Appendix D: Ash Classification Report

REPORT FOR:

WASTE CLASSIFICATION OF ASH DISPOSED AT THE EXISTING ASH DISPOSAL FACILITIES, AT THE MATIMBA POWER STATION ASH DISPOSAL FACILITY, LEPHALALE, LIMPOPO PROVINCE

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1. THIS REPORT

The purpose of this report is to classify the Ash-waste generated at the Eskom Matimba Power Station, Limpopo, in accordance with the National Environmental Management Waste Act (NEMWA- Act 59 of 2008), Minimum Requirements trilogy (DWAF, 1998) and draft Regulations (GNR 613 to 615, 2012) in order to determine the necessary liner requirements and related disposal mechanisms and methods for such a waste type, for the proposed ash disposal facility (ADF).

This report was compiled in May 2013, based on the laboratory test results carried out on representative samples of the Ash. **Figure 1** shows the location of the existing ADF in relation to the Matimba Power Station.

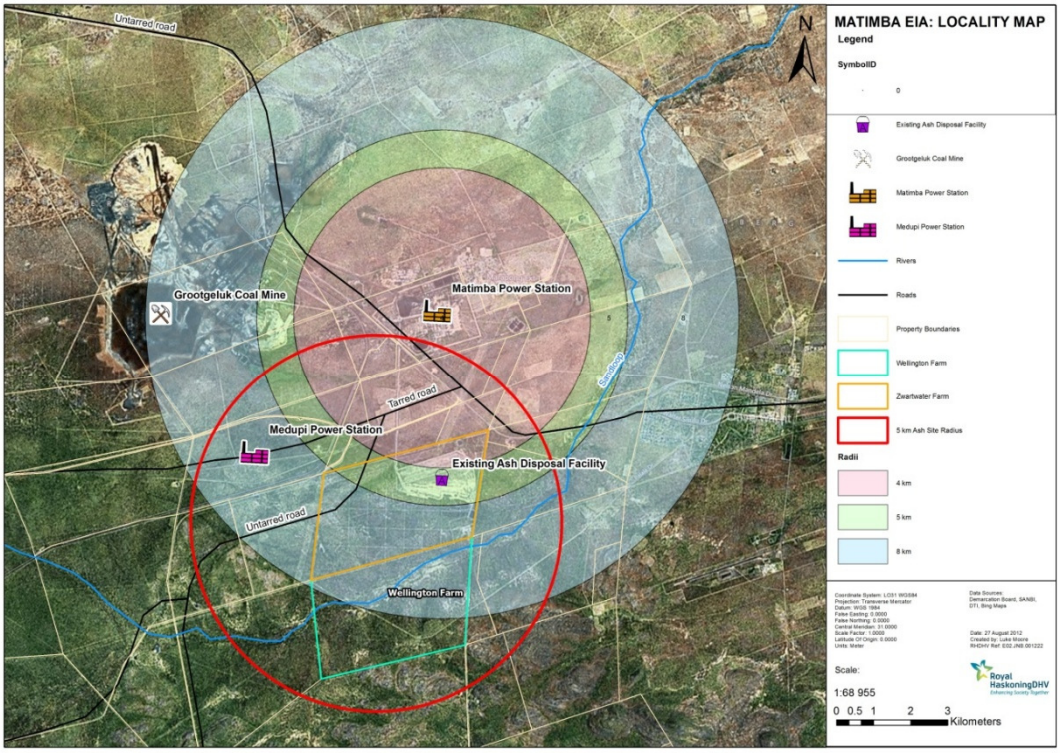

Figure 1 - Matimba Ash Disposal Facility Locality

2. SAMPLING FOR LABORATORY ANALYSIS

Three samples of the ash waste were collected from the existing, operational ADF by a Jeffares and Green representative on the 15 February 2013. Two samples were taken from the current ash pile (Refer to **Figure 2**) and the third sample from a nearby stockpile (of previously deposited waste) in order to obtain a representative sample and possible variances in the ash characteristics (Refer to **Figure 3)**. The samples were taken with decontaminated sampling equipment and were under controlled conditions until submission to the laboratory. The samples were delivered to Waterlab (Pty) Ltd (SANAS accredited laboratory) on the 18 February 2013 for the following analysis:

- **Acid rain leach procedure (ARLP) extraction followed by:**
  - Semi-quantitative 33 element ICP scan
  - Cations and anions including $Cr_{(VI)}$, Ca, Na, K, Mg, SO_4, Cl, F, NH_4, NO_3 and pH.
- **Aqua regia digestion followed by:**
  - Semi-quantitative 33 element ICP scan.
- **Deionised water (1:20) extraction followed by:**
  - Semi-quantitative 33 element ICP scan;
  - Cations and anions including $Cr_{(VI)}$, Ca, Na, K, Mg, SO_4, Cl, F, NH_4, NO_3 and pH.;

Figure 2 - Current Ash Pile at the existing Matimba Ash Disposal Facility

Figure 3 - Existing Ash Pile in close proximity to the Current Ash Pile

3. WASTE CLASSIFICATION

The waste classification is based on the Minimum Requirements for the Handling, Classification and Disposal of Hazardous Waste (MRs) (Second Edition 1998: Department of Water Affairs and Forestry) and the draft Waste Classification and Management Regulations (WCMR) (GN R. 614 of 2012) which was published for comment in August 2012.

Both classification systems have been considered as the draft WCMR are not yet enforceable. The MRs will remain in force for a defined period after the draft WCMR are promulgated.

3.1 Hazard Rating as per DWA(F) Minimum Requirements 1998

A hazard rating is used to classify the waste into one of four Hazard Rating (HR) levels. The four levels are ranked according to a logarithmic progression whereby Extreme Hazard is 10 times more toxic than High Hazard and 1000 times more toxic than Low Hazard. A summary of the HR levels are presented in **Table 1.**

Table 1: Hazard Ratings from Minimum Requirements (1998)

HAZARD RATING 1	***EXTREME HAZARD***	Significant concentrations of extremely toxic substances including certain carcinogens, teratogens and infectious wastes.
HAZARD RATING 2	***HIGH HAZARD***	Highly toxic characteristics or non-persistent, extremely toxic substances including certain carcinogens.
HAZARD RATING 3	***MODERATE HAZARD***	Moderately toxic or contains substances that are potentially highly harmful to human health or to the environment but are not persistent.
HAZARD RATING 4	***LOW HAZARD***	Often occurs in large quantities and which contains potentially harmful substances in concentrations that in most instances would represent only a limited threat to human health or the environment.

A summary of the analytical results, that had concentrations higher than the detection limits, for the Acid Rain Leach Procedure (ARLP) Extraction, are shown in **Table** 2**.**

The only Contaminant of Concern (CoC) that exceeded the Acceptable Risk Level (ARL) is hexavalent chromium (Cr_{VI}) but all other potential CoCs had a concentration lower than the respective ARL. The waste from all three stockpiles has a HR1 rating due to the high concentration of Cr_{VI}.

Based on the ARLP extract results, all of the ash will need to be disposed of at a H:H landfill. Delisting of the waste for disposal to a G:L:B+ landfill would be possible if the maximum monthly disposal loads presented in **Table** 2 are not exceeded[1].

[1] *Note that de-listing of waste is perceived differently in the draft GNR 613-615, 2012.*

Table 2: ARLP Extract Analytical Results compared with ARL

CoCs[2]	ARL[3]	OLD STOCKPILE[4]	NEW STOCKPILE 1[5]	NEW STOCKPILE 2[6]
pH	*Not Listed*	8.5	8.5	8.5
SO_4	*Not Listed*	129	168	148
NO_3 as N	9	< DL*	0.4	< DL*
F	*Not Listed*	0.2	0.3	0.3
Al	10	0.202	0.215	0.181
As	*Not Listed*	0.099	0.128	0.116
B	7.8	1.983	1.924	1.732
Ba	7.8	0.233	0.164	0.2
Ca	*Not Listed*	230	260	251
Cd	0.031	< DL*	0.006	< DL*
Cr	4.7	0.168	0.271	0.148
Cr_{VI}	0.02	**0.199**	**0.307**	**0.175**
K	*Not Listed*	1.7	4.7	2
Li	0.14	< DL*	0.112	0.04
Mg	70	36	35	31
Mn	0.3	0.097	0.143	0.142
Mo	55	0.104	0.261	0.141
Na	148	< DL*	5	< DL*
Se	0.26	0.024	0.034	0.027
Si	1000	9.6	9.5	9.1
Sr	1	0.617	0.591	0.553
V	1.3	0.645	0.683	0.584
Hazard rating		**HR1**	**HR1**	**HR1**
Maximum load for Delisting (tonnes/ha/month)		**15.2**	**9.9**	**17.3**

** <DL: Concentration below analysis detection limit*

The concentrations of polycyclic aromatic hydrocarbons (PAHs) in the ash samples are presented in **Table 3**. Since the Minimum Requirements 2nd Edition (1998) lists only the ARL for benzo[a]pyrene and naphthalene, the acceptable environmental concentrations detailed in the Minimum Requirements 3rd Edition (not published) were used for this analysis.

[2] *The table only shows CoCs that were present in concentrations above the detection limit of the analysis.*

[3] *The ARL data is presented as listed in the Minimum Requirements (1998).*

[4] *Concentrations of CoCs from the ARLP Extract analysis for sample from Old Stockpile.*

[5] *Concentrations of CoCs from the ARLP Extract analysis for sample from New Stockpile 1.*

[6] *Concentrations of CoCs from the ARLP Extract analysis for sample from New Stockpile 2.*

Results found that the Old Stockpile and New Stockpile 1 had elevated concentrations of various PAHs while the concentrations of all PAHs in New Stockpile 2 were within acceptable limits. Ash from Old Stockpile and New Stockpile 1 has a HR1 rating due to elevated benzo[a]pyrene concentrations exceeding the ARL.

Table 3: PAH Concentrations

1. PAHs[7]	ARL[8]	OLD STOCKPILE[9]	NEW STOCKPILE 1[10]	NEW STOCKPILE 2[11]
Acenaphthene	0.17*		0.132	0.004
Acenaphtylene	0.0005*	< 0.001	**0.007**	< 0.001
Anthracene	0.0006*	< 0.001	**0.073**	< 0.001
Benz [a] anthracene	0.001*	**0.126**	**0.28**	< 0.001
Benz [b] fluoranthene	0.0005*	**0.109**	**0.251**	< 0.001
Benz [k] fluoranthene	0.0005*	**0.147**	**0.155**	< 0.001
Benzo [g,h,i] perylene	0.78*	**1.194**	0.725	< 0.001
Benzo [a] pyrene	0.01	**0.238**	**0.3**	< 0.001
Chrysene	0.1*	0.056	**0.251**	< 0.001
Dibenz [a,h] anthracene	0.1*	**0.725**	**0.567**	< 0.001
Fluoranthene	0.11*	< 0.001	**0.488**	< 0.001
Fluorene	0.08*	< 0.001	**0.112**	0.004
Indeno [1,2,3-c,d] pyrene	*Not Listed*	0.571	0.353	< 0.001
Naphthalene	0.38	< 0.001	0.195	0.014
Phenanthrene	0.32*	< 0.001	0.244	0.004
Pyrene	0.2*	< 0.001	**0.359**	< 0.001
HAZARDOUS RATING as per MRs		**HR1**	**HR1**	**Not Hazardous**
PAHs (Total)		**3.173**	**4.492**	**0.038**
HAZARDOUS RATING as per Draft WCMR		**TYPE 3**	**TYPE 3**	**TYPE 3**

** Acceptable environmental exposure according to Minimum Requirements 2005, ARL not available in Minimum Requirements 1998*

3.1.1 Delisting

An analysis calculating the possibility of delisting the waste in accordance with the MRs was carried out based on the assumptions provided in.

[7] *The samples were analysed for the presence of the polycyclic aromatic hydrocarbons listed in order to classify the organic constituents within the waste.*

[8] *The ARL data is presented as listed in the Minimum Requirements (1998) or the Minimum Requirements (2005 – not published) as shown.*

[9] *Concentrations of PAHs from the organic analysis for sample from Old Stockpile.*

[10] *Concentrations of PAHs from the organic analysis for sample from New Stockpile 1.*

[11] *Concentrations of PAHs from the organic analysis for sample from New Stockpile 2.*

Table 4: Waste Generation and Disposal Assumptions

Description	Quantity	Unit
Coal consumption rate[12]	15 050 000	tons per annum
Percentage ash from coal burning[13]	35.5	Percent
Dry Density of Ash to be Disposed[14]	814	kg/m^3
Waste Generation Rate[15]	6 563 575	m^3 per annum
Ash Generation Growth Rate[16]	0	Percent
ADF Service life for proposed ADF (2012)[17]	44	years
Lift heights for Ash Placement[18]	3	m

In order to delist a waste, the MRs requires that the Estimate Environmental Concentration (EEC) (g/ha/month) not exceed the ARL where the units of the ARL are taken as parts per billion (ppb).

The EEC of Cr_{VI} based on the assumptions in and the concentration of Cr_{VI} from the analytical results of the ARLP Extract from New Stockpile 1 (worst case scenario) has been calculated as **49 642 g/ha/month.**

The ARL (ppb) for Cr_{VI} is given as 0.02ppm in the MRs which equates to **20ppb**.

The calculated EEC for Cr_{VI} thus exceeds the ARL for Cr_{VI} and thus the ash waste produced (as sampled) cannot be delisted.

3.2 Waste Type as per Waste Classification and Management Regulations (2012)

In terms of Regulation 13(1) of the WCMR, the potential level of risk associated with disposal or downstream use of wastes must be determined by following the prescribed and appropriate leach test protocols as detailed in GNR.613 of 2012, published for comment in August 2012. The results must be assessed against the four levels of thresholds for leachable and total concentrations, which in combination, determines the Risk Profile of the waste.

[12] *The estimated annual coal consumption of the Matimba Power Station provided by Eskom through RHDHV.*

[13] *The estimated percentage by mass of Ash produced (for disposal to landfill) from the coal burning process provided by Eskom through RHDHV.*

[14] *The estimated dry density of the ash used for calculating volume from mass provided by Eskom through RHDHV.*

[15] *The estimated volume of ash waste to be disposed of per annum provided by Eskom through RHDHV.*

[16] *The estimated growth rate in the ash generation volumes throughout the life of the proposed ADF provided by Eskom through RHDHV.*

[17] *The estimated service life of the proposed ADF provided by Eskom through RHDHV.*

[18] *The estimated operational lift height for ash placement has been assumed by assessing trends in the industry and observing the operations at the existing ADF.*

Table 5: WCMR Terminology

Abbreviation[19]	Definition
LC	leachable concentration of a particular contaminant in a waste, expressed as mg/ℓ
TC	total concentration of a particular contaminant in a waste, expressed as mg/kg
LCT	the leachable concentration thresholds for particular contaminants in a waste (LCT0, LCT1, LCT2 and LCT3)
TCT	total concentration thresholds for particular contaminants in a waste (TCT0, TCT1, TCT2)

The process to be followed in determining the Waste Type as per WCMR is shown in

Figure *4*. The total and the leachable concentrations need to be analysed and compared with threshold values in order to determine the Waste Type (Type 0 to Type 4).

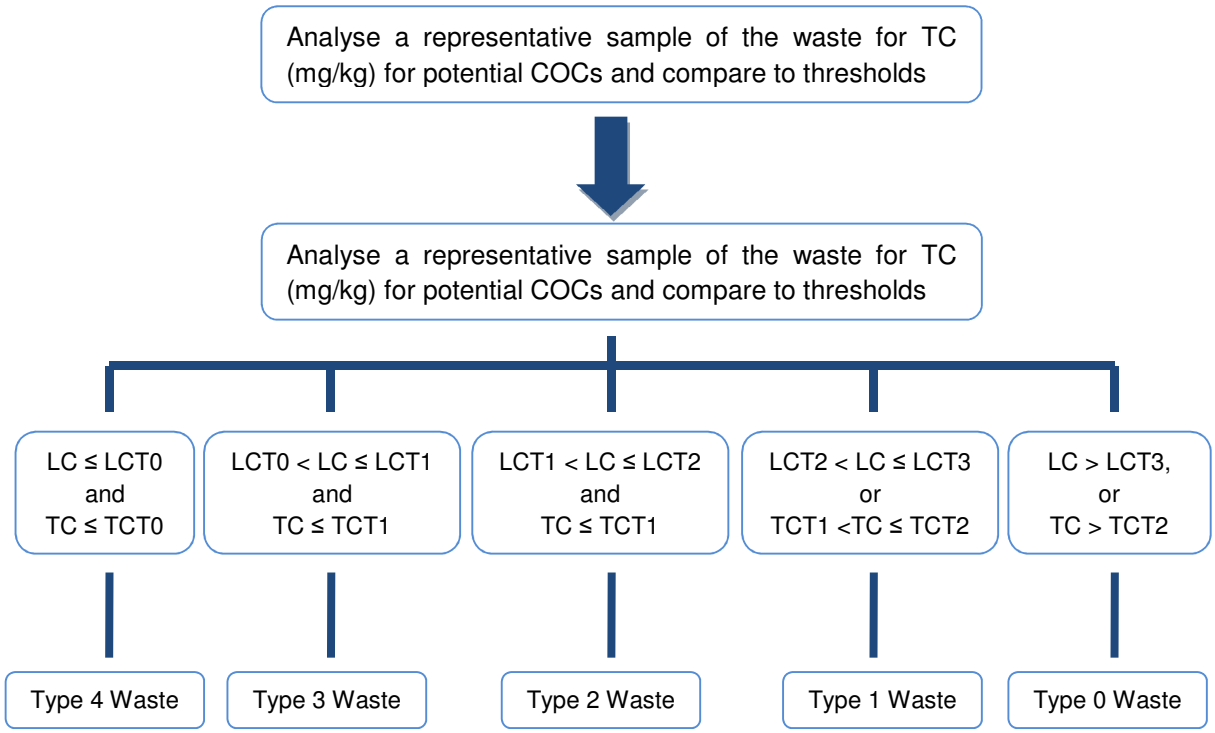

Figure 4 - Waste Classification as per WCMR

[19] *Abbreviations and definitions as described in GNR.613 of 2012*

3.2.1 Total Concentrations

The total concentrations (*aqua regia* extract) of the three ash samples compared to the TCT levels given in the draft WCMR (613 of 2012) are presented in **Table 6**. Levels indicated in green exceeded the TCT0 level. This is a summary of the results and includes only elements which were detected at concentrations higher than the reporting limit. The detailed analytical certificates are appended in **Appendix A**.

These results show elevated total concentrations of Ba in all the ash of samples, exceeding the TCT0 threshold level, while the total concentrations of all other potential CoCs were within acceptable levels (<TCT0).

Table 6: Aqua Regia Analytical Results compared with TCT

CONTAMINANTS OF CONCERN (CoCs)[20]	TCT0[21]	TCT1[22]	TCT2[23]	OLD STOCKPILE	NEW STOCKPILE 1	NEW STOCKPILE 2
Al	*Not Listed*			8800	9800	9000
Ba	62.5	6250	25000	**253.8**	**218.2**	**331.8**
Ca	*Not Listed*			15200	15200	15200
Cr	46000	800000	N/A	23.2	27.4	34
Cu	16	19500	78000	5.8	7	5
Fe	*Not Listed*			16800	16200	20400
K	*Not Listed*			< DL*	240	320
Mg	*Not Listed*			3400	3400	3000
Mn	1000	25000	100000	259.6	286.6	266.2
Mo	40	1000	4000	< DL	7.8	10
Ni	91	10600	42400	14.2	12.2	17.4
Se	10	50	200	< DL	< DL	7.2
Si	*Not Listed*			< DL	847	797.6
Sr	*Not Listed*			97.6	92.2	88
Ti	*Not Listed*			577.6	667.6	612.2
Zn	240	160000	640000	< DL	42.2	18.8
WASTE TYPE (based on TOTAL CONCENTRATION of CoCs)				**TYPE 3**	**TYPE 3**	**TYPE 3**

** <DL: Concentration below test apparatus detection limit*

[20] *The table only shows CoCs that were present in concentrations above the detection limit of the analysis.*

[21] *The TCT data is presented as listed in the draft WCMR (613 of 2012).*

[22] *The TCT data is presented as listed in the draft WCMR (613 of 2012).*

[23] *The TCT data is presented as listed in the draft WCMR (613 of 2012).*

3.2.2 Leachable Concentrations

Leachable concentrations of the waste samples were taken from the analytical results of the deionised water extract which were compared to the LCT levels given in the draft WCMR (613 of 2012) to assess the waste type of the waste samples. The results are presented in **Table 7**; the levels indicated in green exceeded the LCT0 level.

These results indicate the following:

- The soluble Chromium (Cr) and Boron (B) concentrations in all three ash samples exceeded the LCT0 threshold;
- The Cr_{VI} concentration in two of the ash samples exceeded the LCT0 threshold;
- Leachable Molybdenum (Mo) concentration in the ash sampled from new stockpile 1 exceeded the LCT0 threshold;

According to draft WCMR (613 of 2012), all three of the ash samples are classified as Type 3 waste and can be disposed on a landfill site with a Class C liner[24].

[24] *With both the total and leachable concentration analyses taken into account.*

Table 7: Deionised Water Extract Analytical Results compared with LCT

CONTAMINANTS OF CONCERN (CoCs)[25]	LCT0[26]	LCT1[27]	LCT2[28]	LCT3[29]	OLD STOCK PILE	NEW STOCK PILE 1	NEW STOCK PILE 2
pH	*Not Listed*				8.1	7.8	8.3
SO4	250	12500	25000	100000	110	157	137
F	1.5	75	150	600	0.2	0.2	0.2
Al	*Not Listed*				1.384	0.509	3.101
B	0.5	25	50	200	**0.814**	**0.914**	**0.751**
Ba	0.7	35	70	280	0.168	0.135	0.166
Ca	*Not Listed*				51	70	71
Cr	0.05	2.5	5	20	**0.056**	**0.173**	**0.063**
Cr(VI)	0.05	2.5	5	20	<0.010	**0.194**	**0.07**
K	*Not Listed*				1.1	4	1.6
Li	*Not Listed*				<0.025	0.095	<0.025
Mg	*Not Listed*				<2	7	<2
Mo	0.07	3.5	7	28	0.034	**0.186**	0.04
Na	*Not Listed*				<2	5	<2
V	0.2	10	20	80	0.098	0.139	0.097
Zn	5	250	500	2000	<0.025	<0.025	0.025
WASTE TYPE (based on LEACHABLE CONCENTRATION of CoCs)					**Type 3**	**Type 3**	**Type 3**

[25] *The table only shows CoCs that were present in concentrations above the detection limit of the analysis.*

[26] *The LCT data is presented as listed in the draft WCMR (613 of 2012).*

[27] *The LCT data is presented as listed in the draft WCMR (613 of 2012).*

[28] *The LCT data is presented as listed in the draft WCMR (613 of 2012).*

[29] *The LCT data is presented as listed in the draft WCMR (613 of 2012).*

4. LINER DESIGN REQUIREMENTS FOR DISPOSAL

4.1 Liner Requirements as per Minimum Requirements 1998

Due to the ash having an HR1 hazard rating (see **Table** 2), the ash must therefore be disposed on a H:H landfill site. Treatment of the ash to convert Cr_{VI} to Cr_{III} could reduce the hazard rating to HR2 and increase the maximum disposal load. However sampling and analyses of the waste after treatment would be required to confirm the efficacy of the treatment and re-evaluate the hazard rating and disposal load.

4.2 Liner Requirements as per WCMR (2012)

The standard containment barrier design and landfill disposal requirements for the different waste types as per the GNR. 615 of 2012 are presented in **Table 8**.

According to WCMR, all of the waste can be disposed on a landfill facility with a Class C liner as detailed in **Figure 7**.

Table 8: WCMR Landfill Disposal Requirements

Waste Type	Landfill Disposal Requirements
Type 0	The disposal of Type 0 waste to landfill is **not allowed**. The waste must be treated and re-assessed in terms of the *Standard for Assessment of Waste for Landfill Disposal* to determine the level of risk associated with disposing the waste to landfill.
Type 1	Type 1 waste may only be disposed of at a **Class A** landfill designed in accordance with Section 3(1) and 3(2), or, subject to Section 3(4), may be disposed of at a landfill site designed and operated in accordance with the requirements for a **H:h** / **H:H landfill** as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998). Liner requirements shown in **Figure 6.**
Type 2	Type 2 waste may only be disposed of at a **Class B** landfill designed in accordance with Section 3(1) and 3(2), or, subject to Section 3(4), may be disposed of at a landfill site designed and operated in accordance with the requirements for a **GLB+ landfill** as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998) Liner requirements shown in **Figure 5**.
Type 3	Type 3 waste may only be disposed of at a **Class C** landfill designed in accordance with Section 3(1) and 3(2), or, subject to Section 3(4), may be disposed of at a landfill site designed and operated in accordance with the requirements for a **GLB+ landfill** as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998) Liner requirements shown in **Figure 7**.
Type 4	Disposal allowed at a landfill with a **Class D** landfill designed in accordance with Section 3(1) and 3(2), or, subject to Section 3(4), may be disposed of at a landfill site designed and operated in accordance with the requirements for a **GSB- landfill** as specified in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., DWAF, 1998).

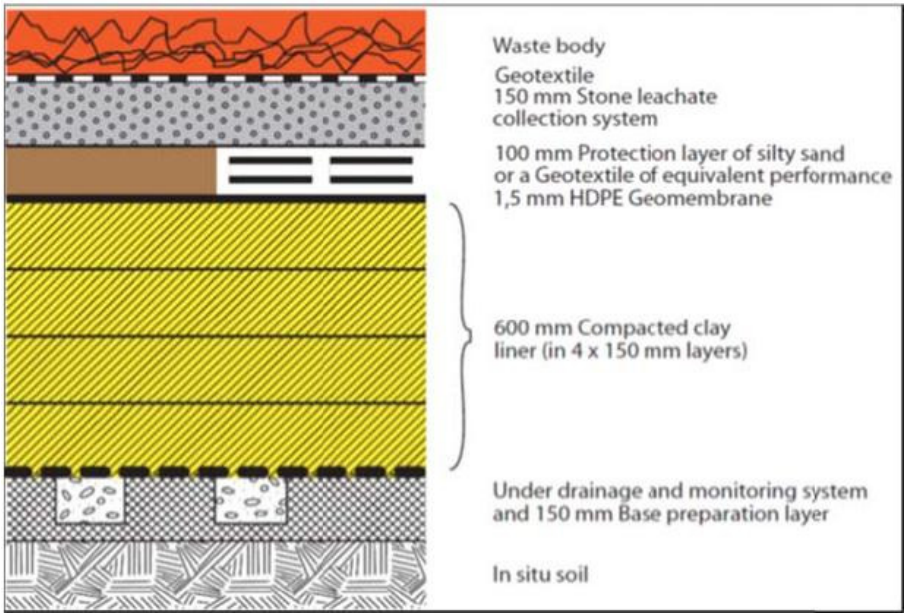

Figure 5 - Proposed Class B landfill liner system

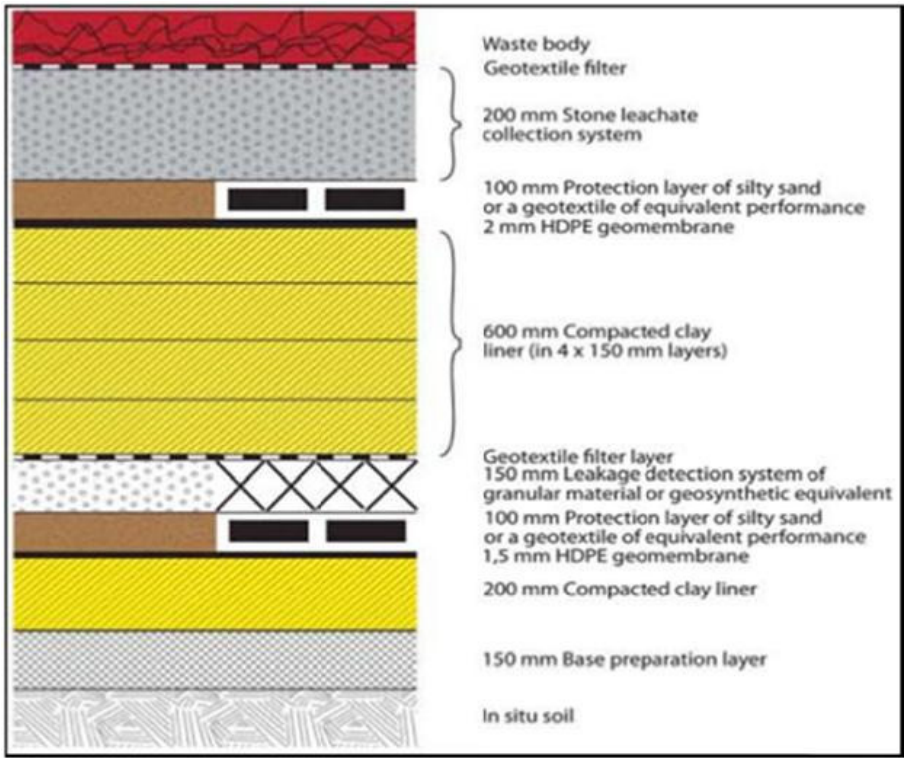

Figure 6 - Proposed Class A landfill liner system

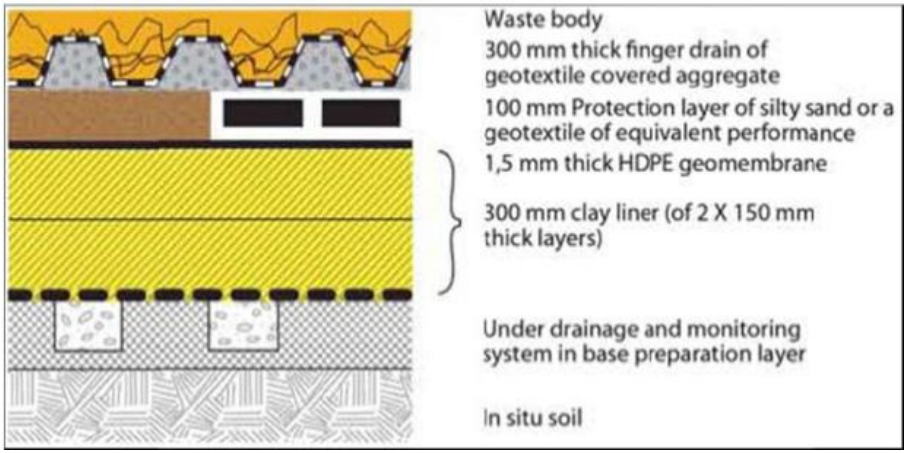

Figure 7 - Proposed Class C landfill liner system

5. CONCLUSION

Analytical results were obtained on three representative samples of the waste to be classified. The results of the waste classification yield the following:

- As per the Minimum Requirements (MRs), the ash has been shown to have an HR1 hazard rating due to the elevated Cr_{VI} concentrations (from the ARLP Extract analysis) and must be disposed on hazardous landfill (H:H) with liner requirements shown in **Figure 6**.
- As per the draft Waste Classification and Management Regulations (WCMR) the ash has been has been classified as a Type 3 Waste and must be disposed on a landfill site with a Class C barrier system (as per WCMR, shown in **Figure 7**) or a G:L:B+ landfill site (as per MRs).

Both classification systems have been considered as the draft WCMRs are not yet enforceable. The MRs will remain in force for a defined period (to be confirmed) after the draft WCMR are promulgated.

The ash must therefore (at this point in time) be disposed of on a facility designed at H:H standards until such time that the WCMR have been promulgated. From the date of promulgation of the WCMR onwards, the waste streams can be disposed of on a landfill designed in accordance with the $G:L:B^{+}$ requirements.

An analysis was carried out to determine the possibility of delisting the waste for disposal to a G:L:B+ landfill facility (as per MRs). It was determined that delisting of the waste is not possible given the high Estimated Environmental Concentration (EEC) of Cr(VI) that the site will receive.

The above is on the proviso that the characteristics of the ash does not change.

6. REFERENCES

GNR 613 of 2012 Draft Standard for Assessment of Waste for Landfill Disposal;

GNR 614 of 2012 Waste Classification and Management Regulations;

GNR 615 of 2012 Standard for Disposal of Waste to Landfill;

Minimum Requirements for Waste Disposal by Landfill: Second Edition 1998: Department of Water Affairs and Forestry;

Draft Minimum Requirements for Waste Disposal by Landfill: Third Edition 2005: Department of Water Affairs and Forestry (not published);

Minimum Requirements for the Handling, Classification and Waste Disposal by Landfill: Second Edition 1998: Department of Water Affairs and Forestry;

GNR 433 of 2011 Draft Standard for Assessment of Waste for Landfill Disposal (superceded);

National Waste Information Regulations (Gazette number 35583, DEA, August 2012);

7. DISCLAIMER

The contents and findings of this report are presented in accordance with the scope of works defined in the Letter of Agreement (LoA) between Jeffares and Green (Pty) Ltd and Royal HaskoningDHV signed on 7 February 2013.

The conclusions are made based on the analytical results of the three test samples received from Waterlab (Pty) Ltd.

Sampling was carried out by obtaining samples from both the current ash disposal pile and an existing ash stockpile, as of 15 February 2013, in order to try obtain a representative sample of the ash waste being disposed of at the existing Matimba ash disposal facility. These samples have been taken as representative at the time of sampling and no responsibility is accepted, by Jeffares and Green, should subsequent testing reveal alternate analytical results or if site conditions change or if any elements of the process changes producing a different ash product for disposal.

APPENDIX A

ANALYTICAL RESULTS

APPENDIX B

Delisting Calculation (CR_{VI})

Ash Load Estimation

From the technical information received:

$$Ash\ Density = 814\ kg/m3$$

$$Ash\ Percentage = 35.5\%$$

$$Mass\ of\ Coal\ Combusted = 15.05\ million\ tons/annum$$

$$Mass\ of\ Ash\ Disposed = 15.05\,(10^6) \times 35.5\% = 5.34\,(10^6) tons/annum = 445\ 230\ tons/month$$

$$Volume\ of\ Ash\ Disposed = \frac{5.34\ million\ (10^3) kg/annum}{814 kg/m^3} \times \frac{1}{12\ months/annum} \approx 547\ 000 \frac{m^3}{month}$$

Maximum height of lifts at waste disposal is assumed at 3m high

$$Area\ for\ Waste\ Disposal = \frac{547\ 000 \frac{m^3}{month}}{3m} \approx 18.2 \frac{ha}{month}$$

$$\boldsymbol{Ash\ Load = \frac{445\ 230\ (10^3) kg/month}{18.2\ ha} \approx 24\ 500\ (10^3) kg/ha/month}$$

EEC[30] Calculation for New Stockpile 1:

$$Dose = 0.307(10^{-3}) g/l \times 24500(10^3) kg/ha/month$$

$$= 7521.5\ g/ha/month$$

$$\boldsymbol{EEC = \frac{dose \times 0.66}{0.1}}$$

$$\boldsymbol{= \frac{7524.5 \times 0.66}{0.1}}$$

$$\boldsymbol{= 49\ 642\ g/ha/month}$$

For Delisting:

$$ARL\ (CRvi) = 0.02ppm = 20\ ppb$$

$$EEC < ARL$$

However

$$\boldsymbol{EEC = 49\ 642 > 20 = ARL}$$ **THEREFORE CR_{VI} CANNOT DELIST**

[30] *The additional 0.1 factor in the EEC calculation is required because the EEC needs to be <0.1 of the ARL (or <0.01 of the LC50) for carcinogens*