source will generally be in accordance with the following guidance:

- Individual hazardous waste streams will be placed in separate, labelled containers at source without any mixing except where prior approval has been obtained based on compatibility of the mixture in relation to its final disposal options. As examples, fluorescent light tubes, dry charged batteries, solvent and chemical wastes, waste oil, process filters from different service applications all require separate individual containment at source. Waste hydrocarbons if deemed compatible may be mixed in a common container;
- Non-hazardous waste streams will be segregated by individual type where a defined waste diversion option is specified. This would specifically apply to ferrous and non-ferrous metals, useable wood and timber, and to various plastics, cardboard, and office paper. Otherwise these waste streams may be accumulated in a common container, although this would limit the option for recycling due to cross-contamination;
- Vegetable food wastes may be segregated within the kitchen and dining area for consolidation and transfer directly off-site for composting;
- Waste cooking oils will be held in dedicated containers for transfer to the WMA or transfer directly off site for reprocessing / local use.
- Bulk inert wastes of significant quantity such as waste building materials, concrete and granular material should be segregated in separate bulk containers for collection and possible reprocessing; and
- Health Care risk waste (medical waste) shall be segregated in labelled containers at source (custom labelled plastic containers for sharps and plastic bags for medical other wastes).

The segregation of waste is critically important because it:

- Maximises the possibilities for waste reuse and recycling;
- Reduces the possibilities of cross-contamination between hazardous and non-hazardous waste;
- Reduces the risk of an adverse reaction between incompatible wastes;
- Facilitates proper management of each specific waste type; and
- Allows for reduction of waste handling, treatment and disposal costs.

By preventing incompatible wastes from interacting, waste segregation also reduces the likelihood of an incident with potentially serious safety, industrial hygiene or environmental impact implications, or a combination of these.

The segregation of waste is the responsibility of all on-site staff including contractors and subcontractors. Waste will be segregated by project personnel at the point of waste generation to prevent materials from being treated or disposed of improperly.

Incompatible wastes should be stored in such a manner that there will be no contact between them even in the event of a release.

On-Site Waste Storage

Specific requirements that developers must adhere to in terms of the layout and design of the waste management facility on-site will be finalised before tenders and construction stage. Municipal building regulations will be implemented. The Norms and Standards for the Storage of Waste, promulgated under the NEMWA, should be adhered to. Clear demarcation of different waste types at the centralised WMA and good housekeeping is required to ensure proper waste separation is implemented.

(a) Non-hazardous Hazardous Waste

It is important to plan and decide on the appropriate means of on-site storage in terms of size and access for the waste generator as well as in conjunction with the requirements for collection and transport options before implementing any system. Storage areas shall be selected and designed with this in mind. A waste storage area is any area on-site where one or more waste bins, or recycling containers, are located for temporary storage. Waste must be stored near points of generation at worksites to allow for reasonable volumes to accumulate and for efficient transportation to the centralized WMA.

The following guidelines shall apply:

- Storage areas must be of adequate size and capacity to accommodate the required size and number of containers consistent with waste generation requirements.
- Waste collection will be undertaken on a pre-determined regular basis for predictable and continuously generated waste streams. If no pre-determined service exists or cannot be implemented, then the waste material shall be removed to the approved disposal site at the earliest opportunity upon request of the generator;
- Waste collection areas must be strategically located at the construction sites, operating industries and public areas to allow convenient access by waste collection vehicles;
- The reception areas must be designed to prevent the spread of fire, emission of airborne pollutants, odour and vectors throughout the area;
- Containers and the storage area must be cleaned on a regular basis;
- All wastes must be stored in compatible collection containers within the site for the specific intended waste and service and shall be labelled accordingly;
- Waste containers must be equipped with lids where applicable which will be closed at all times, except when bins are being emptied or filled. Larger open containers should be stored preferably under a roofed area.
- Waste containers must be located close to the points of waste generation where possible;
- The content of small waste receptacles, and waste bins located in the offices, camps, shops and other premises, must be transferred to the larger containers located at waste collection areas on a daily basis for collection.
- Specific waste management plans must be developed for construction sites and operating industries that will clearly indicate the size, design and location of containers for collection of

refuse and food waste. Large containers may include hook-on or roll off roll on containers for separate collection of construction waste or scrap metal.

- Waste collection must be conducted using appropriate site service vehicles equipped to empty or remove and return containers. Containers removed from generation locations must be returned to those locations in accordance with the permanent labelling on them.
- Waste collected must be taken directly to the centralised WMA for recycling and storage before being transferred to the relevant landfill facilities discussed earlier for final disposal.

The waste storage area at each industry will generally serve as the point of consolidation of some waste prior to transfer to the centralised WMA for accumulation. The activities undertaken at this site cover the consolidation of wastes in a form suitable for collection by waste management service providers.

(b) Hazardous Waste

On-site storage of hazardous waste should be avoided and should only be in small quantities until collection. The hazardous waste storage sections on-site are to be provided with the following:

- Roof for shelter from direct sunlight and any rain events;
- Concrete base and dike/bund walls to contain spillages and to avoid contamination of soil and groundwater by the hazardous substances in the case of a spill. The storage area should include a spill containment system to capture and collect any spills from the containers stored in the area.
- Adequate drainage system to keep storm water away from hazardous areas;
- Similar to non-hazardous waste, separate compartments for each different waste type;
- Containers and storage tanks comprising of suitable / compatible material to contain the hazardous waste and properly labeled;
- Signboards for each waste type and storage area along with personnel protective equipment (PPE) to be used in handling of each waste.
- Any spillage or rinsate from transfer or washing operations shall be captured for appropriate management; and
- Access for mobile equipment to this area is to be provided to facilitate material movement.

In addition to the above the following is also required:

- Storage facilities shall be inspected regularly for leakage;
- Incompatible materials should not be stored or placed in either common containment areas or containers;
- The surface impoundment used to store hazardous wastes shall be adequately lined and leakage monitoring and detection systems installed;
- Where groundwater pollution potential exists the monitoring of the aquifer shall be carried out and contingency plans shall be established to deal with emergencies arising from the accidental discharge of hazardous wastes;
- Hazardous wastes shall not be stored in the storage area more than 90 days; and

- At the expiry of the storage time-limit, hazardous waste shall be transported/removed to a suitable hazardous waste management facility i.e. the Holfontein facility in Ekurhuleni or Vlakfontein facility in Emfuleni, Gauteng.

Specific HSE related practices that shall be applicable to the operation of individual on-site waste storage areas include:

- Waste transfers involving flammable materials and metal containers require grounding of the containers during such transfers;
- Waste transfer of liquid wastes require the wearing of suitable personal protection equipment (PPE), specifically suitable gloves, face shields and aprons;
- Any spillage or rinsate from transfer or washing operations shall be captured for appropriate management; and
- Transfers of waste involving volatile wastes, or those with potentially hazardous particulates, shall be done with appropriate ventilation.
- Proper separation of incompatible chemical wastes during storage based on information provided in updated SDS (in the prescribed 16 point format of SANS 10234: 2019 and SANS 11014: 2010 and for transport SANS 101228: 2012.)

The area should be located on concrete hard-standing under roof with an appropriate drainage system which connects to the process area oil/water drainage system. In the event, that this connection cannot be made, the material will be collected and discharged into the appropriate drainage system via vacuum truck.

The facility perimeter will have a chain link fence and be gated. The on-site waste storage area will be secured with a lock system except when waste management activities are being undertaken on the site and site maintenance staff is present.

Storage Containers

Various containers can be utilised for storage of wastes on-site and at the centralised WMA.

The method of on-site storage has a significant effect on the collection system that can be implemented. The container type used will also be influenced by the collection frequency as well as the quantity of the specific wastes to be stored. It is important to plan and decide on the appropriate means of on-site storage in conjunction with transport options before implementing any system. Hazardous waste should be stored in closed containers and removed in closed skips so that no air, soil or water pollution can occur during incidents as well as for occupational and public health reasons.

Shown below are the various typical containers available for storage and collection of wastes.

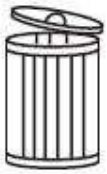
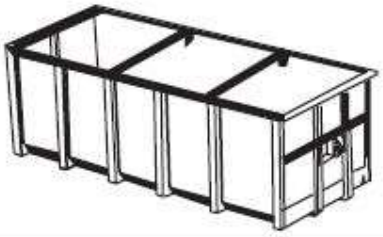
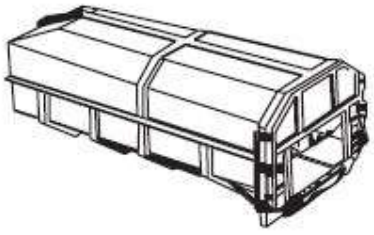
DESCRIPTION	COMMON USAGE		COLLECTION METHODS
85 litre plastic bin liners	Domestic/household Small business & industry General public amenities		By hand on-site or on sidewalk Liners deposited directly into collection vehicle
85 litre rubber/galvanised steel bins	Domestic/household Small business & industry General public amenities		By hand on-site or on sidewalk Bins emptied directly into collection vehicle
120/240 litre mobile refuse bins	Domestic/household Small business & industry General public amenities		Rear-end loading compactors with special lifting equipment
1,0 and 1,2 m^3 mobile refuse containers	Small business and industry		Rear-end loading compactors with special lifting equipment
4,5, 5,5, 6, 9 & 11,0 m^3 bulk containers	Large business & industry, garden refuse, building rubble, general public amenities & bulk wastes and communal collection systems		Load luggers Rear-end loading compactors with special lifting equipment
15 to 30 m^3 open bulk containers	Large business & industry, garden refuse, building rubble & bulk wastes and communal collection systems		Roll-on roll-off vehicles
11, 15 & 35 m^3 closed ontainers	Large shopping centres, transfer stations & selected industries		Roll-on roll-off vehicles

Figure 2*:* Construction and Demolition Waste.

Waste Collection

Each industry within the EMSEZ can appoint third party waste management service providers to collect and transport the wastes from the generation points / collection points in EMSEZ complex to the centralised WMA or can conduct the collection and transportation to the centralised WMA themselves (internally). Self transport is cheaper but operators are less likely to meet requirements, whereas if external waste contractors are used it will be more expensive, but professional services on standard will be provided and it provide good SMME opportunities.

The service providers will then supply waste collection bins, similar to what has been described earlier, which will be located at appropriate locations in the EMSEZ complex during construction phase, and at a suitable location within industry premises during the operation phase. The locations on-site as well as at the WMA where the bins will be placed should have adequate space for the waste transporting trucks to move around.

The waste generator should communicate with the service provider regarding the type of bins required depending on the waste types generated by the generator. Collection points and bins within the industry premises should be selected in conjunction with the industry operator.

Transportation

The waste generator/producer has the responsibility for requesting collection by the contracted service provider if this is not a pre-determined waste collection service. The waste generator is also responsible for supervising the contracted service provider's activities within the on-site waste storage area and also have the responsibility for preparation of the Waste Tracking Form as the key element in the tracking of waste through to its point of final disposal. They will also be the return point for the final copy of the Waste Tracking Form and the verification of the final disposal so documented.

Hazardous waste transport requires a:

(i) waste manifest (GNR 634),
(ii) safe goods transport declaration (Road Transport Regulation and SANS 10228) and
(iii) safe disposal certificate (GNR 634) These are 3 legal documents that are used for criminal enforcement. (In practice these 3 documents are combined in 1 document with carbon coloured copies for the different stages).

For General Waste, no Waste Tracking System (WTS) is prescribed by waste law but it is considered best environmental practice under the general duty of waste management (cradle to grave principle) (and also forms a legal requirement for financial management). Companies in industrial complexes with various plants such as SASOL, AEL, Oil refineries, and some mines use different WTFs , some use bar coded scanners to track waste movements.

Shown below are typical vehicles available for waste collection of the various waste containers proposed earlier.

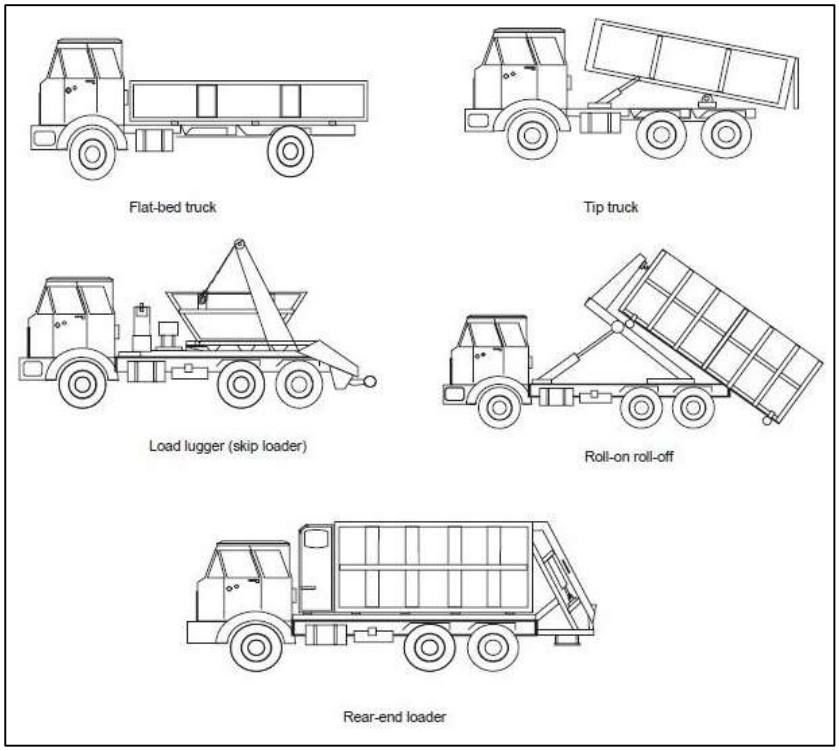


Figure 3*:* Construction and Demolition Waste.

Centralized Waste Management Area

The location of the on-site centralised Waste Management Area is indicated in Section 2 of this WMP.

The centralised WMA facility is located towards the entrance of the overall EMSEZ development, to allow for easy in and out of waste collection vehicles.

The WMA is intended to house certain wastes generated at the various project sites in EMSEZ during the construction and operational phases. The WMA will also serve as accumulation point for waste to reach economic quantity for transportation to the recycling, treatment or disposal outlet. It can also serve as a centralised storage area for waste resources from where different industries could collect these resources for use. However, it would be preferable that such resources be directly transferred from the point of generation to the point of use.

The centralized WMA should be located downwind of residential areas (labour accommodation areas) and away from environmentally sensitive areas (at least 500 m). The current layout shown earlier in this report have already made allowance for a buffer zone area of 100m. The site shall not be located within a 100-year flood plain or in any area which has a chance of flooding. Based on the current layout, the WMA is located close to transportation routes to receive and transfer wastes and to ensure easy access by fire trucks and waste collection vehicles.

A 4 Ha area (400m x 400m) was sized for the WMA, based on the waste volumes and storage requirements/conditions that have to be implemented. This area would allow for sufficient space to store wastes/resources as well as accommodate movement of equipment and vehicles delivery and collection, including the 100 m buffer zone.

The WMA would also have to be developed in line with the National Norms and Standards for the Storage of waste, promulgated under NEMWA. Specific requirements that the WMA must adhere to in terms of the layout and design of the waste management facility will be finalised before tender and construction stage.

The capital cost for the establishment of the centralised Waste Management Area for storage of waste will be approximately R2,500,000.00 to R3,000,000.00 (15% VAT excluded).

Non-Hazardous Waste Storage

The non-hazardous waste storage area will require following separate storage sections:

- Scrap storage section – for metal scrap, wood scrap and paper packaging materials;
- Used tires; and
- Other wastes section – for plastic water bottles, detergent bags and soap boxes etc.

The non-hazardous waste storage area to be provided with the following:

- Roof for shelter from direct sunlight and any rain events. This will help in preventing generation of run-offs to and from the waste storage areas and damage to the waste materials;
- The area where the bins are placed is to be provided with a concrete floor, sloped or provided with a drainage system in and around the area to act as a drainage/containment system to capture and collect any spills from the containers stored in the areas well as to avoid land contamination due to spillage;
- Separate storage areas/compartments for each of the storage sections listed earlier;
- Storage areas shall be of adequate size and capacity to accommodate the required size and number of containers for the specific intended waste shall be labelled accordingly;
- Waste containers must be equipped with lids where applicable which will be closed at all times, except when bins are being emptied or filled. Larger open containers should also preferably be stored under roofed areas;
- Containers and the storage areas shall be kept clean at all times;
- The reception areas shall be designed to prevent the spread of fire, emission of airborne pollutants, odour and vectors throughout the area;
- Although stored separately from hazardous waste the non-hazardous wastes area should also be a fenced area with access control; and
- Weighbridge for accurate control of waste handled (could be one weighbridge for both hazardous and non-hazardous wastes);

Hazardous Waste Storage

The hazardous waste storage area will require separate storage areas/sections as indicated below:

- Container storage section – for metal and plastic drums, and chemical sacks;
- A/C and refrigerant cylinder storage section;
- Filter storage section;
- Oily waste storage section;
- Waste chemicals storage section; and
- Battery storage section.

- Electronic waste storage area.

The hazardous waste storage sections are to be provided with the following:

- Roof for shelter from direct sunlight and any rain events. This will help in preventing generation of run-offs to and from the hazardous waste storage areas;
- Concrete base and dike/bund walls to contain spillages and to avoid contamination of soil and groundwater by the hazardous substances. At the entrance, the dike/bund walls may be replaced with humps; this will provide access to waste handling equipment such as forklifts, while still providing containment of spillages;
- Drainage system in and around the area to act as spill containment systems to capture and collect any spills from the containers stored in the area;
- Drainage system to keep storm water away from hazardous areas to avoid contamination;
- Separate compartments for each of the storage sections listed earlier;
- Containers and storage tanks comprising of suitable / compatible material to permanently contain the hazardous waste and have an identification label;
- Signboards for each waste type and storage section along with personnel protective equipment (PPE) to be used in handling at each of the storage sections. The sizing of the signage will be as per the area of display;
- Signboards for the WMA, displaying the restriction on access, emergency contact number;
- Fence around the area with a single controlled access / entry point; access / entry control could be by keeping the area under locked, requirement of access permits, setting up a guard house next to the gate with a guard monitoring the access;
- Internal roads and lighting for access;
- Weighbridge for accurate control of waste handled; and
- Access for mobile equipment to this area is to be provided to facilitate material movement.

In addition to the above the following is also required:

- Storage facilities shall be inspected regularly for leakage;
- Incompatible materials should not be stored or placed in either common containment areas or containers;
- The surface impoundment used to store hazardous wastes shall be adequately lined and leakage monitoring and detection systems installed;
- Where groundwater pollution potential exists the monitoring of the aquifer shall be carried out and contingency plans shall be established to deal with emergencies arising from the accidental discharge of hazardous wastes;
- Hazardous wastes shall not be stored in the storage area more than 90 days; and
- At the expiry of the storage time-limit, waste shall be transported/removed for disposal at the Holfontein hazardous facility in Benoni or the Vlakfontein hazardous facility in Vanderbijlpark, Gauteng.

Specific HSE related practices that shall be applicable to the operation of hazardous waste storage areas include:

- Waste transfers involving flammable materials and metal containers require grounding of the containers during such transfers;
- Waste transfer of liquid wastes require the wearing of suitable personal protection equipment (PPE), specifically suitable gloves, face shields and aprons;
- Any spillage or rinsate from transfer or washing operations shall be captured for appropriate management; and
- Transfers of waste involving volatile wastes, or those with potentially hazardous particulates, shall be done with appropriate ventilation.

Waste containers

Similar containers as was shown in Figure 5-1 will be utilised for waste storage at the WMA before being collected and taken for treatment or disposal at landfill.

Storage of hazardous liquid may require somewhat different types of containers such as sealed mobile tanks of different shape and sizes, or drums/bins suitable to safely contain the various waste types.

The requirements in type and size of the containment required will be finalised before tender and construction stage.

Signboards and Labels

Although this has been mentioned in the storage areas, it is of utmost importance that waste should be handle correctly at the WMA. To ensure no mixing or cross contamination take place it is proposed that proper signage be installed on site.

Appropriate signboards are to be provided at the WMA for the each of the various storage areas/ sections within the WMA, both non-hazardous and hazardous.

The waste collection bins are to be labelled identifying the type of wastes contained. The label may display the type of waste (i.e., hazardous, non-hazardous, medical, etc.) and in an appropriate colour code.

The PPE to be used in handling the wastes are also to be indicated using appropriate signboards. The signboards for the central storage area and sections within the central storage for different wastes can be permanent, while the signage indicating waste hazard property will be depending on type of waste stored.

Waste Transportation

Once the waste/resource has been received by the WMA they take further responsibility for the collection and transport of the waste material. The WMA will have the responsibility for requesting collection by the contracted service provider if this is not a pre-determined waste collection services, similar to each waste generator. The WMA is also responsible for supervising their activities within the storage areas within the WMA. They also have the responsibility for preparation of the Waste Tracking Form as the key element in the tracking of waste through to its point of final disposal. They will also have to be notified through a copy of the Waste Tracking Form to verify the final disposal of the materials.

Similar vehicles as was shown in Figure 5-2 will be utilised for waste collection to be taken to treatment or disposal at landfill.

Offsite Recycling, Treatment & Disposal

There are several recycling facilities available within Makhadu and Musina areas which can be used to recycle some waste streams, such as paper, metal scrap and used oil.

The non-recyclable hazardous waste will be transported to the Holfontein or Vlakfontein hazardous waste management facilities for disposal should they agree to it. Arrangements will have to be made for incineration of medical waste.

Waste Streams Management Summary

Waste management summary is presented in Tables 9 and 10. The tables also summarize appropriate handling, storage, transportation, and management practices for each waste type. For now, the assumption has been made that the Musina and Makhado landfills (for general waste) and Holfontein and/or Vlakfontein waste disposal facilities (for hazardous waste) will be able to accept the waste from EMSEZ.

Table 9: Waste management summary for construction phase

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
Empty metal and plastic drums	Hazardous	Segregated and stacked near construction site, accommodation facilities	Stacked separately on pallets	Drum washing
Textile, fabrics, leather	Non Hazardous	Bins at accommodation facilities	Onsite domestic waste skips	Musina Landfill
Domestic waste	Non Hazardous	Bins at offices, accommodation facilities	Onsite domestic waste skips	Musina Landfill
Packaging waste (plastic)	Non Hazardous	Collected in bins at warehouses	Onsite domestic waste skips	Musina Landfill
Packaging waste (paper and cardboard)	Non Hazardous	Collected in bins at warehouses	Onsite domestic waste skips	Musina Composting or Landfill
Wooden waste	Non Hazardous	Skips for wooden wastes at workshops	Onsite wooden waste skips	Musina Composting or Landfill
Dewatered digested sludge	Non Hazardous	Sludge ponds at effluent treatment plant	Onsite sludge skips	Musina Composting or Landfill
Glass, concrete, cement, mortar,	Non Hazardous	Waste pads at offices and	Onsite construction waste skips	Musina Landfill

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
ceramics wastes		accommodation facilities		
Metal scraps	Non Hazardous	Skips for metals at workshops	Onsite metal scrap skips	Recycling at the approved facility
Food waste	Non Hazardous	Covered bins at kitchens	Stored for a maximum of 24 hrs in plastic bags away from living quarters and away from wildlife	Musina composting plant or landfill
Rubber (hoses, waste tyres)	Hazardous	Bins at workshops and onsite vehicle maintenance facilities	Onsite rubber waste skips	Tyre recycling facility Rubber shredding and Holfontein/Vlakfontein Landfill
Batteries	Hazardous	Skips at mechanic workshop	Stored on pallets with shrink wrapping	Recycling
Clinical wastes	Hazardous	Special bins at clinics	Onsite clinical waste skips	Enviroserv Health Care Waste Incinerator
Oily rags	Hazardous	Bins at construction sites, workshops, vehicle maintenance facilities, fuelling area, etc.	Onsite hazardous wastes skips	Holfontein/Vlakfontein landfill
Waste lubricants	Hazardous	Bins at construction sites, workshops, vehicle maintenance facilities, fuelling area, etc.	Onsite hazardous wastes skips	Holfontein/Vlakfontein landfill or Rose Foundation approved Oil recycling facility
Contaminated soil from spills	Hazardous	Skips near vehicle maintenance	Onsite oily waste skips	Holfontein/Vlakfontein landfill

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
		facilities, workshops		
Used chemicals	Hazardous	On pallets at workshops, vehicle maintenance facilities	Onsite chemical waste skips	Holfontein/Vlakfontein Neutralisation, Stabilisation and Landfilling
Electrical and electronic wastes	Hazardous	Bins at workshops, offices, accommodation facilities	Transferred from point if generation / use and stored in the designated area	Recycling
Welding rod ends / slags	Hazardous	Bins at workshops	Onsite skips	Holfontein/Vlakfontein Landfill

Table 10: Waste management summary for operation phase

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
Wood and paper wastes	Non Hazardous	Bins and skips at offices, workshops, accommodation facilities	Onsite skips	Musina/Makhado Composting or Landfill or recycling at the approved facility
Plastic wastes	Non Hazardous	Bins at offices, workshops, accommodation facilities	Onsite skips	Musina/Makhado Landfill or recycling at the approved facility
Metal scraps (tins, aluminium cans, welding rod ends, aerosol cans)	Non Hazardous	Skips for metals at workshops	Onsite skips	Recycling at the approved facility
Glass and ceramic wastes	Non Hazardous	Skips at offices, accommodation facilities	Onsite skips	Musina/Makhado Landfill or recycling at the approved facility
Domestic waste	Non Hazardous	Bins at offices, accommodation facilities	Onsite skips	Musina/Makhado Landfill

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
Food waste from kitchens, food processing industries	Non Hazardous	Kitchen bins, waste containers in the processing areas	Stored in plastic bags and placed in containers with lids. To be moved out to final disposal location within 24 hours of storage	Musina/Makhado composting plant or landfill
Textile, fabrics, leather	Non Hazardous	Bins at accommodation facilities	Onsite skips	Musina/Makhado Landfill
Clinical waste	Hazardous	Special bins at clinics	Onsite clinical waste skips	Enviroserv Health Care Waste Incinerator
Filters (air and oil filters), cartridges, chemical containers	Hazardous	Skips for collecting filters at process areas, waste yards	Onsite skips	Recycling or Holfontein/Vlakfontein landfill
Lead acid batteries (dry cell batteries, bolts, gaskets, valves and other scraps)	Hazardous	Skips for collecting batteries at process areas or waste yards	Onsite skips	Recycling
Dewatered sludge from onsite treatment of industrial effluent	Hazardous	Industrial wastewater treatment plants	Onsite skips	Holfontein/Vlakfontein Landfill
Electrical and electronic wastes	Hazardous	Skips at workshops, offices, accommodation facilities	Stored on pallets at designated area and bound by shrink wrapping	Recycling
Spent chemicals	Hazardous	In waste containers on pallets at workshops, vehicle maintenance	Onsite skips	Recycling or Holfontein/Vlakfontein Neutralisation, Stabilisation and Landfilling

Waste Stream	Category	Collection Point at Site	Onsite Storage	Final Treatment / Disposal
		facilities, process areas		
Abrasives, blasting sand, etc.	Hazardous	Waste pads with impervious floorings, bunds and roof cover near process area in metal industries	Onsite skips or waste pads with impervious floorings, bunds and roof cover	Holfontein/Vlakfontein Landfill
Oily rags	Hazardous	Bins at process areas, workshops, vehicle maintenance facilities, fuelling area, etc.	Onsite skips	Holfontein/Vlakfontein landfill
Waste tyres	Hazardous	Stacked near vehicle maintenance facilities	Tidily stacked together at a designated area	Tyre recycling facility
Contaminated soil from spills	Hazardous	Skips near vehicle maintenance facilities, workshops	Onsite skips	Holfontein/Vlakfontein Landfill
Air conditioning units (containing ODS / GHG material)	Hazardous	Offices, accommodation, process area	Stacked together on pallets and bound with shrink wrappings	Recycled or dismantled and parts sent to respective disposal points

Based on the information provided in tables above the following treatment and disposal facilities will be required to manage waste generated during the EMSEZ development:

Facility	Availability
Hazardous waste incinerator	Enviroserv Incinerator, Gauteng
Stabilization /solidification unit	Available at the Holfontein/Vlakfontein landfill
Neutralization unit	Available at the Holfontein landfill
Hazardous waste landfill cell	Available at Holfontein/Vlakfontein landfill
Land farm for oily waste	Not Available

Oil/water separator	Currently not available
Evaporation pond	Currently not available
Composting facility	Available at Musina/Makhado landfills, to be constructed as part of expansion
Waste compacting equipment (drum crusher, filter press)	Currently not available

8. WASTE RESOURCE MANAGEMENT AND TRACKING

In line with the implementing the waste hierarchy it is proposed that a Project Waste Tracking and Documentation System (PWTDS) be developed, specifically for EMSEZ. This system should include a resource management software platform to ensure best practice for waste/resource reuse and recycling are implemented.

To ensure proper Duty of Care, EMSEZ project waste lifecycle will be tracked and recorded. Waste management records will serve as a basis for internal and external reporting in accordance with South African Waste Management Information Regulations.

Waste tracking on-site will be provided for within the asset waste log/register. The same tracking system will also allow for tracking of waste from WMA to the external waste management facilities i.e. Musina and Holfontein.

Such records will include information on waste description, origin, classification, transfer routing, destination, and method of management as well as the care of custody.

Waste Register

All waste producers (Operators, Contractors and Sub-contractors) are required to keep a waste inventory.

The waste inventory must include, as a minimum, the following information:

- Waste streams;
- Source of waste (e.g. catering, production);
- Waste description (e.g. oily rags);
- Classification of waste streams (i.e. hazardous or non-hazardous);
- Quantity; weight (kg) or volume (l or m3);
- Reference to Safety Data Sheets (as per GNR 634 regulation requirements), if available;
- Safe Handling and collection method;
- Storage method, both at each site and in waste management area;
- Disposal method through approved vendor/contractor;
- Destination location (identification of disposal methods and contractors used);
- Waste tracking form numbers; and
- Dates of transfer.

The following needs to be added to the inventory:

- the financial value of the waste, because it is generally required for compiling of annual sustainability reports for annual financial audit reports.
- Waste Management License Number, Category, Period
- Waste Information Registration Number, Category and Period
- Date of third party inspection of the waste disposal/treatment facility, reference number of report.

Waste Tracking Forms

Waste tracking forms (manifests) will be used to record hazardous and waste movement from the point of generation/accumulation to the point of recycling, treatment, centralized storage, further treatment or disposal. The completed manifest provides detailed information on the types and amounts of waste, a record of the firms or individuals involved in the transfer, and information on the storage, treatment or disposal of the waste and confirmation that it reached its intended final destination. The specific manifest format should be determined at a later stage of the development.

Movement of non-hazardous waste will be tracked using the existing system of waste transporters.

9. PERFORMANCE MEASUREMENT AND ASSESSMENT

Monitoring of Waste Management Activities

EMSEZ is responsible for the monitoring of supervised contractor and subcontractor waste management activities and on-site as well as the WMA facility to verify that they comply with regulatory requirements and project commitments, and the WMP.

EMSEZ will work with supervised contractors and subcontractors to inspect and monitor project waste management activities. This will include but may not be limited to:

- Joint inspections of temporary waste storage areas;
- Formally scheduled inspections of the WMA; and
- Audits of waste documentation and tracking.

Regular inspections and monitoring will not be limited to formal or scheduled inspections, and will include the following, as applicable:

- Confirming proper waste segregation;
- Inspecting housekeeping;
- Inspecting accuracy and quality of signage;
- Inspecting secondary containment;
- Inspecting container conditions and labelling;
- Inspecting fencing/gate condition;
- Confirming controlled access points are properly used and enforced;
- Confirming record keeping and document control; and

- Inspecting the use and management of each industry's on-site waste storage areas and the WMA.

Performance Measurement and Assessment

The WMP requires continual improvement of waste management performance. Using Key Performance Indicators (KPIs) allows for setting a baseline and tracking progress quantitatively against the baseline on a regular basis. A KPI is a quantitative and reportable parameter that represents the level of achievement and/or compliance against targets of an objective.

The information required to set the KPI's for monitoring the performance of waste management in EMSEZ would include information such as:

- Tonnes of waste produced
- Tonnes of waste sent to landfill
- Gross footprint area of the project
- Reuse, recycled content by value

Due to the fact that construction and operations will take place in a phased approach and not all at once, it is proposed that KPI's to be set must be normalised against the average total development/floor area of projects under construction and operation in a particular year.

The following KPIs are proposed to evaluate the performance of construction waste management:

- % Reduction/increase in tonnes generated per 100m² gross internal floor area (GIFA);
- % Reduction/increase in tonnes disposed of at landfill per 100m² GIFA; and
- % Reduction/increase in tonnes reused/recycled per 100m² GIFA.

Table 11 presents the proposed KPI's for the % reduction/increase in tonnes generated per 100m² GIFA to track continual improvement in construction waste management.

The waste management baseline will be set based on the parameters achieved during the first year of construction and operation. Generally, waste reduction is more difficult in the construction phase and efforts should be focused at waste diversion (reuse and recycling). A typical achievable diversion rate for non-hazardous waste may be up to 40% and up to 90% for hazardous waste. During the operation phase waste generation is more stable and continual improvement can be applied in waste generation reduction and waste diversion from disposal. Achievable waste reduction targets may be set as 2-5% a year.

Table 11: Waste generation benchmarks (tonnes/100m² GIFA)

KPI	**Construction**		
	Year 01 Actual	**Year 02**	**Year 03**
Excavation	Base Line	TBD	TBD
Construction	Base Line	TBD	TBD

KPI	Construction		
	Year 01 Actual	Year 02	Year 03
Refurbishment	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 12 presents the proposed KPI's for the % reduction/increase in tonnes disposed of at landfill per 100m² GIFA to track continual improvement in construction waste management.

Table 12: Waste disposal at landfill benchmarks (tonnes/100m² GIFA)

KPI	Construction		
	Year 01 Actual	Year 02	Year 03
Excavation	Base Line	TBD	TBD
Construction	Base Line	TBD	TBD
Demolition	Base Line	TBD	TBD
Refurbishment	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 13 presents the proposed KPI's for the % reduction/increase in tonnes reused/recycled per 100m² GIFA to track continual improvement in construction waste management.

Table 13: Waste reuse/recycled benchmarks (tonnes/100m² GIFA)

KPI	Construction		
	Year 01 Actual	Year 02	Year 03
Excavation	Base Line	TBD	TBD
Construction	Base Line	TBD	TBD
Demolition[1]	Base Line	TBD	TBD

[1] The KPI's mentioned in the table above can be even further broken down, i.e. Demolition Waste can be broken down into concrete, steel, wood etc. For the purpose of this document the breakdown will be left at the high-level breakdown is indicated in the above Tables 12-11 to 12-13. A further breakdown could be further investigated and

KPI	Construction		
	Year 01 Actual	Year 02	Year 03
Refurbishment	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

It is proposed that operational waste KPI's also be normalised per GIFA, similarly to construction waste, seeing that more operational projects will come on board as EMSEZ starts to develop. Waste will also be measured per year of operation.

The following KPIs are proposed to evaluate the performance non-hazardous as well as hazardous waste management for operations:

- % Reduction/increase in tonnes generated per 100m² gross internal floor area (GIFA);
- % Reduction/increase in tonnes sent for treatment2 of at landfill per 100m² GIFA;
- % Reduction/increase in tonnes sent for energy generation per 100m² GIFA;
- % Reduction/increase in tonnes reused/recycled per 100m² GIFA; and
- % Reduction/increase in tonnes disposed of at landfill per 100m² GIFA;

Table 14 presents the proposed KPI's for the % reduction/increase in tonnes generated per 100m² GIFA to track continual improvement in operational waste management.

Table 14: Waste generation benchmarks (tonnes/100m² GIFA)

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Hazardous Industrial waste	Base Line	TBD	TBD
Residential waste	Base Line	TBD	TBD
Commercial waste	Base Line	TBD	TBD
Non-Hazardous Industrial[3] waste	Base Line	TBD	TBD

elaborated on in the Final Resource and Waste Management Master Plan after more information regarding the waste streams have become available and after further inputs from stakeholders.

[2] Treatment includes incineration, composting etc., but exclude reuse and recycling

[3] Note that Non-Hazardous Industrial waste could be further broken down into glass, plastic, metal, wood etc. However, for the purpose of this document the breakdown will be left at the high level breakdown is indicated in the table above. A further breakdown could be further investigated and elaborated on in the Final Resource and Waste

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Electrical/Electronic waste	Base Line	TBD	TBD
Healthcare waste	Base Line	TBD	TBD
Green waste	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 15 presents the proposed KPI's for the % reduction/increase in tonnes sent for treatment per 100m² GIFA to track continual improvement in operational waste management.

Table 15: Waste treatment benchmarks (tonnes/100m² GIFA)

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Hazardous Industrial waste	Base Line	TBD	TBD
Residential waste	Base Line	TBD	TBD
Commercial waste	Base Line	TBD	TBD
Non-Hazardous Industrial waste	Base Line	TBD	TBD
Electrical/Electronic waste	Base Line	TBD	TBD
Healthcare waste	Base Line	TBD	TBD
Green waste	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 16 presents the proposed KPI's for the % reduction/increase in tonnes sent for energy generation per 100m² GIFA to track continual improvement in operational waste management.

Management Master Plan after more information regarding the waste streams have become available and after further inputs from stakeholders during workshops

Table 16: Waste sent for energy generation benchmarks (tonnes/100m² GIFA)

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Residential waste	Base Line	TBD	TBD
Commercial waste	Base Line	TBD	TBD
Non-Hazardous Industrial waste	Base Line	TBD	TBD
Green waste	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 17 presents the proposed KPI's for the % reduction/increase in tonnes sent for reuse/recycling per 100m² GIFA to track continual improvement in operational waste management.

Table 17: Waste reuse/recycling benchmarks (tonnes/100m² GIFA)

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Hazardous Industrial waste	Base Line	TBD	TBD
Residential waste	Base Line	TBD	TBD
Commercial waste	Base Line	TBD	TBD
Non-Hazardous Industrial waste	Base Line	TBD	TBD
Electrical/Electronic waste	Base Line	TBD	TBD
Green waste	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

Table 18 presents the proposed KPI's for the % reduction/increase in tonnes disposed of at landfill per 100m² GIFA to track continual improvement in operational waste management.

Table 18: Waste disposal benchmarks (tonnes/100m² GIFA)

KPI	Operation		
	Year 01 Actual	Year 02	Year 03
Hazardous Industrial waste	Base Line	TBD	TBD
Residential waste	Base Line	TBD	TBD
Commercial waste	Base Line	TBD	TBD
Non-Hazardous Industrial waste	Base Line	TBD	TBD
Electrical/Electronic waste	Base Line	TBD	TBD
Healthcare waste	Base Line	TBD	TBD
Green waste	Base Line	TBD	TBD

TBD = To Be Determined; N/A = Not Applicable.

The baseline should be used once determined, to assess it against the targets set in the National Waste Management Strategy, in order to set achievable targets for reduction per review interval (1 year in this case) towards the targets set in the National Waste Management Strategy.

Audits

EMSEZ is responsible for the monitoring of supervised contractor and subcontractor waste management activities and on-site facilities to verify that they comply with regulatory requirements and project commitments and the WMP. EMSEZ will undertake regular audits with respect to the management of waste. Audits will evaluate performance by comparing monitored KPI values against baseline benchmarks/conditions and plans. Where deficiencies are identified through the audit results and other reporting results, EMSEZ will use this information to apply adaptive management.

Data analysis and evaluation reporting will include a step for identifying problematic areas that require improvement as well as new best practices or procedures to allow for continual improvement. Recommendations for improvement will be identified both on an as needed basis and based on monthly and annual monitoring program results. The recommendations will be reviewed and approved by EMSEZ and enforced in a timely manner.

License audits must as a minimum comply with the requirements specified in regulation 34 and Appendix 7 of the EIA Regulations.

However, best practice may require integrated third party audits by a team of properly accredited professionals addressing:

(i) technical and environmental impacts (professional engineer and environmental scientist; one specializing in waste and the other focusing on environmental impacts),
(ii) financial aspects (professional or chartered accountant or engineer with MBA specializing in environmental management), and
(iii) legal compliance (attorney or advocate specializing in environmental law).

10. RECOMMENDATION

The following EMSEZ waste management option was recommended:

Waste accumulated at the construction sites, operating industries and public areas will be collected by either third party waste transportation contractors (a newly established EMSEZ utility company) or the specific industry themselves and delivered to a centralized WMA, that will be established within the boundaries of the EMSEZ complex for accumulation and temporary storage (general waste and small volumes of hazardous waste). The WMA could serve as a waste depot and will provide a more flexible solution for recyclables and "difficult" waste streams that cannot currently be treated and disposed off at the existing facilities.

General waste will be transferred from the centralised WMA to the existing authorised Musina and/or Makhado landfills where it will be disposed off. The existing Musina and Makhado landfill sites would have to be upgraded and expanded to cater for the capacity of general waste from EMSEZ.

Should negotiations for the expansion of the Musina and/or Makhadu landfills for the disposal of general waste not be successful, a new landfill facility should be established in close vicinity **outside the EMSEZ** complex.

- The activity *inter alia* entails site identification, funding application, rezoning, possible property purchasing and transfer, full Environmental Impact Assessment with specialist investigations required by the authorities, design in terms of National Norms and Standards for Disposal of Waste to Landfill (promulgated in August 2013) and a construction period of 10-12 months. **It is anticipated that the cost estimate to design and construct a Class B general landfill facility of 35 Ha (full 35 Ha development) will be approximately R42,000,000.00,** depending on the availability of *in situ* material available on site. The landfill will have enough airspace for at least 50 years, based on the volumes given elsewhere in the report.

The option to develop a general landfill site **within the EMSEZ complex** would not be possible unless developed outside the EMSEZ complex.

The following options is however relevant with regards to the **disposal of hazardous waste** from the subject industries:

- **Option 1:** For Hazardous Waste, since the long-hauling of hazardous waste i.e. ash, slag sludge etc to the existing Holfontein and Vlakfontein hazardous waste management facilities in Gauteng, might not be feasible in the medium to long term due to the distance and severe transport cost; therefore a close by integrated hazardous waste management facility of approximately 3000 Ha (with 40 years lifespan) (i.e. for the disposal/treatment of hazardous waste i.e. ash, slag, sludge etc), outside the EMSEZ complex needs to be established. The facility will have to be licensed in terms of Section 45 of the National Environmental Management Waste Act, Act 59 of 2008 (NEMWA). The licensing process will be a separate process from the WMP, and have to follow a full Environmental Impact Assessment process for its establishment, meaning that the need, site selection process from a few candidate sites to be identified, detail investigations on the most suitable identified site (which could include the following detailed studies viz Geohydrological Assessment, Geotechnical Assessment, Heritage, Archaeology and Palaeontology Assessment; Ecology (Fauna & Flora) Assessment; Wetland Assessment and Delineation; Social Baseline

Assessment, Economic Assessment; Visual Assessment; Traffic Assessment; Blast and Vibration Assessment (if required); Air Quality Assessment; Noise and Ground Vibration Assessment), needs to be conducted. This process should start as soon as possible. Should 2/3 of the waste stream be recycled as indicated by the EMSEZ, only 1000 Ha facility would be required. The cost to design and construct a full size integrated hazardous waste management facility could cost approximately R1,2 billion. The facility can be developed in a phased manner to alleviate initial cost i.e. establish a 200Ha facility for approximately R250,000,000 and with time develop the remainder.

- **Option 2:** Since each and every plant owner will be responsible to manage the waste generated within their respective plants, their responsibility will be to establish their own disposal facility for the disposal of their industrial hazardous waste they generate (if in large quantities, and as an option in the short term, until the outside "to be established integrated waste management facility" mentioned above, will be established). The same authorization requirements (mentioned in the above bullet for the establishment of an integrated hazardous waste management facility outside the EMSEZ complex) will apply for the hazardous waste disposal facility developed at the respective plants, where a need for such a facility is identified i.e. full EIA and WML application.

The potential impacts and mitigatory measures that needs to be considered for the hazardous waste management facility will be as follows:

Table 19:Potential Impacts and Mitigation Measures from hazardous waste management facility

Potential Impact	Impact Source	Mitigation measure
Visual – change to landscape	Waste body Dust emissions Heavy vehicle traffic Industrial infrastructure including buildings	Sensitive receptors to be identified Visual impact study to be conducted to predict changes to viewshed from key sensitive receptors Properly designed facility, properly shaped for the least visually intrusive
Land-use and zoning – agricultural to waste facility (industrial) Proper buffer zone to be included in rezoning	Waste management activity that poses a health risk	Require buffer zone determined through air quality impact assessment report
Air quality – increase in odours and increase in ambient levels of criteria air pollutants at receptors	Storage, treatment and disposal of wastes and leachate with strong chemical odours	Air quality Impact Assessment to assess emissions of criteria air pollutants against legislative limits
Health risks to nearby receptors from inhalable particulates and/or pollutants	Direct and cumulative risk to health (carcinogenic and non-carcinogenic) to nearby receptors from site emissions	Sensitive receptors to be identified Air Quality Impact Assessment to compare modelling and dispersion results against legislated and best practise limits to assess health risks to key receptors
Reduction in Water Quality	Release of Contaminants, run-off from waste body	Properly containment design (Class A facility) with required stormwater infrastructure to prevent any run-off into the environment

Potential Impact	Impact Source	Mitigation measure
Reduction in Groundwater quality	Contaminated surface water infiltrating to groundwater Seepage from leachate and storm water dams infiltrating to groundwater	Conduct hydrogeological impact assessment, model the dispersion plume, and assess any possible impacts on groundwater Proper Class A containment design for waste facility and dams in terms of Norms and Standards
Biodiversity – loss of natural habitat	Removal of vegetation and establishment of buildings and disposal facility	Conduct ecological study Site layout designed to avoid wetlands or areas of high conservation importance
Destruction of heritage resources on the site	Stripping and backfilling for levelling, establishment of buildings and waste facility	Conduct Heritage assessment to determine presence of any resources
Traffic – reduction in road safety	Increased volume of heavy vehicles on the access roads High risk nature of the loads of hazardous waste on the vehicles	Traffic Impact Assessment to be conducted
Social and Economic development – nuisance impacts to neighbours which affect quality of life	Cumulative impacts on quality of life from noise, odour, dust and air quality impacts Operations on site	Ensure maximum benefit to local communities and business Specialist assessments to identify and consider impacts to receptors and identify measures to safeguard neighbours and landowners from project risks
Real/perceived impacts on property values	Establishment of waste management facility altering perception of area and influencing property values Buffer zones restrictions influencing future land-use with resultant influence on values	Socio-economic assessment to assess current property values and consider influences on future values
Waste Management Implementation of waste management hierarchy to obtain the most sustainable result from waste streams (positive)	Multiple facilities at a single site allow for waste streams to be managed at the various plants where the maximum benefit can be obtained from the waste such as the smallest fraction becomes residual waste requiring disposal	Ensure an integrated waste management facility, properly operated and maintained, that can derive the maximum sustainable benefit from target waste streams

In summary, the option to establish a centralised WMA for general and low volumes of hazardous waste with a combination of option 1 and 2 mentioned above for the management of larger volumes of hazardous waste is recommended. In other words, each plant owner needs to make provision and establish its own hazardous disposal facility on their respective premises. This is specifically important in the short term and for those industries generating large volumes of industrial hazardous waste, for example the power station (ash disposal facility). Industries which generate small volumes of industrial waste, can make provision for a storage facility only on their premises, from where the waste can be taken to the centralised WMA and then taken off site to either Holfontein or Vlakfontein existing hazardous waste

management facilities. If decided to develop an integrated hazardous waste management facility close-by to the EMSEZ complex in the longer term, these waste streams can be taken to this facility for disposal.

A high-level plan for implementing the WMP would be as follows:

In the near future:

- Identify and assess the capacities of existing solid waste management facilities in Musina and Makhado (to accept General waste from EMSEZ) and Holfontein and Vlakfontein (to accept small quantities of hazardous waste from EMSEZ). The Musina and Makhado general disposal facilities does not currently have the capacity but are in both cases in the process of extending their facilities. The Holfontein hazardous waste management facility has a lifespan of approximately 15 years at current rates of disposal, but an extension to accommodate an additional 10,500 tons per month has been approved by the authorities. The Vlakfontein hazardous waste disposal facility has 6 cells providing 6,5 million m^3 capacity (approximately 30 years lifespan). Both these facilities have a Class A barrier liner system comprising of compacted clay, HDPE, stone and geotextiles. Transporting large quantities of hazardous waste to these facilities, is not regarded as feasible due to long distance hauling.

- In case the existing capacity of the Makhado and/or Musina landfill sites are not adequate, the required development of additional cells at the mentioned landfill sites or upgrade have to be implemented **(for General Waste)**. Waste will then be transferred from the centralised WMA to the Makhadu and/or Musina landfill sites.

- Start making arrangement for the conceptual designs and approvals of the Centralised Waste Management Area, should the WMP be approved as part of the overall EIA approval process for the EMSEZ complex.

Before the any construction starts in EMSEZ:

- Set up agreement with the existing waste management facilities (Musina and Makhado Local Municipalities and EnviroServ, owner of the Holfontein waste management facility and Interwaste, owner of the Vlakfontein Hazardous Waste Management Facility, the latter in the short term until the integrated hazardous waste management close by the EMSEZ complex has been identified, authorised and constructed) to accept waste from EMSEZ, if possible.

- Ensure implementation of necessary upgrades (development of additional disposal cells) of the existing waste management facilities (Musina, Makhado – for General waste disposal) to accommodate EMSEZ waste if possible and discuss the cost and operational implications thereof.

- Review and select a third-party waste transportation service provider for providing resources and services to move waste from collection point to the selected facilities. Prior to selecting a waste management service provider, EMSEZ should check the validity of the service provider's waste management license, audit their equipment and vehicles, their manpower and waste management awareness of the personnel and their system of manifesting, logging and record-keeping.

- In case EMSEZ decides on the proposed utility company to manage the waste at EMSEZ, the practicality and cost effectiveness thereof should be investigated.

- Set up agreement with recyclers, for recycled papers, for recycled metals, for recycled glass etc.

- Ensure design and approval of the centralized WMA if required. **According to the NEMWA listed activities, only storage areas that have the through put capacity to store in excess of 100m^3 of general waste at any one time, or to store in excess of 80m^3 of hazardous waste at any one time, excluding the temporary storage of such waste, need to be licensed in terms of the NEMWA. Therefore, should the centralised waste management area/facility trigger a**

Category A listed activity, a basic assessment process set out in the Environmental Impact Assessment Regulations made under section 24(5) of the National Environmental Management Act, 1998 (Act 107 of 1998) as part of a waste management licence application contemplated in section 45 read with section 20(b) of this Act, must be conducted. Should the facility have a throughput of less than 100m^3 of general waste at any one time, and hazardous waste of not more than 80m^3 is stored temporarily, no waste management license would be required for the centralised WMA.

During the construction and operation:

- Establish the centralised WMA at the early stages of construction activity;
- Implement waste collection and transportation system as described in the WMP;
- Audit and monitor the waste management activities and records of the waste management service provider/s during both phases;
- Review waste management reports from the EMSEZ tenants during the operation phase.

ANNEXURE E

MUSINA MAKADO SEZ MINERALS REQUIRED, FINAL PRODUCTS AND POSSIBLE SOURCE OF MATERIAL

Musina Makado SEZ Minerals requied and final products		
	From:	
Materials required:	**Possible Mines**	**Most Likely Mines**
Coal (C):		
Steam Coal	Coal of Africa's Vele Colliery, Makhado Project and MbeuYashu (The Greater Soutpansberg Project) all in the Limpopo Province.	Coal of Africa's Vele Colliery, Makhado Project and MbeuYashu (The Greater Soutpansberg Project) all in the Limpopo Province.
	Grootegeluk Mine, Lephalale	Grootegeluk Mine, Lephalale
Metallurgical Coal	Limpopo Province coal mines & Zimbabwe coal mines.	Makhado coal mine, Waterberg coal mine, Vele coal mine, Mopane coal mine, Chapudi coal mine in the Limpopo Province.
	Grootegeluk Mine, Lephalale	
Coking Coal	Limpopo Province coal mines & Zimbabwe coal mines.	Berenice/Cygnus Mine 90km southwest of Musina.
	MCMining Makhado mine 36km north of the town of Makhado.	MCMining Makhado mine 36km north of the town of Makhado.
Lime (Ca)	Union Lime Company at Ulco, Richtersveld, Northern Cape	Union Lime Company at Ulco, Richtersveld, Northern Cape
	Lichtenburg-Lothlane, Slurry, Dwaalboom, Zebedelia-Pilansberg, Rietfontein	Lichtenburg-Lothlane, Slurry, Dwaalboom, Zebedelia-Pilansberg, Rietfontein
	Potgietersrus, Mopane, Syferfontein	Potgietersrus, Mopane, Syferfontein
Silica (SiO_2)	Rebone Mining, Silicon Smelters and Thaba Chueu Mining - Polokwane	Rebone Mining, Silicon Smelters and Thaba Chueu Mining - Polokwane
Alumina (Al_2O_3)	Imported	Imported
Chrome (Cr)	Buffelsfontein, Sky Chrome mine, MooiNooi tailings plant, Tweefontein project - North West Province, Samancor, Sefateng chrome mine, Tshepong chrome mine, Dwarsrivier chrome Mine, Ruighoek chrome mine.	Samancor, Sefateng chrome mine, Tshepong chrome mine, Dwarsrivier chrome Mine, Ruighoek chrome mine.
	Steelpoort area, Limpopo	Steelpoort area, Limpopo
Iron Ore (Fe)	Sishen Mine - Kathu, Kolomela - Postmasburg, Khumani - Kathu, Beeshoek - Postmasburg.	Sishen Mine - Kathu, Kolomela - Postmasburg, Khumani - Kathu, Beeshoek - Postmasburg.
	Thabazimbi Mine, Limpopo	Mine closed
	Palaborwa Mining Company, Limpopo	Iron Magnetite by product.
	Magnetite in the Polakwane area, Limpopo	Magnetite in the Polakwane area, Limpopo
Manganese (Mn)	Mines in the Hotazel area, Northern Cape	Nchwaning Manganese mine, Tsipi Borwa Mine, Wessels Mine, Mamatwan mine in the Hotazel area.
Vanadium (V)	Mokopane , Limpopo	Mokopane , Limpopo - Bushveld Minerals, Tumela, Mogalakwena, Bokoni, Marula, Modikwa, Dishaba, Wickenham, Der Brochen and Two River mines in Limpopo.
Vanadium Titanium-Magnetite	Dragon Light Mine (Shaanxi CEI Investment Holdings Co. Ltd), Mokopane, Limpopo	Dragon Light Mine (Shaanxi CEI Investment Holdings Co. Ltd), Mokopane, Limpopo
Cement	Sebako plant Lydenburg	Sebako plant Lydenburg
	Mamba Cement, Northam in Limpopo	Mamba Cement, Northam in Limpopo
	Lafarge Readymix Bela-Bela	Lafarge Readymix Bela-Bela
	Power Plant waste (40 - 50%)	Power Plant waste (40 - 50%)