3.2.6.4 Process Water Storage

Process Water at GMBS is stored in the following storage facilities:

- Process Water Dam 101
- Process Water Dam 102
- HSEC Reservoir
- Sinter Plant Slurry Pit
- MEP Jig Plant Process Water Dam
- Slimes Dam Return Water Sump
- Current Jig Plant and Spiral Plant Tailings Quarry Dam – MG1 abandoned pit
- Old Jig Plant and Spiral Plant Tailings Quarry Dam – LG6 abandoned pit
- North Pit Final Void 1
- North Pit Final Void 2

Relevant details for the Process Water Storage Facilities at GMBS are given in Tables 3.2.6.4(a) through 3.2.6.4(i).

3.2.6.5 Recreational Water Use

Two surface water dams are used for recreational purposes at GMBS. The two dams are located in a tributary of the Matlapyane Stream.

- Recreation Dam 1
- Recreation Dam 2

Relevant details for the Recreation Dams at GMBS are given in Tables 3.2.6.5(a) and 3.2.6.5(b).

Table 3.2.6.4(a): Process Water Dams Details

Facility Name:	**PROCESS WATER DAMS 101 & 102**	
Coordinates:	Y: -10,008.90 m Lat: 25° 29' 23.8" S	X: 2,820,335.46 m Long: 27° 05' 58.4" E
Surface Dimensions:	47.5 m x 25.5 m	
Volume:	2,000 m^3 *	
Type of Water:	Process Water	
Liner Specifications:	Lined with HDPE Liner	
Drawing Reference:	118/002/002. Rev 1.	
Inlet:	Storm Water / Scrubber Sumps / Slimes Dam / Potable Tank / Fire Hydrant Tanks **	
Outlet:	Sinter Plant / Furnaces	
Comments:	Located to the south of the raw material stockpile area. The overflow connects the two Process Water Dams (101 and 102).	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.60	408.0	2800	46.10	162.00	461.00	325.00	1268	307.00	603.00	22.50	16.00	13.00	0.28	3.60
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.92	0.05	23.00	0.15	0.217	0.010	0.001	0.003	0.001	0.208	0.016	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.007	0.022	0.007	0.012	0.001	0.000	0.001	0.001	0.001	0.068	0.004	0.001	0.001	0.001	0.023
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	2.430	0.008	0.028	0.007	0.055	0.001	0.050	0.000	0.058	0.003	0.001	0.001

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Table 3.2.6.4(b): HSEC Dam / Reservoir Details

Facility Name:	**HSEC DAM / RESERVOIR**	
Coordinates:	Y: - 10,202.06 m Lat: 25° 29' 39.9" S	X: 2,820,823.44 m Long: 27° 06' 05.2" E
Surface Dimensions:	Radius = 7.74 m	
Volume:	328.35 m^3	
Type of Water:	Abstracted Groundwater	
Liner Specifications:	Concrete Base and Walls	
Drawing Reference:	XSTB-00-52-058.	
Inlet:	Abstracted Groundwater	
Outlet:	Process Water	
Comments:	Located to the south of the HSEC office buildings.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
7.50	76.8	544	36.00	78.40	11.60	1.09	280	38.00	111.00	39.20	4.50	0.10	0.00	0.20
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.01	0.00	0.20	0.00	0.001	0.010	0.001	0.001	0.001	0.013	0.051	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.002	0.011	0.001	0.001	0.167	0.001	0.050	0.001	0.007	0.001	0.001	0.001

Table 3.2.6.4(c): Sinter Plant Slurry Pit Details

Facility Name:	**SINTER PLANT SLURRY PIT**	
Coordinates:	Y: -9,838.46 m Lat: 25° 29' 23.3" S	X: 2,820,316.47 m Long: 27° 05' 52.4" E
Surface Dimensions:	11.0 m x 10.5 m	
Volume:	*No information has been made available.*	
Type of Water:	*No information has been made available.*	
Liner Specifications:	Concrete Foundations and Walls	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	*No information has been made available.*	
Outlet:	*No information has been made available.*	
Comments:	Located to the north of the Pelletizing Plant	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
6.90	415.0	2834	181.00	135.00	505.00	119.00	96	526.00	1153.00	5.75	40.00	16.00	0.21	20.00
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
2.17	0.06	10.00	0.01	1.450	0.010	0.001	0.002	0.001	0.113	0.007	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.003	0.004	0.007	0.001	0.001	0.000	0.001	0.001	0.001	0.024	0.022	0.001	0.001	0.001	0.019
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.182	0.003	0.036	0.001	0.142	0.001	0.050	0.001	0.117	0.005	0.001	0.001

Table 3.2.6.4(d): Metal Extraction Plant Process Water Dam Details

Facility Name:	**METAL EXTRACTION PLANT PROCESS WATER DAM (JIG PLANT PROCESS DAM)**	
Coordinates:	Y: -10,217.20 m Lat: 25° 29' 08.6" S	X: 2,819,868.23 m Long: 27° 06' 05.9" E
Surface Dimensions:	50.5 m x 45.0 m	
Volume:	3800 m^3 *	
Type of Water:	Dirty Surface Water	
Liner Specifications:	Lined with HDPE Liner	
Drawing Reference:	118/002/006. Rev A.	
Inlet:	Surface water run-off from MEP operational area	
Outlet:	Metal Extraction Plant	
Comments:	Located to the west of the Metal Extraction Plant.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.30	229.0	1530	54.10	104.00	237.00	123.00	404	175.00	611.00	10.60	15.00	4.80	2.01	1.70
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
2.20	0.05	0.60	0.02	0.334	0.010	0.001	0.001	0.001	0.085	0.007	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.003	0.001	0.003	0.002	0.001	0.000	0.001	0.001	0.001	0.057	0.003	0.001	0.001	0.001	0.009
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.150	0.005	0.023	0.001	0.030	0.001	0.050	0.001	0.011	0.003	0.001	0.001

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Table 3.2.6.4(e): Slimes Dam Return Water Sump Details

Facility Name:	**SLIMES DAM RETURN WATER SUMP**	
Coordinates:	Y: -11,527.06 m Lat: 25° 29' 07.2" S	X: 2,819,823.65 m Long: 27° 06' 52.7" E
Surface Dimensions:	*No information has been made available.*	
Volume:	*No information has been made available.*	
Type of Water:	Slimes Dam Return Water	
Liner Specifications:	Concrete Foundations and Walls	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	Slimes Dam Return Water	
Outlet:	Process Water	
Comments:	Located to the north of the slimes dam.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.70	608.0	4702	62.20	177.00	804.00	577.00	1100	304.00	1928.00	19.60	44.00	4.10	0.01	1.90
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.07	0.02	18.00	0.03	0.358	0.329	0.001	0.002	0.001	0.286	0.022	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.006	0.027	0.007	0.005	0.001	0.000	0.001	0.001	0.001	0.126	0.005	0.001	0.001	0.001	0.012
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	3.290	0.007	0.034	0.004	0.114	0.001	0.050	0.000	0.029	0.002	0.001	0.001

Table 3.2.6.4(f): Current Jig Plant and Spiral Plant Tailings Phase 2 Quarry Dam Details

Facility Name:	**JIG PLANT and SPIRAL PLANT TAILINGS DAM / QUARRY**	
Coordinates:	Y: - 11,978.41 m Lat: 25° 28 '47.7" S	X: 2,819,219.93 m Long: 27° 07' 07.8" E
Surface Dimensions:	*No information has been made available.*	
Volume:	150 00 m^3 *	
Type of Water:	*No information has been made available.*	
Liner Specifications:	No Liner or Base Preparation Layer.	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	*No information has been made available.*	
Outlet:	Process Water	
Comments:	Located to the north-east of the GMBS operations.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
9.20	160.0	1090	8.28	113.00	113.00	53.70	304	129.00	369.00	2.42	6.80	0.50	0.01	3.90
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.01	0.00	0.60	0.00	0.005	0.010	0.001	0.001	0.001	0.054	0.004	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.022	0.002	0.001	0.001	0.001	0.002
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.046	0.001	0.013	0.001	0.009	0.001	0.050	0.001	0.005	0.002	0.001	0.001

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Table 3.2.6.4(g): Old Jig Plant and Concentrator Plant Quarry Phase 1 Dam Details

Facility Name:	**CONCENTRATOR SPIRAL PLANT DAM / QUARRY**	
Coordinates:	Y: - 11,173.15 m Lat: 25° 28' 49.4" S	X: 2,819,245.09 m Long: 27° 06' 40.2" E
Surface Dimensions:	*No information has been made available.*	
Volume:	*No information has been made available.*	
Type of Water:	*No information has been made available.*	
Liner Specifications:	No Liner or Base Preparation Layer.	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	*No information has been made available.*	
Outlet:	Process Water	
Comments:	Located to the north of the spiral plant operations.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.40	91.6	608	46.80	82.00	28.70	4.80	364	39.00	77.00	23.70	13.00	0.30	0.00	0.30
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.01	0.00	0.20	0.00	0.061	0.070	0.001	0.001	0.001	0.024	0.028	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.003
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.009	0.012	0.002	0.001	0.045	0.001	0.050	0.000	0.026	0.001	0.001	0.001

Table 3.2.6.4(h): North Pit Void 1

Facility Name:	**NORTH PIT VOID 1**	
Coordinates:	Y: -11,275.12 m Lat: 25° 29' 01.7" S	X: 2,819,760.24 m Long: 27° 06' 44.3" E
Surface Dimensions:	Still to be determined	
Volume:	Still to be determined	
Type of Water:	Ground Water	
Liner Specifications:	None	
Drawing Reference:	None	
Comments:	The North Pit Void 1 is located in the northern extent of the Northern (Benhaus) opencast mining management area at Boshoek. The void will remain open and will serve as an access point for potential future mining operations. Water is used as make-up water for process purposes.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011 (Drinking Water).

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.20	92.4	598	19.00	97.90	21.80	1.09	268	12.00	29.00	36.80	56.0	0.100	0.06	0.20
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.01	0.001	0.20	0.007	0.060	0.060	0.001	0.001	0.001	0.007	0.158	0.001	0.001	0.0001	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.003	0.001	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.003	0.007	0.001	0.001	0.161	0.001	0.050	0.002	0.018	0.001	0.001	0.001

Table 3.2.6.4(i): North Pit Void 2

Facility Name:	**NORTH PIT VOID 2**	
Coordinates:	Y: -12,153.36 m Lat: 25° 30 '22.1" S	X: 2,822,118.03 m Long: 27° 07' 15.0" E
Surface Dimensions:	Still to be determined	
Volume:	Still to be determined	
Type of Water:	Ground Water	
Liner Specifications:	None	
Drawing Reference:	None	
Comments:	The North Pit Void 2 is located in the southern extent of the Northern (Benhaus) opencast mining management area at Boshoek. The void will remain open and will serve as an access point for potential future mining operations. This water is not currently being used in the process.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011 (Drinking Water).

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.20	92.4	598	19.00	97.90	21.80	1.09	268	12.00	29.00	36.80	56.0	0.100	0.06	0.20
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.01	0.001	0.20	0.007	0.060	0.060	0.001	0.001	0.001	0.007	0.158	0.001	0.001	0.0001	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.003	0.001	0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.003	0.007	0.001	0.001	0.161	0.001	0.050	0.002	0.018	0.001	0.001	0.001

Table 3.2.6.5(a): Recreation Dam 1 Details

Facility Name:	**RECREATION DAM 1**	
Coordinates:	Y: - 10,062.41 m Lat: 25° 29' 32.6" S	X: 2,820,599.89 m Long: 27° 06' 00.2" E
Surface Dimensions:	*No information has been made available.*	
Volume:	*No information has been made available.*	
Type of Water:	Surface water from Matlapyane Stream tributary.	
Liner Specifications:	No Liner	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	Matlapyane Stream Tributary	
Outlet:	Recreation Dam 2	
Comments:	Located to the south of the beneficiation plant operations.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
7.10	7.0	62	4.04	3.11	2.03	1.22	32	5.00	5.00	5.60	0.20	0.10	0.03	0.20
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.80	0.01	0.20	0.00	0.005	0.010	0.001	0.001	0.001	0.004	0.010	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.001	0.002	0.001	0.001	0.006	0.001	0.050	0.000	0.001	0.001	0.001	0.001

Table 3.2.6.5(b): Recreation Dam 2 Details

Facility Name:	**RECREATION DAM 2**	
Coordinates:	Y: - 10,129.20 m Lat: 25° 29' 32.9" S	X: 2,820,607.29 m Long: 27° 06' 02.6" E
Surface Dimensions:	*No information has been made available.*	
Volume:	*No information has been made available.*	
Type of Water:	Surface water from Matlapyane Stream tributary.	
Liner Specifications:	No Liner	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	Recreation Dam 1	
Outlet:	Matlapyane Stream Tributary	
Comments:	Located to the south of the beneficiation plant operations.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
7.20	8.1	70	4.05	3.77	2.40	1.80	32	5.00	5.00	5.29	0.20	0.10	0.11	0.20
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
0.70	0.02	0.20	0.00	0.007	0.010	0.001	0.001	0.001	0.006	0.008	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.001	0.001	0.001	0.001	0.001	0.000	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.001	0.002	0.001	0.001	0.006	0.001	0.050	0.000	0.002	0.001	0.001	0.001

3.2.6.6 Storm Water Management

The current storm water management at GMBS is done in fulfilment of Regulation GN 704 which regulates water management at mines.

The main objectives for storm water management are to:

- separate clean and dirty water
- minimize dirty water catchments
- capture and contain dirty storm water in appropriate storage facilities
- re-cycle and re-use contaminated water
- divert and discharge clean water into the receiving environment

GMBS currently has surface water management infrastructure in place that isolates and contains the dirty water on site at the appropriate containment facilities, whilst diverting clean water around the site into the receiving environment. The major surface water management infrastructure at GMBS is delineated on Figure 3.2.6.6(a). The design specifications and drawings that have been made available for the water management facilities at GMBS are attached as APPENDIX VIII to the Process and Materials Characterization Specialist Report attached as **APPENDIX 3.2 (C)** to this report.

Clean water diversion berms and canals are located upstream of the following areas and facilities in order to divert clean storm water run-off away from contaminated areas and into the receiving environment:

- Storm Water Diversion at South Pit
- Storm Water Diversion at North Pit
- Storm Water Diversion at Concentrator Spiral Plant
- Storm Water Diversion at Slurry Disposal Facility
- Storm Water Diversion at current Jig Plant and Spiral Plant Tailings Quarry
- Storm Water Diversion at old Jig Plant and Spiral Plant Tailings Quarry
- Storm Water Diversion/Canals at Smelting Plant

Affected (contaminated) storm water runoff from within the smelting plant is captured by a series of storm water canals and channelled to and stored in two storm water pollution control dams (PCD's). The water contained in these storm water PCD's is pumped to the process water dams and re-used in the plant process. Emergency overflow from the main Storm Water PCD enters the external environment. The water level in the main Storm Water PCD is maintained between 35% and 40% during the winter and between 15% and 25% during the summer months.

Affected storm water at GMBS is stored in the following storage facilities:

- Plant Dirty Water PCD
- Plant Storm Water (main) PCD

Relevant details for the two Pollution Control Dams at GMBS are given in Tables 3.2.6.6(a) and 3.2.6.6(b).

Figure 3.2.6.6(a): Major Storm Water Management Measures at GMBS

Table 3.2.6.6(a): Plant Dirty Water PCD Details

Facility Name:	**PLANT DIRTY WATER DAM**	
Coordinates:	Y: -10,019.68 m Lat: 25° 29' 18.0" S	X: 2,820,155.76 m Long: 27° 05' 58.8" E
Surface Dimensions:	62.5 m x 50.5 m	
Volume:	10 000m^3 *	
Type of Water:	Dirty Surface Water	
Liner Specifications:	Lined with HDPE Liner	
Drawing Reference:	118/002/003. Rev A.	
Inlet:	Surface water run-off from raw material stockpile area	
Outlet:	Sinter Plant / Furnaces	
Comments:	Located adjacent to the raw material stockpile area.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
7.70	425.0	2900	176.00	133.00	520.00	137.00	244	523.00	982.00	6.68	43.00	14.00	0.14	14.00
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
1.43	0.04	12.00	0.01	0.160	0.010	0.001	0.001	0.001	0.113	0.010	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.003	0.005	0.007	0.001	0.001	0.000	0.001	0.001	0.001	0.027	0.017	0.001	0.001	0.001	0.014
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	0.822	0.003	0.032	0.002	0.285	0.001	0.050	0.001	0.030	0.004	0.001	0.001

** Water Use License (Number 03/A22F/ACGIJ/580)*

Table 3.2.6.6(b): Plant Storm Water (main) PCD Details

Facility Name:	**STORM WATER DAM**	
Coordinates:	Y: -10,075.48 m Lat: 25° 29' 04.2" S	X: 2,819,727.95 m Long: 27° 06' 00.7" E
Surface Dimensions:	120 m x 145 m	
Volume:	100 000 m^3 *	
Type of Water:	Dirty Surface Water	
Liner Specifications:	Lined with HDPE Liner	
Drawing Reference:	*Drawing has not been made available.*	
Inlet:	Dirty surface water run-off from the plant area	
Outlet:	Process Water	
Comments:	Located along the north-western perimeter of the beneficiation plant operations.	

Water Quality:

Assessed with regards to the limits set in the SANS 241:2011.

pH	EC	TDS	Ca	Mg	Na	K	T.Alk	Cl	SO_4	Si	NO_3	NO_2	Al	F
8.40	342.0	2334	41.30	155.00	375.00	264.00	996	242.00	518.00	21.50	15.00	14.00	1.72	3.30
Fe	**Mn**	**NH_4**	**Zn**	**Cr**	**Cr^{6+}**	**Ag**	**As**	**Au**	**B**	**Ba**	**Be**	**Bi**	**Cd**	**Ce**
2.35	0.11	4.80	0.34	0.263	0.039	0.001	0.003	0.001	0.197	0.020	0.001	0.001	0.000	0.001
Co	**Cs**	**Cu**	**Ga**	**Hf**	**Hg**	**Ho**	**Ir**	**La**	**Li**	**Mo**	**Sn**	**Nb**	**Nd**	**Ni**
0.007	0.020	0.006	0.016	0.001	0.000	0.001	0.001	0.001	0.062	0.003	0.001	0.001	0.002	0.025
Pb	**PO_4**	**Pt**	**Rb**	**Sc**	**Se**	**Sb**	**Sr**	**Te**	**Ti**	**U**	**V**	**W**	**Y**	**Zr**
0.001	0.200	0.001	1.960	0.010	0.027	0.006	0.048	0.001	0.050	0.000	0.081	0.002	0.001	0.001

** Water Use License (Number 03/A22F/ACGIJ/580)*

3.2.6.7 Ground Water Management

Ground water management at GMBS relates primarily to dewatering of the mining areas to establish safe mining conditions and measures aimed at the protection of the ground water resource from possible contamination as a result of seepage of water containing waste or water containing dissolved contaminants, originating from surface located waste facilities or water storage facilities.

Details of ground water management measures, including details on liner systems, toe drains and under drains of various facilities are contained in the approved EMPR, as well as in a detailed report on Waste and Water Management compiled by Metago Environmental Engineers in support of the EMPR. Both these reports are attached as APPENDICES to this report.

APPENDIX 3.2 (A): APPROVED (2007) GMBS EMPR – 2004 - METAGO
APPENDIX 3.2 (B): REPORT ON WASTE AND WATER MANAGEMENT SA CHROME EXPANSION - 2004 - METAGO

In this section the conceptual arrangements for ground water management measures will be discussed for:

- Dewatering of South Pit
- Dewatering of North Pit
- Raw Materials and Product Stockpiles Liner Systems
- Slag Stockpiling and Disposal Facility Underdrains
- Slurry/Slimes Facility Liner System
- Process Water Dams Liner Systems
- Pollution Control Dams Liner Systems
- Jig and Spiral Tailings Quarry Underdrains

Dewatering of South Pit

During the operational phase of the south pit, ground water and surface water accruing to the south pit was used as far as possible for dust suppression on haul roads inside and beyond the open pit. Excess water was abstracted from the open pit and was pumped via the Jig Plant and Concentrator Plant Tailings Disposal Facility into the Metal Extraction Plant (Jig) and Concentrator Plant (Spiral) process water system. Dewatering of the south pit has now stopped and the water will be allowed to accumulate in the south pit. The south pit will be fully rehabilitated and no final voids will be left. The ground water level in the pit will be monitored to ensure that surface decant does not occur.

Dewatering of North Pit

During the operational phase of the north pit, ground water and surface water accruing to the north pit was used as far as possible for dust suppression on haul roads inside and beyond the open pit. Excess water was abstracted from the open pit and was pumped via the Jig Plant and Concentrator Plant Tailings Disposal Facility into the Metal Extraction Plant (Jig) and Concentrator Plant (Spiral) process water system.

Mining has now stopped and water is allowed to accumulate in the two north pit final voids. These two voids are left open for possible future access to mining.

Water accumulating in the North Pit Void 1 will continue to be used for process water purposes. The water is abstracted from the void and is pumped via the Jig Plant and Spiral Plant Tailings Disposal Facility into the Metal Extraction Plant (Jig) and Spiral Plant process water system.

Raw Materials and Product Stockpiles Liner Systems

Certain Raw Materials (essentially the reductant materials such as anthracite), have to potential to mobilize contaminants into the ground water system, whilst others are inert and are not expected to impact on the ground water quality.

Raw materials at GMBS are stored on both lined and unlined areas. All raw material stockpiles located on unlined areas, are continuously rolled over to minimize their residence time on surface, thereby minimizing their potential to mobilize contaminants into the ground water system.

Table 3.2.6.7(a) below gives information on the lining systems for different raw materials storage areas.

Table 3.2.6.7(a): Indicated Existing Raw Materials and Method of Storage

Material	Quantity	Method of Storage
Daily feed coke	890m^3	Concrete base
Daily feed char	740m^3	Concrete base
Daily feed lumpy LG6 ore	390m^3	Concrete base and compacted clay
Daily feed concentrated ore	1260m^3	Concrete base
Daily feed quartz, dolomite, limestone	280m^3	Turf / Field
Strategic coke	2000m^3	Concrete base
Strategic char	2000m^3	Concrete base
Strategic LG6 Lumpy	515m^3	Compacted turf / field
Strategic LG6 concentrate	770m^3	Concrete base
Strategic UG2 concentrate	690m^3	Concrete base
Strategic anthracite	2000m^3	Concrete base
Strategic quartz,dolomite, limestone	370m^3	Compacted turf
Bentonite	60m^3	Raw material stores in sealed bins
Pellets	Variable	Concrete base and concrete silo
Diesel	5000 litres	Sealed tank in bunded concrete area
Nitric acid	5000 litres	Sealed vessel in chemical store
Low pressure gas	5 of 90kg vessels	Sealed vessels in chemical store
Paste	20 of 500kg cylinders	Concrete base in the furnace building
Flocculent	100 litres	Sealed containers in the stores
Grease	200kg	Sealed drums in chemical stores
Oil	300kg	Sealed drums in the chemical store

Final product stockpile areas are all concrete lined.

Slag Stockpiling and Disposal Facility Underdrains

Motivation for the type of liner/seepage prevention measures at slag dumps and slag stockpiles, is contained in the Water and Waste Management Report compiled by Metago Environmental Engineers in support of the 2004 EMPR submission, attached as **APPENDIX 3.2(B)**.

The motivation was based on the physio-chemical characterization of slag samples according to methodologies as they applied to waste characterization at the time and included Particle Size Distribution Analyses, Petrographic Analyses, Acid Base Accounting and Acid Rain Leachate Tests.

The overall results were then used to assess the potential environmental threat and to motivate the proposed mitigation measures to protect the ground water resource from unacceptable impacts. The outcome of the assessment is copied below:

"Based on the tests conducted on the jig slag and the groundwater monitoring results, the slag is unlikely to have a significant effect on surface water quality or groundwater quality. Some precautionary measures are however recommended. Despite the fact that the slag disposal operation is a dry process, the coarse particle distribution of the slag means that virtually 100% of the rainfall infiltrates the slag dump. A proportion of this rainfall is then evaporated from the near surface layer before it reaches the footprint of the dump, but it is estimated that between 40 and 60% of the Mean Annual Precipitation (MAP) reaches the base of the dump due to the coarse particle distribution. Toe seepage and seepage into the underlying strata would therefore be expected. The provision of a system of toe drains around the slag dump will serve to eliminate toe seepage."

"Surface runoff from the side slopes is expected to be minimal and can be captured by the toe wall from whence it will feed the underlying toe drain. As for the concentrator tailings, use should be made of the natural barrier properties of the silts and clays prevalent in the area to limit seepage loads to the groundwater."

"Water from the toe drains should be captured in a return water dam facility and is expected to be suitable for re-use as concentrator plant make-up water, or if required and in preference to Magalies Water, as make-up to the smelter process water dam."

The final conclusion and recommendation for the slag disposal and stockpiling facilities, as far as ground water protection is concerned was as follows:

Lining: None required: In-situ soils provide a significant barrier to metal mobility.

Under Drains: Filter drainage system comprising a toe drain along the toe of the facility to intercept seepage. Drains protected by a layer of carefully placed slag to prevent damage during end tipping. Drain outlets comprising of two 160mm diameter closed HDPE corrugated drainex pipe and a sump from where water will be pumped to the return water dam.

Closed solution drain around the perimeter of the slag dump with rodding manholes discharging to solution trench.

Surface run-off will be retained by the toe wall and drained from the slag dump via the under drainage system.

Contingency: In the event that the pollution plume is intercepted, which poses a threat to the reserve quality and downstream users, consideration will be given to the use of cut-off trenches and dewatering wells on the perimeter of the dump.

The measures as proposed were authorized in the EMPR approved in 2007.

Slurry/Slimes Facility Liner/Drainage System

Motivation for the type of liner/seepage prevention measures at the slurry/slimes facility, is contained in the Water and Waste Management Report compiled by Metago Environmental Engineers in support of the 2004 EMPR submission, attached as **APPENDIX 3.2(B)**.

The motivation was based on the physio-chemical characterization of slurry samples according to methodologies as they applied to waste characterization at the time and included Particle Size Distribution Analyses, Petrographic Analyses, Acid Base Accounting and Acid Rain Leachate Tests.

The overall results were then used to assess the potential environmental threat and to motivate the proposed mitigation measures to protect the ground water resource from unacceptable impacts. The outcome of the assessment is copied below:

"The clarifier slurry should be placed in a lined facility to protect the groundwater system. In order to minimise the risk of dispersion of this material into the environment, a containment facility, which collects both surface runoff and seepage is proposed. The supernatant decant water should be pumped back to the clarifier, and re-used in the venturi scrubber. The venturi scrubber water should be kept separate from the concentrator plant water, jig plant process water and mine service water."

"Due to the clarifier slurries higher potential to leach metals and salts, use of this material to backfill the open pits is not recommended."

Lining: Alternative A: Upper 1500micron HDPE, underlain by Hidrain 75, underlain by Bentomat, underlain by compacted in-situ material.

Alternative B: Upper 1500micron HDPE, underlain by Hidrain 75, underlain by 1000micron HDPE, underlain by compacted in-situ material.

Under Drains: None above the liner. Drying and consolidation will be achieved by low rate of rise and sun drying.
Toe drain to outer toe of slag embankment with outlet drain pipes and rodding manholes.

Surface run-off from the slurry beach will be decanted via the penstock and incorporated into the scrubbing system.

Contingency: In the event that the pollution plume is intercepted, which poses a threat to the reserve quality and downstream users, consideration will be given to the use of cut-off trenches and dewatering wells on the perimeter of the slurry facility.

The measures as proposed were authorized in the EMPR approved in 2007.

Process Water Dams Liner Systems

Process water is stored in the following facilities:

- Process Water Dam 101
- Process Water Dam 102
- HSEC Reservoir
- Sinter Plant Slurry Pit
- MEP Jig Plant Process Water Dam
- Slimes Dam Return Water Sump
- Current Jig Plant and Spiral Plant Tailings Quarry Dam – MG1 abandoned pit
- Old Jig Plant and Spiral Plant Tailings Quarry Dam – LG6 abandoned pit

With the exception of the HSEC Reservoir, which contains abstracted ground water of good quality and which is used for garden irrigation, the remainder of the facilities contain recycled process water or affected storm water.

The lining system at each of the facilities is listed in Table 3.2.6.7(b).

Table 3.2.6.7(b): Liner Systems at Process Water Storage Facilities

Process Water Storage Facility	Liner System
Process Water Dam 101	HDPE
Process Water Dam 102	HDPE
HSEC Reservoir	CONCRETE
Sinter Plant Slurry Pit	CONCRETE
MEP Jig Plant Process Water Dam	HDPE
Slimes Dam Return Water Sump	CONCRETE
Jig Plant and Spiral Plant Tailings Quarry Dam	NO LINER – UNDER DRAIN
Old Jig Plant and Spiral Plant Tailings Quarry Dam	NO LINER – UNDER DRAIN

Pollution Control Dams Liner Systems

Polluted Storm Water at GMBS is stored in the following facilities:

- Plant Dirty Water PCD
- Plant Storm Water (main) PCD

Both PCD's contain affected storm water which has the potential to impact on the underlying ground water resource.

The lining system at each of the facilities is listed in Table 3.2.6.7(c).

Table 3.2.6.7(c): Liner Systems at Pollution Control Dams

Process Water Storage Facility	Liner System
Plant Dirty Water PCD	HDPE
Plant Storm Water (main) PCD	HDPE

Jig and Spiral Tailings Quarry Liner/Drainage System

Motivation for the type of liner/seepage prevention measures at the Jig Tailings and Spiral Tailings facility, is contained in the Water and Waste Management Report compiled by Metago Environmental Engineers in support of the 2004 EMPR submission, attached as **APPENDIX 3.2(B)**.

The motivation was based on the physio-chemical characterization of slurry samples according to methodologies as they applied to waste characterization at the time and included Particle Size Distribution Analyses, Petrographic Analyses, Acid Base Accounting and Acid Rain Leachate Tests.

The overall results were then used to assess the potential environmental threat and to motivate the proposed mitigation measures to protect the ground water resource from unacceptable impacts. Two options were considered of which the disposal within the old open cast workings was selected. The outcome of the assessment as relevant to this option, is copied below:

"The only potential pollution issue associated with the tailings (dam) is the salinity likely to be released from the tailings material as a result of re-circulation of process water. Approximately 30 to 40% of the water pumped in the tailings disposal process is re-used by the concentrator plant. Conservative elements, such as Na, Cl, Mg and SO4 tend to increase in concentration as a result of this process. This could potentially contribute to increased salinity of surface and groundwater."

"Where the concentrator (and jig) tailings is disposed of into the old opencast pits, use should be made of a subsoil drainage system located below the surrounding phreatic surface to ensure that water is drawn from the surrounding aquifer towards the pits thereby ensuring that pollution of the groundwater as a result of seepage of process water from the pit to the surrounding aquifer does not occur. The underdrainage system can be decommissioned on completion of backfilling.

Lining: None.

Drains: Filter Drainage System Comprising

a) 500mm high by 5m wide central drain along the base of the open pit.
b) Elevated toe drains along inner toe of earth embankment to enhance stability of earth embankments.
c) Drain outlets comprising 100mm diameter closed HDPE corrugated Drainex pipe.

Contingency: In the event that the pollution plume is intercepted, which poses a threat to the reserve quality and downstream users, consideration will be given to the use of dewatering wells.

The measures as proposed were authorized in the EMPR approved in 2007.

3.2.6.8 Water Treatment Plant (polluted process and storm water)

There is currently no Water Treatment Plant at GMBS.

3.2.6.9 Water and Salt Balance

The Water Balances for dry and wet seasons as compiled by Metago, and as contained in the approved EMPR for GMBS, are shown in Figure 3.2.6.9(a) and Figure 3.2.6.9(b) respectively.

The Water Balances for the GMBS site will be update as part of this EMPR Addendum process, whilst a Salt Balance will also be compiled.

These updated water and salt balances will be contained in the EMPR Addendum to be compiled during the EIA phase of this project.

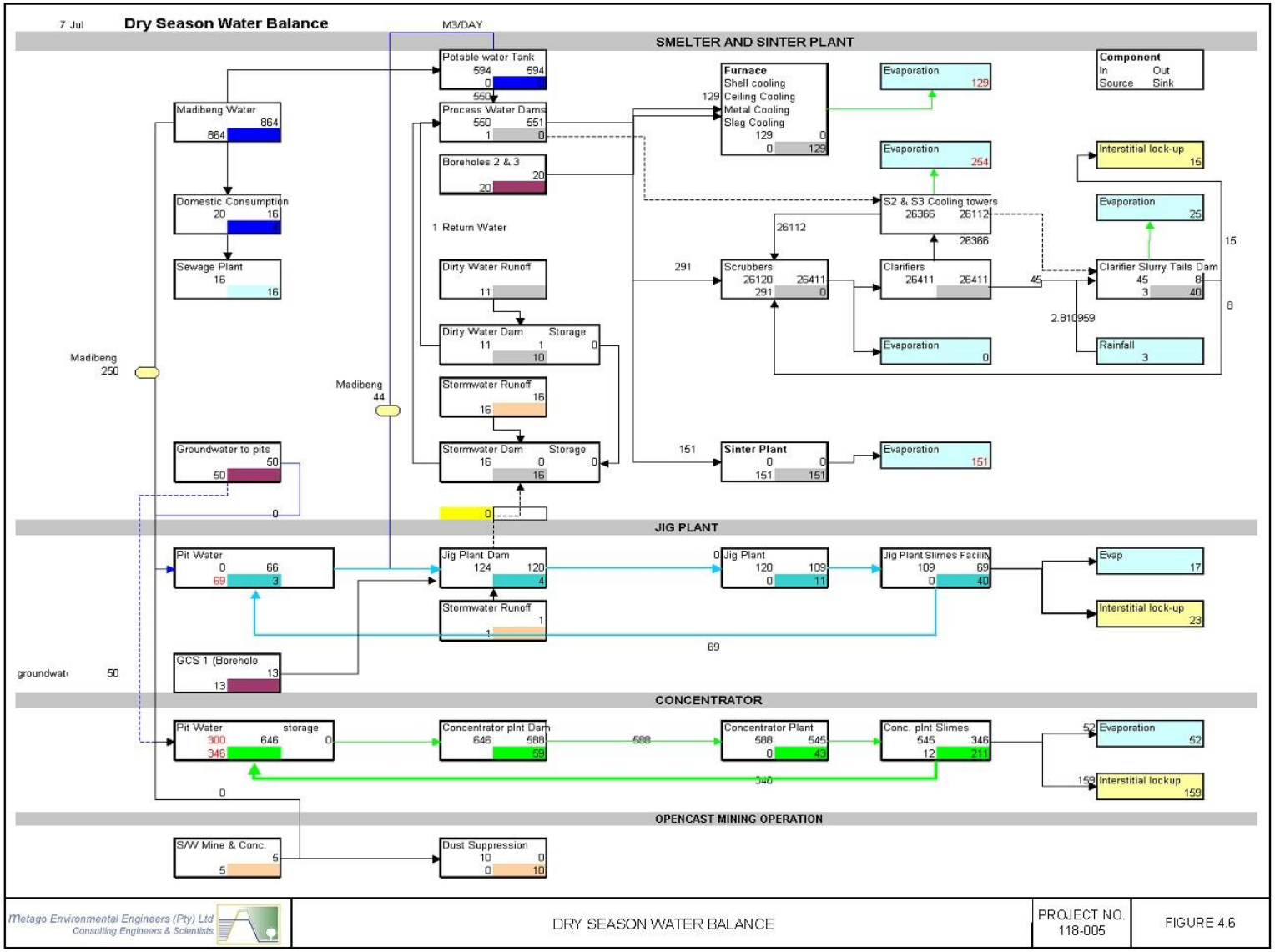


Figure 3.2.6.9(a): Water Balance Diagram – Dry Season (from approved EMPR – compiled by Metago)

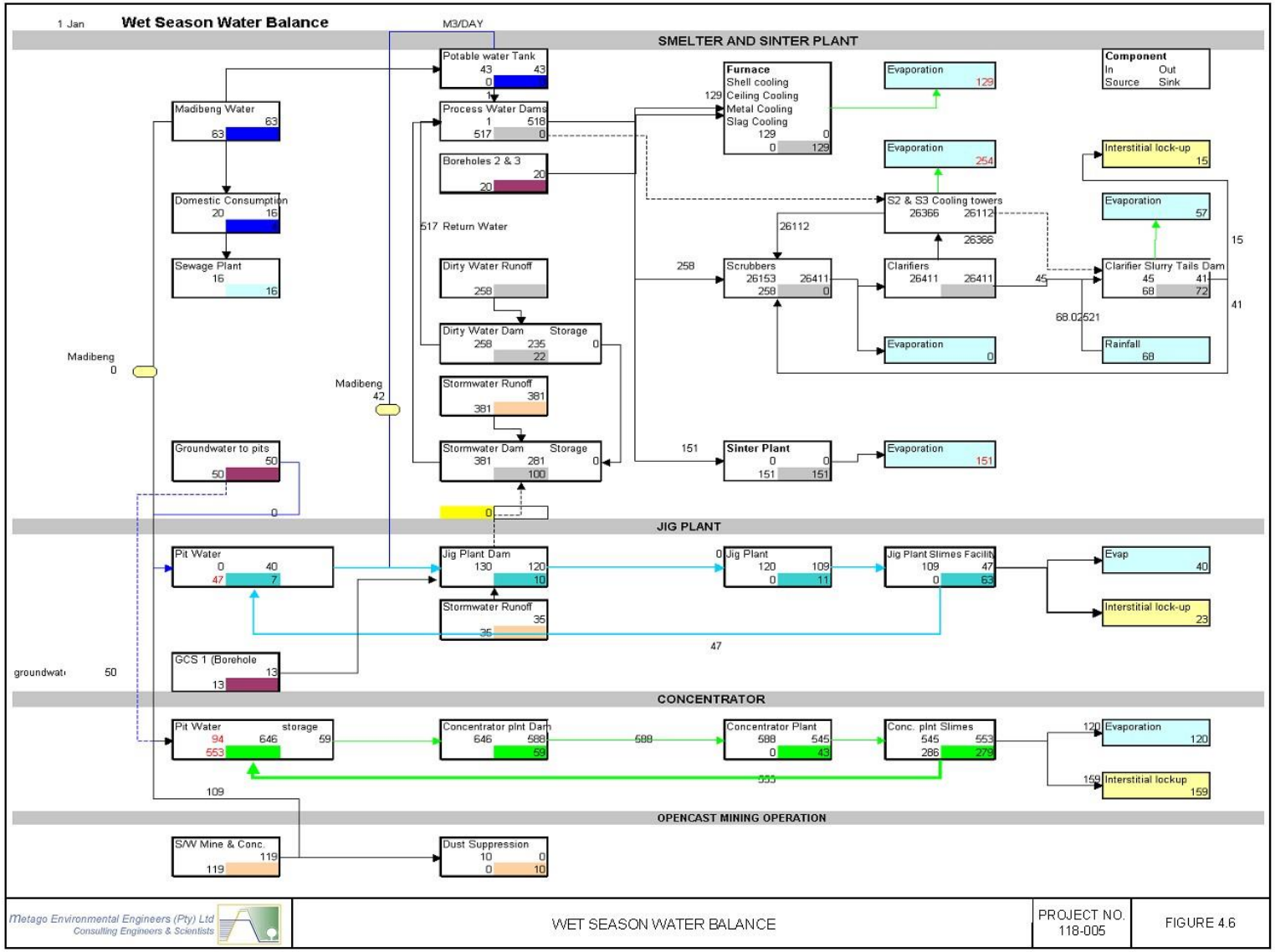


Figure 3.2.6.9(b): Water Balance Diagram – Wet Season (from approved EMPR – compiled by Metago)

3.2.7 Air Quality Control Systems

Air quality control systems are currently in operation to manage dust emissions, particulate matter emissions, as well as gaseous emissions at both the Mining Management Area, as well as at the Smelting Management Area.

3.2.7.1 Open Cast South and North

Dust suppression was until recently done routinely at the two open pits, but will now be terminated as soon as the rehabilitation has been completed. It comprised:

- Dust Suppression at South Pit – Bowsers with Mine Water
- Dust Suppression at North Pit – Bowsers with Mine Water

3.2.7.2 General Smelting Management Area

Dust suppression is also done on roads within the Smelting Management Area. It comprises:

- Dust Suppression at Smelting Plant – Bowsers with Jig Tailings Quarry Water

3.2.7.3 Raw Materials Proportioning Plant

Dust emissions control is also done at the Raw Materials Handling Area (proportioning plant). It comprises;

- Raw Materials Handling and Day Bin Area - Wet Scrubbing

NB! Upgrade of Dust Control at the Raw Materials Proportioning Plant is one of the new activities applied for.

3.2.7.4 Motswedi Pelletizing (Sinter) Plant

Dust and particulate matter emissions control is done at the Motswedi Pelletizing and Sinter Plant. It comprises:

- Dosing and Batching Circuit for the Sinter Plant - Dry Cartridge Filters
- S2 Furnace Dosing and Batching Circuit - Wet Scrubbing
- Sintering Furnace Drying Section - Wet Scrubbing
- Sintering Furnace Heating Section - Wet Scrubbing
- Sintering Furnace Sintering Section – Wet Scrubbing
- Sintering Furnace Pellet Products - Wet Scrubbing

3.2.7.5 Smelter Plant

Dust and particulate matter emissions control is done at the Smelter Plant. It comprises:

- Dosing and Batching Circuit for the S3 Furnace - Dry Cartridge Filters
- Smelter Preheater - Wet Scrubbing
- Smelter 2 - Wet Venturi Scrubbing
- Smelter Tap Holes - Wet Scrubbing

NB! An upgrade of the Scrubber System at the Furnaces (tap hole fume extraction system) is one of the new activities applied for.

3.3 NEW BOSHOEK ACTIVITY INFRASTRUCTURE AND PROCESS

JMA Consulting was presented by GMBS with a list of **additions, alterations and expansions of Ferrochrome Smelting Beneficiation Plant related infrastructure** at the existing Glencore Merafe Venture Boshoek Mine and Smelter.

In addition to amendment of the current approved EMPR in terms of the provisions of the MPRDA to reflect current site conditions, JMA was also requested to conduct the required NEMA EIA process as may be required for:

- NEMA EIA Listed Activities,
- NEMWA Waste Management Activities

The activities listed below, was confirmed after a series of meetings between JMA and GMBS Management, as the ones to be considered for inclusion into the EIA process:

- New Access Roads to new Slurry Dam and new Slag Dump
- New Lapa Dam
- New Storm Water Drainage Canals
- Extension of Temporary Waste Storage Facilities
- Upgrade of Salvage Yard
- New Slag Dump
- New Slag Dump Pollution Control Dam
- New Slurry/Slimes Dam
- Upgrade of Dust Control at Raw Materials Proportioning Plant
- Upgrade of Dust/Fume Control System at Furnaces (tap hole fume extraction system)

Each of the activities listed above, will now be discussed synoptically in order to support the EIA Scoping Process. Further details are being developed for each of the activities and which will be included in the EIA Report and EMP, during the EIA Phase.

3.3.1 New Access Roads to new Slurry Dam and new Slag Dump

New sections of access road are required to provide access to the proposed new Slurry Dam and Slag Dump.

The access road to the Slurry Dam will be used for construction of the new facility and thereafter for routine inspection and maintenance purposes only while the access road to the Slag Dump will, in addition to the aforementioned, also be used for transport of slag to the Slag Dump.

Preliminary Designs for these access roads are currently being done and will be included in the Draft EIA Report to be compiled during the EIA Phase of this project. These roads will be standard 4 m wide, gravel paved, internal service roads.

3.3.2 New Lapa Dam

GMBS has developed a functional recreational area within the Smelting Management Area for use by its employees. The development is located along the banks of the Matlapyane Spruit and comprise of a thatched lapa building within a 22 ha fenced area within which game is roaming. The game is kept in terms of a permit issued by the DACERD.

The multifunctional facility is used for a number of purposes including meetings, functions and general recreational purposes by the staff and visitors to the GMBS operations.

GMBS now wishes to construct and commission a weir in the Matlapyane spruit to dam some water to provide a natural water hole for the game and to affect a general upgrade to the environmental and recreational value of the area. The dam will also provide a wetland off-set area for other wetland areas impacted at GMBS, mainly the "wetland area" north from the existing Smelting Plant operations.

The storage capacity of this facility is estimated to be approximately 500 m^3.

A Conceptual Layout and Design for this Lapa Dam is shown in Figure 3.3.2(a). A Preliminary Design for the dam, as required to support the water use authorization application, will be done and will be contained in the EIA Report to be compiled for the EIA Phase of this project.

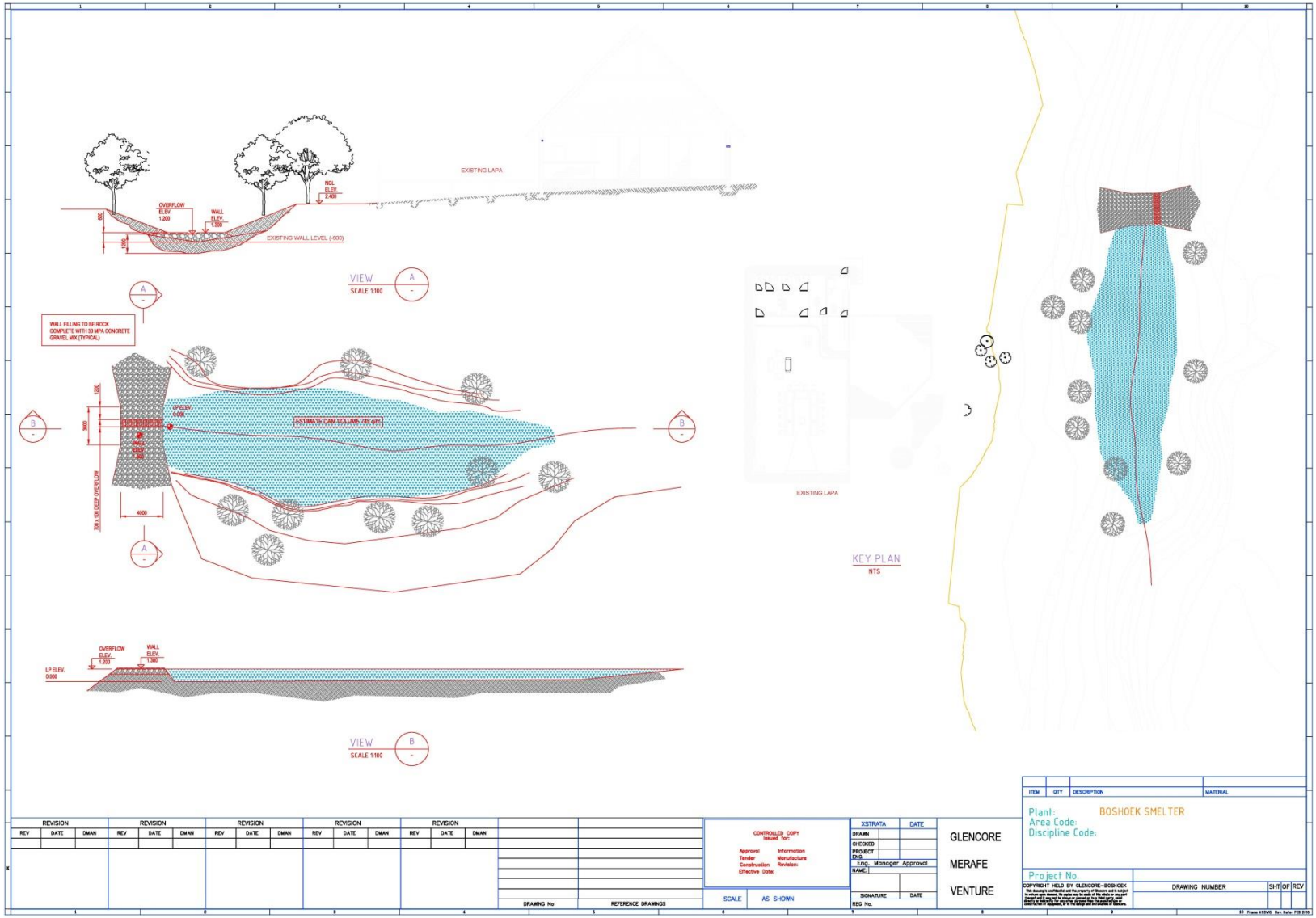


Figure 3.3.4(a): Conceptual Layout and Design for the Lapa Dam at GMBS

3.3.3 New Storm Water Drainage Canals/Berms

Upgrades to Storm Water Management at GMBS are required for six separate geographical areas:

- Existing Smelting Plant and Proposed New Slag Dump Area
- Southern Open Cast Area
- Northern Opencast Area (Includes Slurry Disposal Area)
- Spiral Plant Area
- Phase I Spiral and Jig Tailings Disposal Quarry (old)
- Phase II Spiral and Jig Tailings Disposal Quarry (current)

The location and extent of the six areas listed is delineated on Figure 3.3.3(a).

When dealing with a SWMP for a site, four primary principles need to be applied in the development and implementation of a SWMP. The four principles are as follows:

- Keep clean water clean by maximising clean areas and ensure that runoff from these areas is routed directly to natural watercourses and not contained or contaminated.
- Collect and contain dirty water from all sources of dirty water. Minimise dirty areas and reuse dirty water. Seepage and overflow of storage facilities must be prevented. Less and more polluted water must be separated.
- The SWMP must be sustainable over the total life cycle of the facility. Risk management is critical to the success of the SWMP.
- The statutory requirements of regulatory agencies and the interests of stakeholders must be considered and incorporated.

The proposed new upgrades to the storm water management at each of the areas will now be discussed.

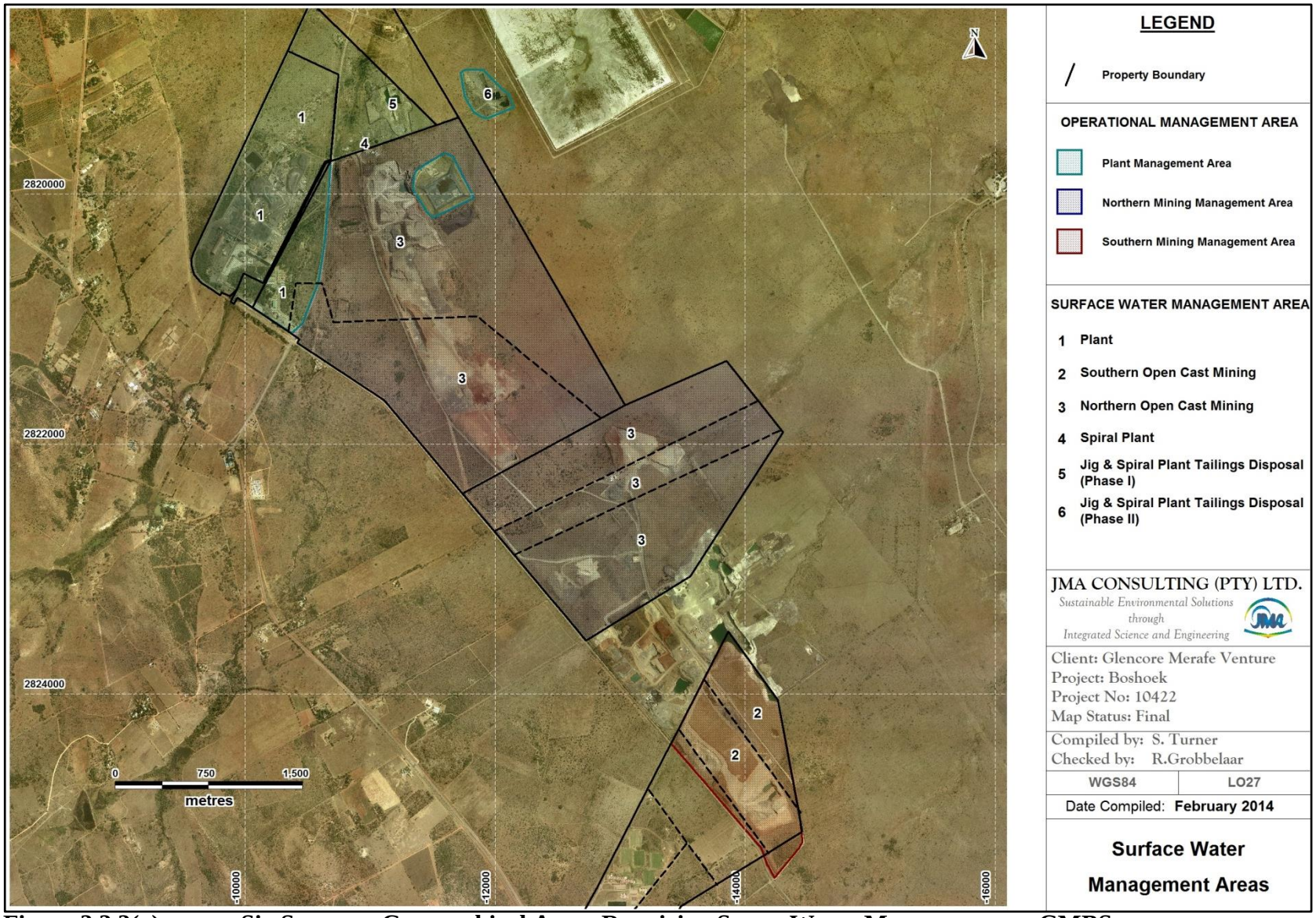


Figure 3.3.3(a): Six Separate Geographical Areas Requiring Storm Water Management at GMBS

3.3.3.1 SWMP for the Existing Smelting Plant and Proposed New Slag Dump Area

The existing and proposed upgraded Storm Water Management Plan details for this area are shown on Figure 3.3.3.1(a).

The existing Storm Water drainage at the Smelting Plant consists of two primary lined HDPE canals labelled SWD 1 and SWD 2 (Figure 3.3.3.1(a) that intercepts runoff from the Furnaces, Pelletizing Plant and Raw Materials Storage Areas. A large portion of these areas are paved and runoff drains in a northerly direction and is captured in the HDPE lined Plant Storm Water PCD (labelled SW Dam 1)

A second HDPE lined PCD, the Plant Dirty Water PCD (labelled Dirty Dam) is located at the raw materials yard. The overflow from this dam discharges into canal SWD 2. The catchment of the Plant Storm Water PCD (SW Dam 1) is approximately 24 ha.

The southeast area of the Smelting Plant, next to the Furnaces, is not secured and storm water runoff from this area discharges into the small adjacent tributary that discharges into the Matlapyane stream.

Drain SWD 2 will be extended to contain runoff from this area. SWD 3 indicates the required extension.

The existing Waste Slag Stockpiling and Disposal Area, as well as the Metal Recovery Plant Area, are regarded dirty areas and runoff, including all stockpiles and dump seep water, is classified as affected and dirty. All affected storm water runoff from these sites, need to be contained, as it currently discharges into the clean Matlapyane stream. The catchment for this area is approximately 25 ha.

Further north, next to the existing Waste Slag Dump area, the area is earmarked for the proposed new Slag Dump footprint. Runoff from this new footprint should eventually also be contained. The eventual total footprint size will be 17 ha.

The proposed surface drains SWD 4, SWD 5 and SWD 6 will intercept all runoff from the above areas and direct it to the proposed new Slag Dump PCD (labelled SW Dam 2) located north of the proposed new Slag Dump.

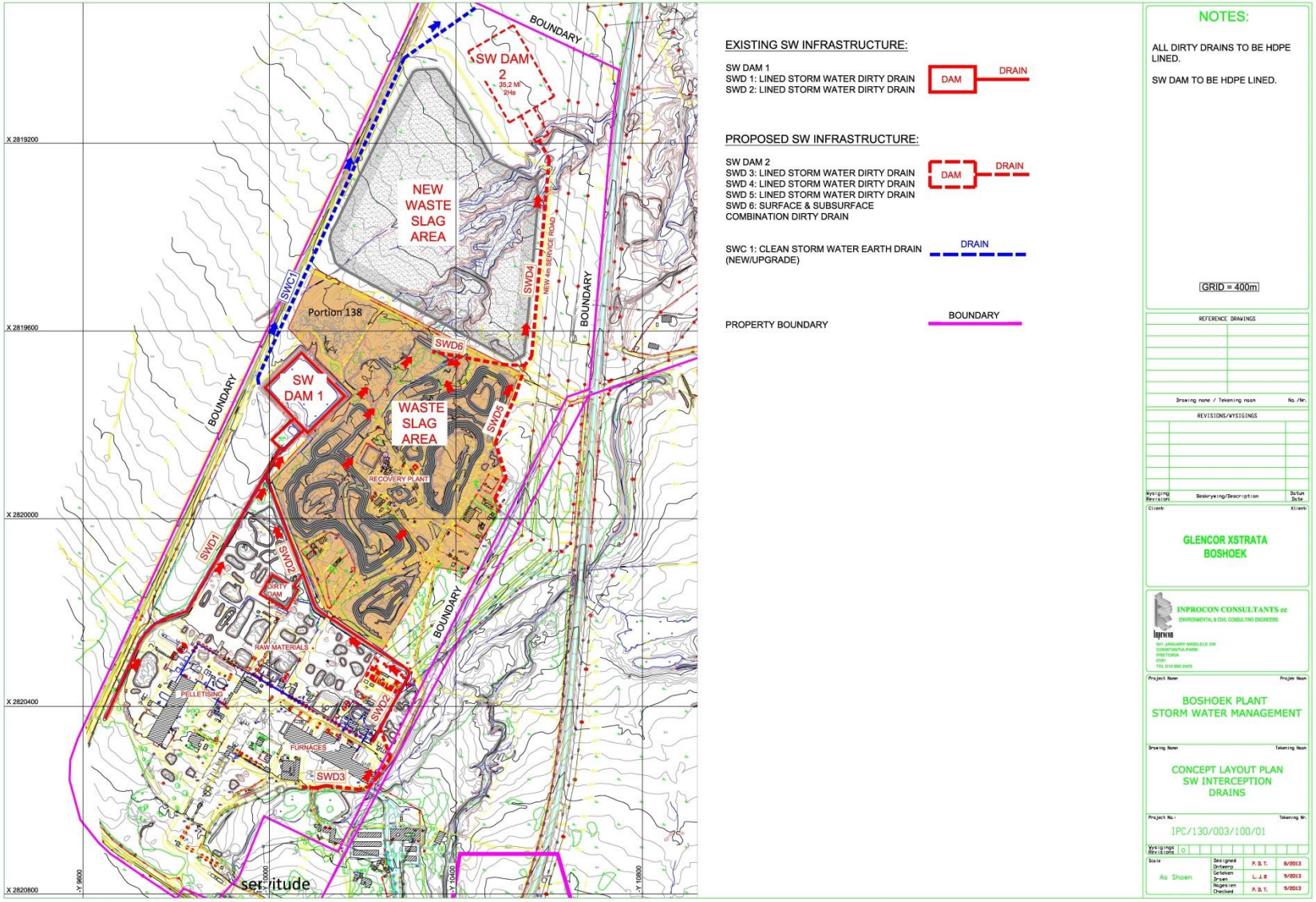


Figure 3.3.3.1(a): Proposed SWMP for Existing Smelting Plant and New Slag Dump Area

3.3.3.2 SWMP for the Southern Open Cast Area

The layout of the two opencast mine pits are indicated in Figure 3.3.3.2(a) and particular mine sections with Storm Water Measures are shown on Figure 3.3.3.2(b). The South Pit is the smaller pit.

The South Opencast is situated on Boekenhoutfontein 260 JQ Portion 27 and Portion 28. Mining also cuts across a subtle slope where the drainage of the upslope catchment appears as sheetflow. The rehabilitation of the south opencast must allow free draining conditions but importantly also the drainage required of the alongside perway (rail) culverts.

Due to the bulking factor the final surface of the backfilled mine area is elevated above natural ground level thereby cutting off of upslope runoff. The same principle as at the North Pit is required to allow runoff from the upslope to divert passed the mine area. For this to occur drain S1 will divert runoff to the eastern side of the south pit area. This is also towards a natural and more prominent drainage line.

The rail line culverts are shown in red triangles in Figure 3.3.3.2(b) and are upslope of the mine area. Culverts no's 14, 15, 16 and 17 project runoff towards the South Pit.

The South Pit interfaces with the Stellite mining operations on its north border and both mines cut across a drainage line. The catch area of the drainage line upstream of the mining area is approximately 1.5 km^2 and the catchment including the mined out area is 3.4 km^2. It is inevitable that the rehabilitation of both mines will require that the drainage line be reinstated and suitably lined to prevent erosion and scouring to cause obstructions in the flow path. Mine settlement and subsidence should be prevented to impact on this drainage line alignment. This requires planning and special backfill sequencing and compaction along the drainage line route. Refer to the Figures section for drainage line at culvert no.13. An alternative option should be investigated to divert upstream runoff towards the Boretjhane stream north of the Stellite site and the Boekenhoutfontein stream at the south of the site.

The pre-mining capability of the mine area is highly likely to be classified as grazing land. The profiling, shaping and placement of topsoil should support a grazing land form and land use. The target surface slopes should ensure a soil loss of less than 10t/ha.

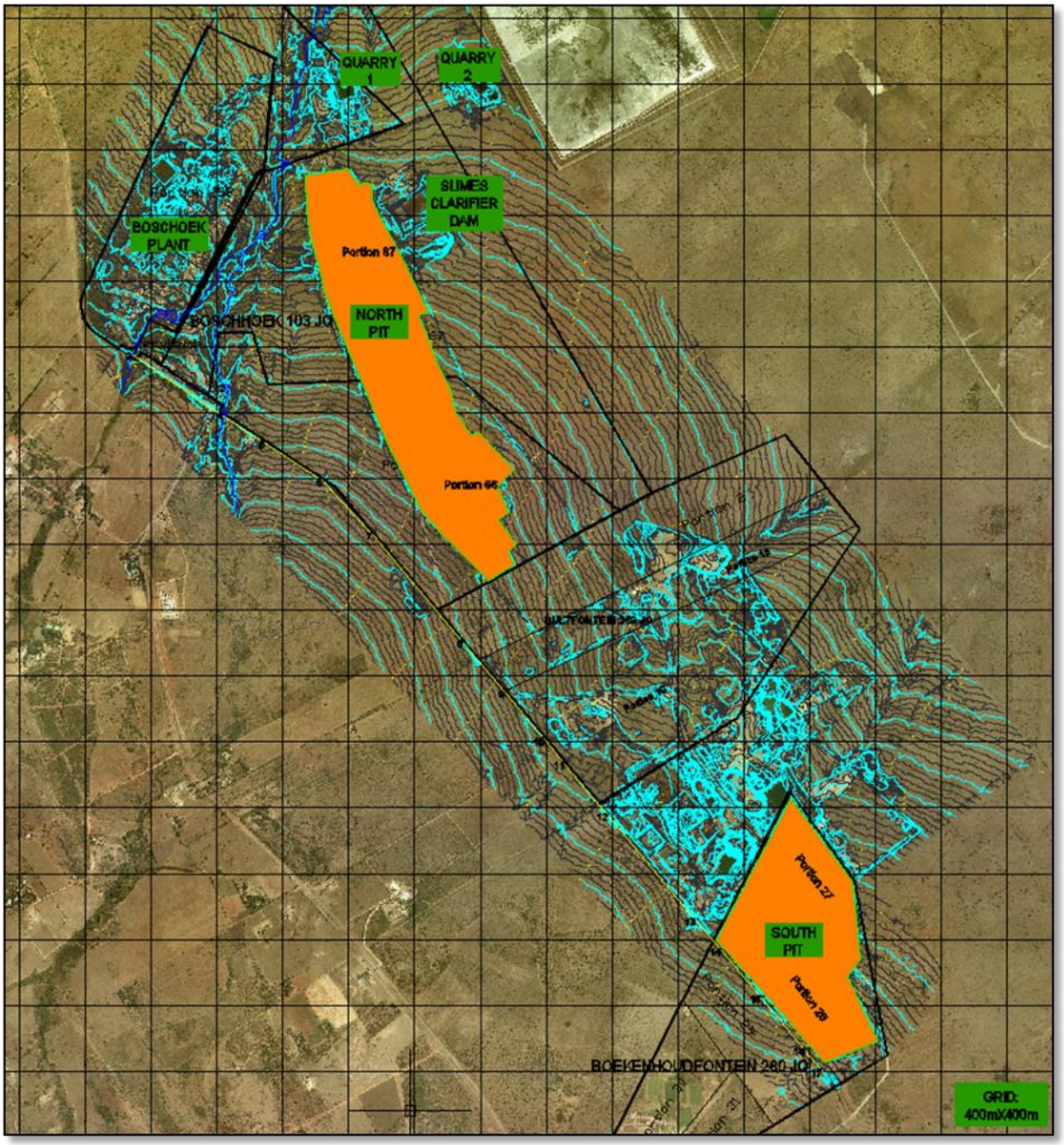


Figure 3.3.3.2(a): General Layouts of the two Open Cast Mining Areas

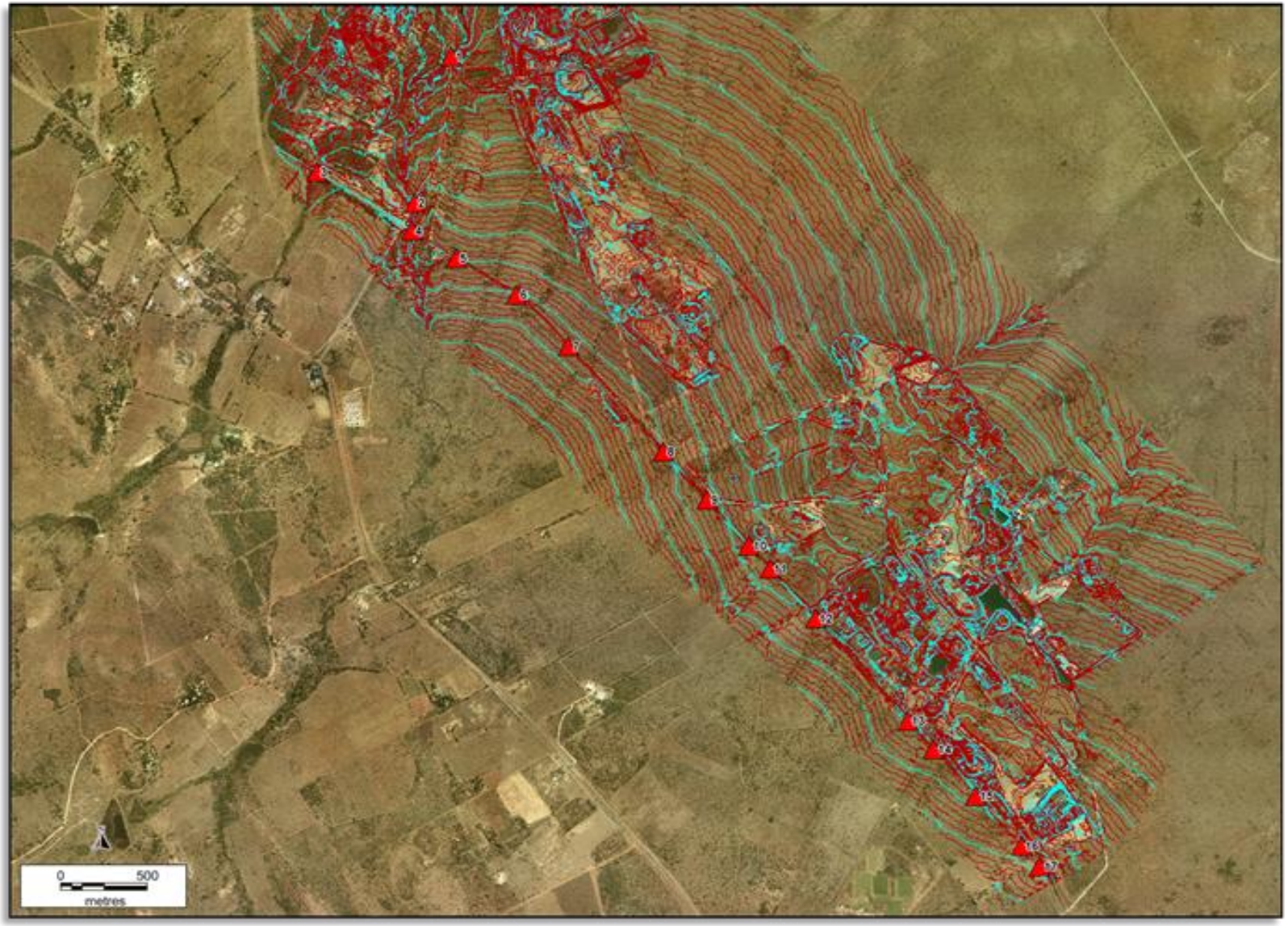


Figure 3.3.3.2(b): Proposed Conceptual Storm Water Management Measures for the two Open Cast Mining Areas

3.3.3.3 SWMP for the Northern Opencast Area (Includes Slurry Disposal Area)

The North Opencast is situated on Boschhoek 103 JQ Portion 66 and Portion 67. Mining cuts across a subtle slope (the extended outcrop of the ore reef as for the south pit) where the drainage of the upslope catchment appears as sheetflow. The rehabilitation of the north opencast must allow free draining conditions for the rehabilitated surfaces and the upslope areas as well.

It is foreseen that due to bulking that the final surface of the backfilled mine area will elevate above natural ground level. In order to provide free draining of the upslope catchment (1.2 km2) diversion drains (N1, N2 and N3) need to be provided.

Alternatively the backfilled mine area must have a number of storm water canals that allow upslope runoff to pass through the mine area. The initial option of providing cut-off surface drains like indicated in Figure 3.3.3.2(b) is easier to construct and no complicated layout of additional drains running through rehabilitated mine areas will be required. These drains will also be onto solid ground without the risk of surface subsidence to prevent free flow of water. The size of the trapezoidal drains will be approximately be 1m depth with 1.5m floor width and 1:1.5 wall slopes.

However the rehabilitated surface of the mine must be smooth and graded to allow draining as indicated with the blue arrows.

The rail line culverts are shown in red triangles in Figure 3.3.3.2(b) and are upslope of the mine area. Culverts no's 6, 7 and 8 project runoff towards the North Pit.

The pre-mining capability of the mine area is highly likely to be classified as grazing land. The profiling, shaping and placement of topsoil should support a grazing land form and land use. The target surface slopes should ensure a soil loss of less than 10t/ha.

3.3.3.4 Spiral (Concentrator) Plant Area

The location of the Spiral (Concentrator) Plant is shown in Figure 3.3.3.4(a).

The Spiral (Concentrator) Plant used to crush ROM from the open cast mining areas and was also used to separate lumpy waste from the ore. Mining has stopped and the crusher limb at the concentrator plant has been decommissioned. The spirals section is currently used by the Smelting Plant to concentrate ore imported from other mining activities. The site appears to be situated onto or next to disturbed mining areas with vastly uneven terrain covered with overburden and waste rock stockpiles. No surface runoff measures have been employed and the containment of all silts and sediments from spreading to the Matlapyane stream is the main risk to surface water quality.

The primary contaminants are silts and sediments and it is foreseen that silt barriers should be necessary to contain all fines and silts. Large vehicle traffic for the unloading of ore and loading of ore into the feeds of the spiral conveyor contributes to the sources of dust. The catchment area inside and draining towards the concentrator perimeter is approximately 2.4 ha. The complete disturbed area that includes the Phase 1 Jig and Spiral Tailings Disposal Quarry is 16.1 ha.

The site is close (<200m) from the Matlapyane Stream with the layout shown in Figure 3.3.3.4(b). The drainage in the form of surface flow/ sheet flow is indicated with red arrows.

Silt barriers will allow runoff to drain towards the natural stream but will contain sediments and silts emanating inside the terrain. Barriers 1.1 and 1.2 will serve to contain fine particles transported by surface runoff. The barriers could be bidum geofabric wrapped around rock filled gabions 1.2m high (1m width) or similar.

The runoff will flow through the barrier but the bidum will act as barrier to trap soil particles. Part of regular maintenance will be to remove particles next to the barrier and to be disposed of into the quarries.

Part of the operational maintenance will also be to remove excessive fines on accessible surfaces by grading with a grader. This is especially required before the start of the wet season. Dust suppression by spraying water by water truck should be a continuous activity.

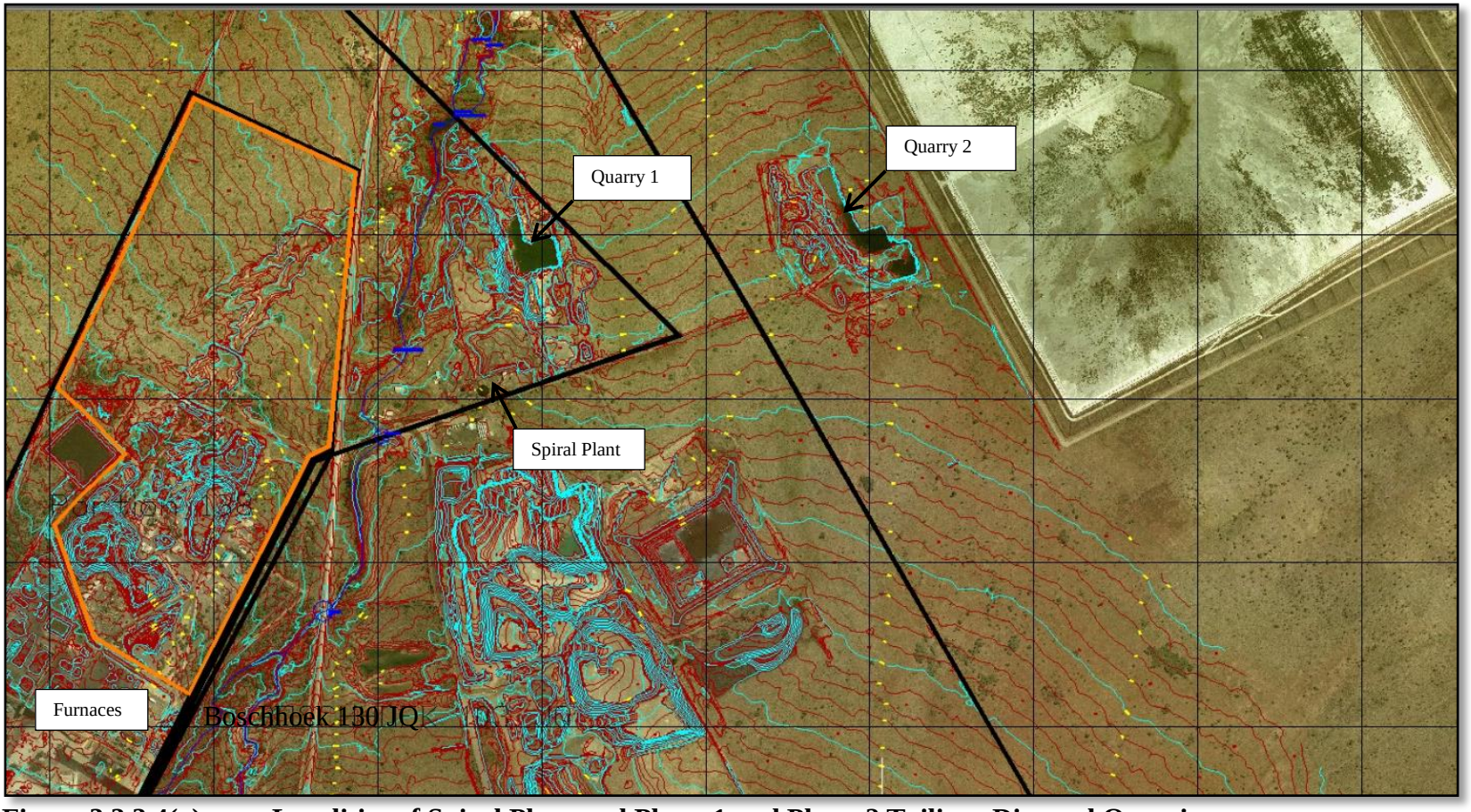


Figure 3.3.3.4(a): Localities of Spiral Plant and Phase 1 and Phase 2 Tailings Disposal Quarries

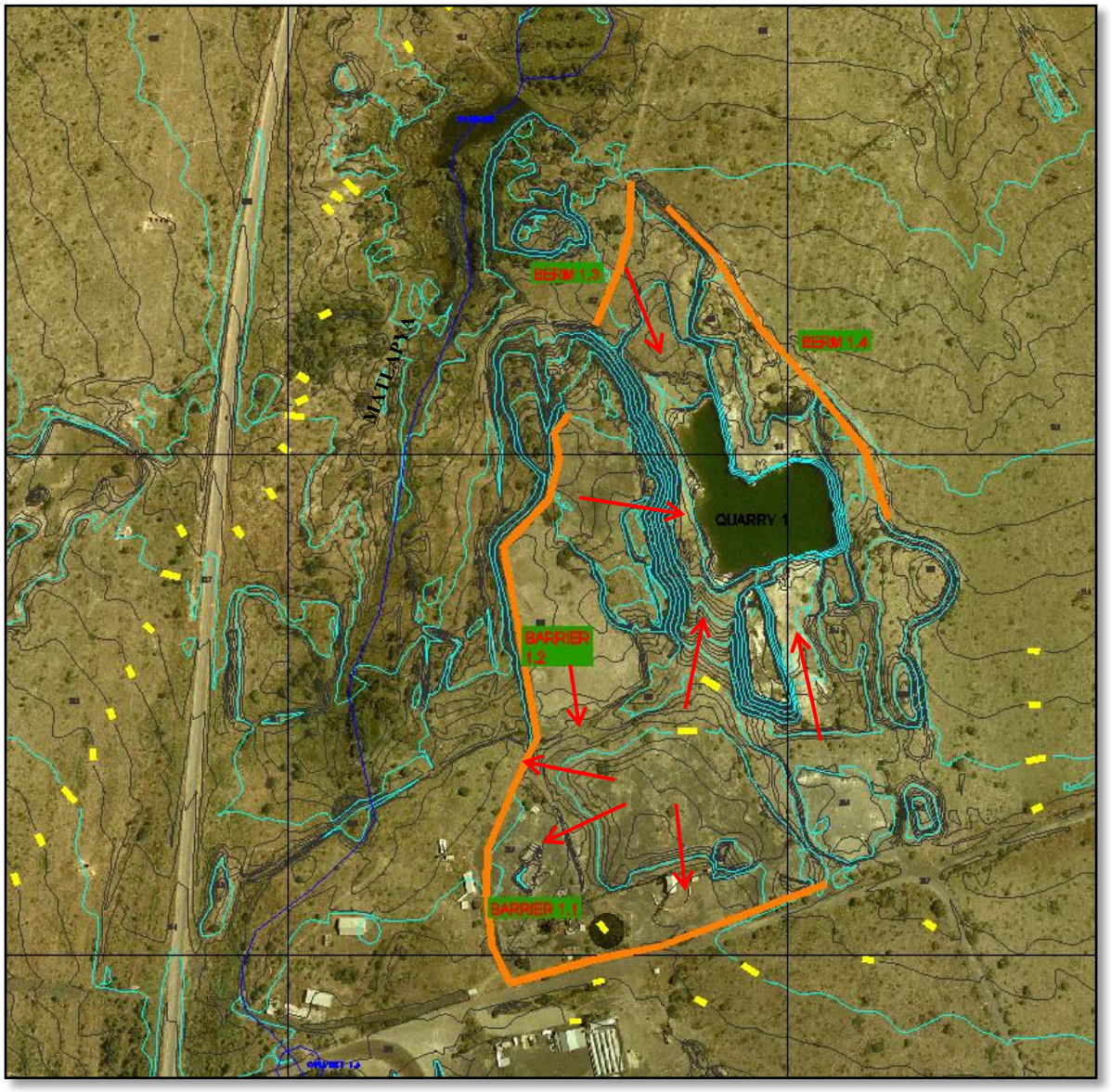


Figure 3.3.3.4(b): SWMP for Spiral Plant and Phase 1 Tailings Disposal Quarry Area

3.3.3.5 Phase I Spiral and Jig Tailings Disposal Quarry (old)

The location of the Phase 1 Jig and Spiral Tailings Disposal Quarry is included in 3.3.3.4(a)

The Phase 1 Jig & Spiral Tailings Disposal Quarry is an open void from previous mining operations at Boshoek. The void is situated next to and to the north of the Concentrator Plant. The void is surrounded with overburden waste stockpiles and the terrain in general is disturbed and rough.

The quarry is currently full of water. The water is extracted for use at to the GMBS Smelting Plant Till such time as the quarry is fully rehabilitated, temporary surface water management measures are required that will then eventually be superseded with final surface rehabilitation of the void.

As part of temporary measures Berm 1.3 and Berm 1.4 shown in 3.3.3.5(a) is required to prevent runoff from adjacent areas and the Matlapyane stream to discharge in to the quarry. This will be earth berms of 1.5m high with 1m crest widths. Most of the disturbed areas and stockpiles between the Concentrator Plant and the Quarry drain towards the Quarry.

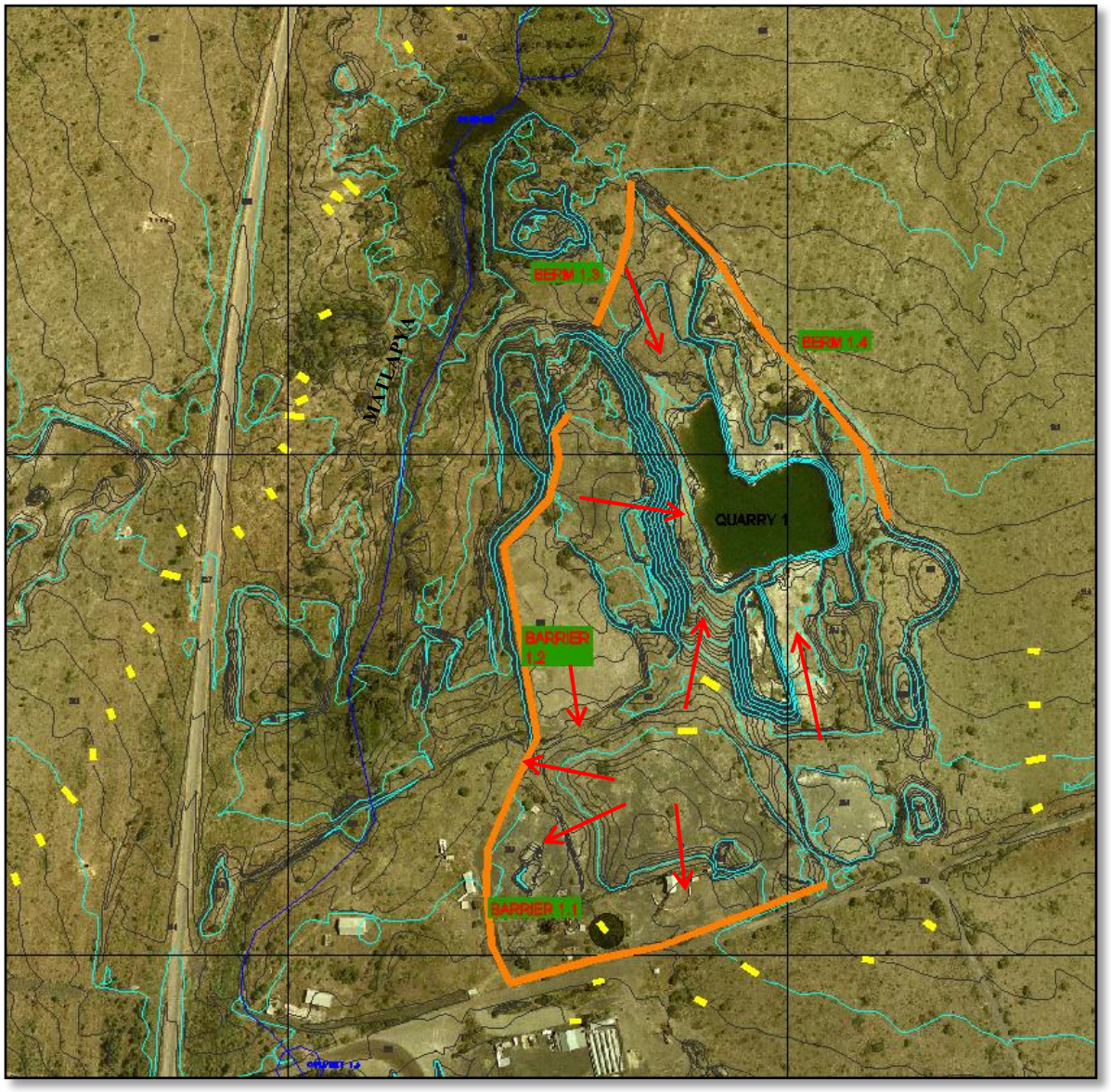


Figure 3.3.3.5(a): SWMP for Phase I Jig Plant and Spiral Plant Tailings Disposal Quarry Area

3.3.3.6 Phase II Spiral and Jig Tailings Disposal Quarry (current)

The Phase II Jig & Spiral Tailings Disposal Quarry is also an open void from previous mining operations at Boshoek. The disturbed footprint of this site is 9.9 ha. The void is situated 1 km east of the Spiral (Concentrator) Plant. The void is surrounded with overburden stockpiles at its west perimeter. Supernatant water is recycled to the Plants.

The void will eventually also be filled with tailings from the jig and spiral plant. This quarry is hence a temporary facility and have existing perimeter berms and diversion drains to isolate the site. Refer to Figure 3.3.3.6 (a) for proposed SW management measures for the site. The berms with side drains need to be upgraded by extending the berms to isolate the entire footprint and also to extend side drains and to clear drains from growth and obstructions.

Temporary surface water management measures need to be upgraded that will then eventually be superseded with final surface rehabilitation of the void site. It is expected that when the quarry is completely filled with tailings that the adjacent overburden stockpiles will be sufficient to cover the quarry surface and profiled with concave hump side slopes to create free surface drainage, preventing any ponding and to minimise side slope erosion.

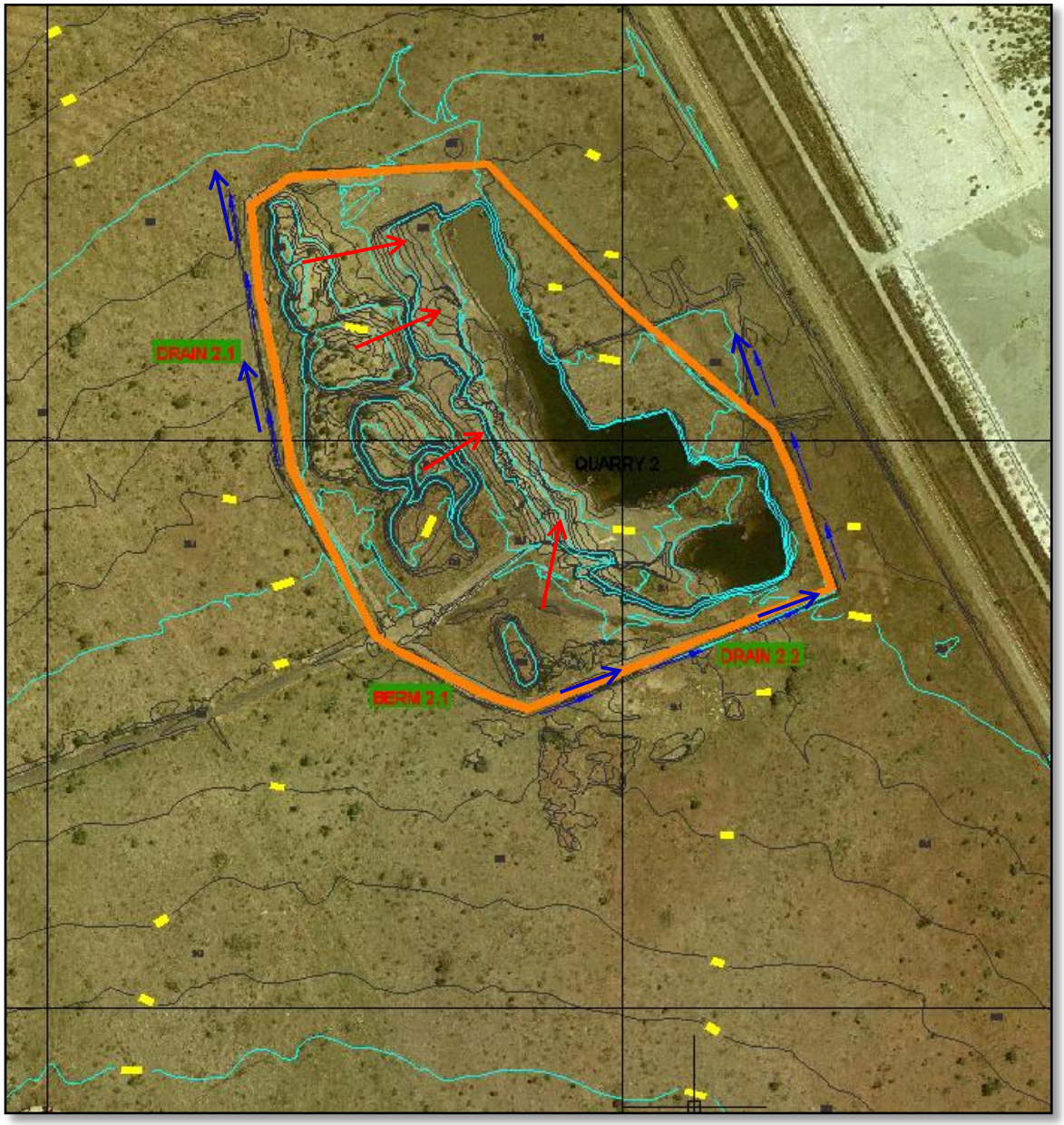


Figure 3.3.3.6(a): SWMP for Phase II Jig Plant and Spiral Plant Tailings Disposal Quarry Area

3.3.4 Extension of Temporary Waste Storage Facilities

In addition to the formal salvage yard at GMBS, temporary storage of waste occurs in waste bins located at strategic recycle points throughout the Smelting Management Area.

The intention of these temporary storage areas are to provide formal centralised areas where waste can either be deposited directly by the waste generator and/or where waste can be collected and sorted for final disposal, either to the salvage yard or removed directly by waste removal service providers, whichever the case may be.

The localities where these temporary storage facilities currently exist are indicated on Figure 3.3.4(a).

Table 3.3.4(a) contains a collage of photographs taken at some of these existing facilities at GMBS, clearly indicating the infrastructure and operational efficiency of these sites.

GMBS now wishes to add 6 waste skips at various localities within the Smelting Management Area. The proposed localities are shown on Figure 3.3.4(a) together with the existing localities.

The cumulative volume of all the temporary waste storage bins and skips will now exceed the legal threshold of 100 m^3 and therefore application will be made to license this activity separate from the Salvage Yard.

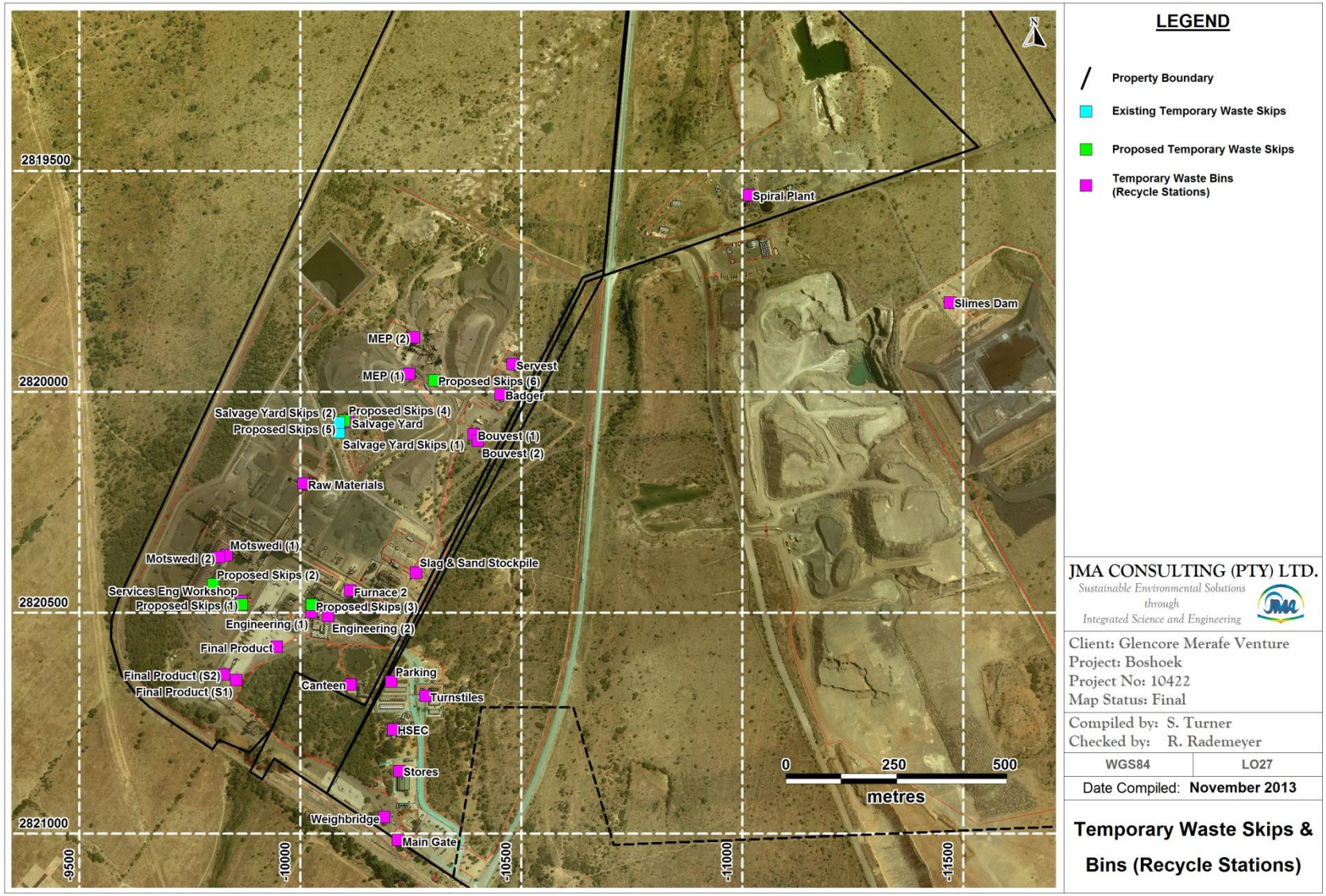
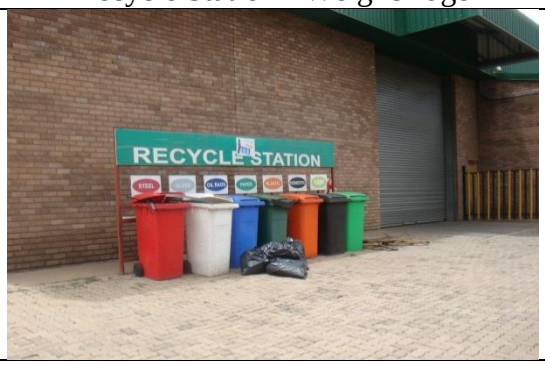


Figure 3.3.4(a): Location of Current Temporary Waste Storage Facilities at GMBS

Table 3.3.4(a): Photographs Showing the Nature and Operational Efficiency of Temporary Waste Storage in Waste Sips and Bins

	
Waste Skips – Salvage Yard (Domestic Waste)	Waste Skip – Salvage Yard (Domestic Waste)
	
Recycle Station - Weighbridge	Recycle Station – Main Gate
	
Recycle Station - Stores	Recycle Station – HSEC
	
Recycle Station – Final Product Southern Extent 1	Recycle Station – Final Product Southern Extent 1

	
Recycle Station – Services Engineering Workshop	Recycle Station – Raw Materials
	
Recycle Station – Bouvest yard no 1	Recycle Station – Bouvest yard no 2
	
Recycle Station – MEP 1	Recycle Station – MEP 2
	
Recycle Station – Badger Yard	Recycle Station – Servest Contractors Yard

	
Recycle Station – Slag and Stockpiles	Recycle Station – Engineering Furnaces 1
	
Recycle Station – Engineering Furnaces 2	Recycle Station – Furnaces
	
Recycle Station – Final Product	Recycle Station – Canteen
	
Recycle Station – Training Centre	Recycle Station – Parking

	
Recycle Station – Spiral Plant	Recycle Station – Slimes Dam
	
Recycle Station – Turnstiles	

3.3.5 Upgrade of Salvage Yard

The Glencore Merafe Venture Boshoek Smelter Salvage Yard forms the main facility for the storage and management of domestic and industrial waste generated at the site.

This Temporary Waste Storage Facility is operated under a Waste License (License Number 12/9/11/L239/7) in Terms of Section 20(b) of the National Environmental Management: Waste Act, 2008 (Act No.59 of 2008), issued to Merafe Ferrochrome and mining (Pty) Ltdon 23 March 2010.

The license authorizes the temporary storage of general and hazardous waste on portion 138 of the farm Boshoek 103 JQ.

The Salvage Yard is located to the south of slag disposal area and to the north of the eastern / central storm water canal and covers a surface area of 1.02 ha. The layout of the salvage yard is depicted on Figure 3.3.5(a).

The salvage yard serves as a temporary waste storage and management area, from which the waste that is generated at the plant can be temporarily stored, handled, sorted and loaded for removal from the site. The following activities take place within the salvage yard:

- Temporary storage and sorting of general/domestic waste;
- Temporary storage and sorting of hazardous waste;
- Temporary storage, sorting, grading, control and re-distribution of the salvageable re-usable scrap waste;
- Temporary storage, sorting, grading and control of the non-salvageable re-usable scrap waste.
- Temporary storage and removal of ferrous and non-ferrous scrap material.

The aforementioned services relate to all type of waste generated at the plant, which include:

- General waste;
- Hazardous waste excluding used laboratory chemicals;
- Reusable waste including ferrous and non-ferrous metal scrap;
- Shredding of confidential documents;
- Rubber waste;
- Recyclable waste and non-recyclable waste including:
    - Paper cardboard;
    - Machine wood;
    - Garden/green waste
    - Food waste;
    - Used/waste oil;
    - Concrete and glass; conveyor belt
    - Batteries
    - Pallets
    - Plastic; and
    - Sludges.

At present, several contractors purchase and collect some of the waste material from the site, including the salvage yard. Waste material is brought to the salvage from throughout the plants skips and bins via mobile machinery, where they are stockpiled in the relevant areas.

Contractors further remove the material from the Salvage Yard for re-working, recycling, selling or disposal. The expected average monthly waste materials, waste classification, final waste stream, incoming and outgoing waste volumes as obtained from the relevant sources on site, was provided by GMBS and is indicated in Table 3.3.5(a).

The information provided in Table 3.3.5(a) assumes that all the waste that is brought into the salvage yard is temporarily stored, reworked and removed from the salvage yard. No waste material is therefore expected to accumulate at the Salvage Yard over the long term or life of operations at GMBS.

Operations at the Salvage Yard are proposed to be upgraded to ensure and enable good housekeeping practices and to optimise re-use and re-cycling. The proposed Salvage Yard development phases are depicted in Figure 3.3.5(b) and are described below.

Phase 1: Place the whole area between the Hazardous Waste and the Oil Handling Facility under cement and seal all bund walls and cement pads with the accredited Stonecor product. (Completed)

Phase 2: Place the Domestic Waste Sorting Area under a roof suitable for skip replacement and the prevention of rain into domestic waste. (Completed)

Phase 3: Cement pad the Domestic Waste Sorting Area and build a safe waste sorting wall to prevent skip replacement – employee interaction. (Completed)

Phase 4: Build sorting bunkers for waste other than Domestic, Hazardous and Ferrous Waste, i.e. Wood, Rubber, Plastic, Non-Ferrous, etc. for easy sorting and good housekeeping practises. (Completed)

Phase 5: Build large cement bunkers for reusable Ferrous Scrap for efficient scrap sorting and removal. Also include a large bunker for re-usable/ saleable conveyor belt. (Proposed)

Phase 6: Build a storm water drainage cement trench from the gate (highest place – south) to the lowest point (north) in the waste section of the Salvage Yard. The trench will flow in a constructed cement sump with a submersible pump that will pump excess storm water out of the Salvage Yard to the Storm Water Canal. This project will also include covering the northern corner of the Salvage Yard with cement. (Proposed)

Phase 7: Includes the building of an access control room, a cement pad around it and around the sorting bunkers as well as a gate close to the control room. (Proposed)

Phase 8: Includes a cement dumping pad for easy dumping of old conveyors and ferrous. (Proposed)

Phase 9: Includes a cement dumping pad for easy dumping and offloading of Domestic Waste Skips and old Hydrocarbons as well as Hazardous Waste Skips. (Proposed)

Phase 10: (not included in drawing): Will include covering the remaining area of the Salvage Yard under cement.

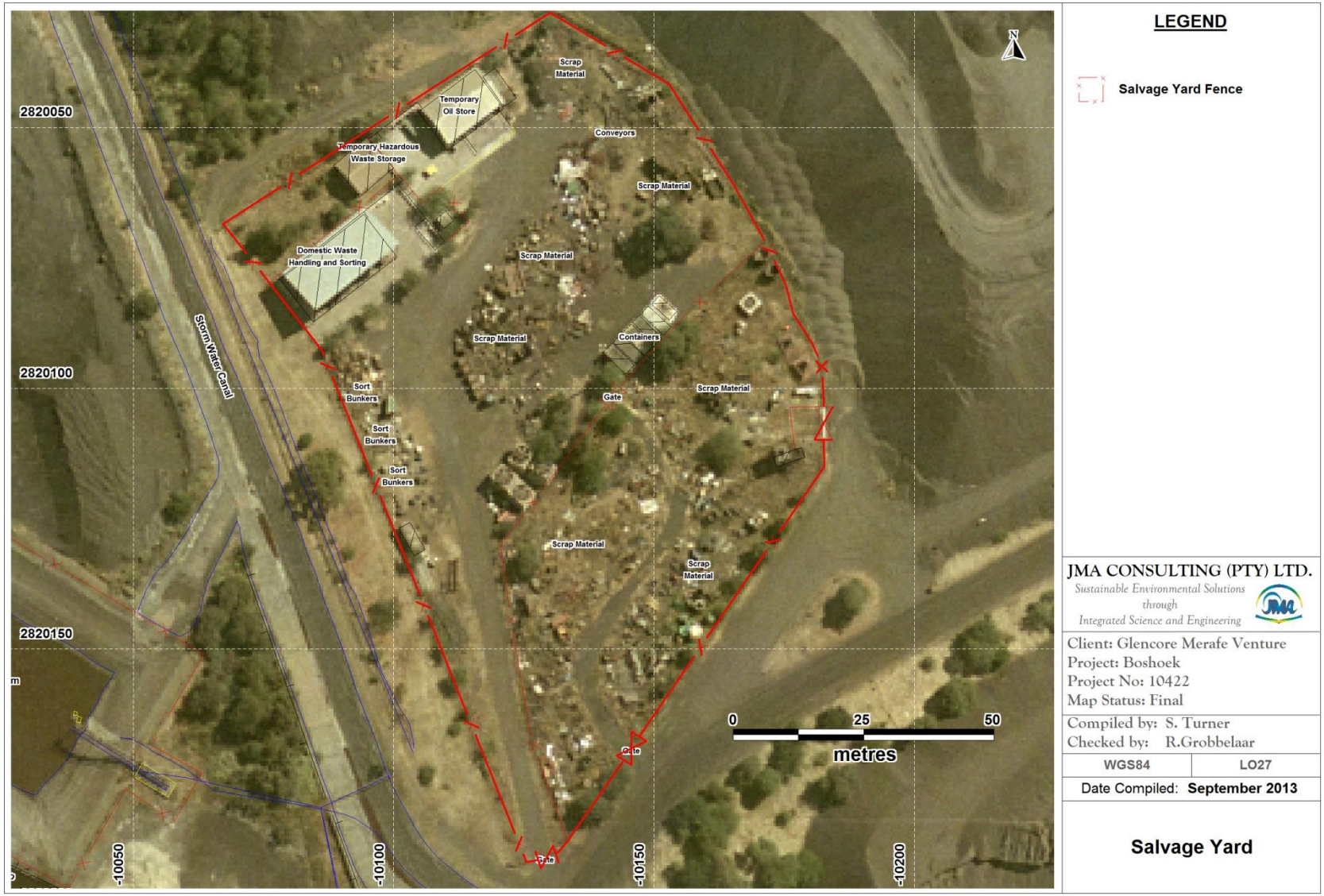


Figure 3.3.5(a): Current Salvage Yard Operations located in the Smelting Management Area

Figure 3.3.5(b): Proposed Phased Upgrade of the Salvage Yard

Table 3.3.5(a): Expected Maximum Monthly Volumes of Waste Reworked at and Removed from the GMBS Salvage Yard

NATURE OF WASTE	WASTE CLASSIFICATION	FINAL WASTE STREAM	XSTRATA	BADGERS	BOUVEST	CANTEEN	INCOMING VOLUME	RE-WORKED VOLUME	OUTGOING VOLUME
RECYCLABLE / RE-USEABLE			**kg/month**	**kg/month**	**kg/month**	**kg/month**	**kg/month**	**kg/month**	**kg/month**
Rubber lined Steel	**General (Non-Hazardous) Waste – Recycled / Re-used**	Sell to North West Recycling	2	0	0	0	**2**	**2**	**2**
Unclean Metal		Sell to North West Recycling	117	0	0	0	**117**	**117**	**117**
Unprocessed Scrap Metal		Sell to North West Recycling	1460	12	14	0	**1486**	**1486**	**1486**
Scrap Steel Auction		Auction	0	0	0	0	**0**	**0**	**0**
Subgrade Steel		Sell to North West Recycling	177	0	0	0	**177**	**177**	**177**
Rubber / Conveyor		North West Recycling	272	0	0	0	**272**	**272**	**272**
HDPE Pipes		Sell to North West Recycling	50	0	0	0	**50**	**50**	**50**
Cans		North West Recycling	3	0	0	0	**3**	**3**	**3**
Plastic		North West Recycling	4	0	0	0	**4**	**4**	**4**
Paper		North West Recycling	5	0	0	0	**5**	**5**	**5**
Electric Motors		Sell to North West Recycling	5	0	0	0	**5**	**5**	**5**
Domestic (Wet)		Farming	3	0	0	12	**15**	**15**	**15**
Wood (Mixed)	**Other (Non-Hazardous) Recycled / Re-used**	Community	173	12	0	0	**185**	**185**	**185**
Oil (kl)	**Waste Oil (Hazardous) Recycled / Re-used**	Oilkol	17	33	0	1	**51**	**51**	**51**
TOTAL			**2409**	**57**	**14**	**13**	**2493**	**2493**	**2493**
NON-RECYCLABLE				**kg**	**kg**	**kg**	**kg**	**kg**	**kg**
Garden Waste	**Other (Non-Hazardous) – Disposed Off-Site**	Off-Site Landfill	0	0	0	0	**0**	**0**	**0**
Hazardous Waste	**Hazardous Waste not reported elsewhere – Disposed Off-Site**	Enviro Serve	41	0	0	0	**41**	**41**	**41**
Domestic (Dry)	**General Waste – Disposal Off Site**	Off-Site Landfill	490	0	0	0	**490**	**490**	**490**
TOTAL			**531**	**0**	**0**	**0**	**531**	**531**	**531**
OTHER				**kg**	**kg**	**kg**	**kg**	**kg**	**kg**
Building Rubble	**General Waste**	On-Site Landfill							
TOTAL			**2940**	**57**	**14**	**13**	**3024**	**3024**	**3024**

3.3.6 New Slag Dump

The existing space for waste slag dumping is going to be exhausted soon and additional waste slag area will be required. The existing waste slag is dumped on virgin surface without any internal drainage or a formal liner. The new Slag dump must comply with requirements for landfill sites and as required by DWA.

3.3.6.1 Optimal Site Location

From a practical and operational perspective, the new Slag Dump is proposed to be located north of the existing Slag deposits on Portion 138 of the same property. The proposed Slag Dump locality is shown on Figure 3.3.6.1(a).

The terrain dips towards the north with a small drainage line running through the existing deposits area as well as through the proposed new footprint. The upstream section of the drainage line has been compromised by the GMBS Smelting Plant infrastructure as well as the Storm Water Management infrastructure.

High voltage power lines runs parallel with the east fence. A 20 m reserve or safe distance will be provided. Another 20 m strip will accommodate a service road and a new storm water drain.

The average haul distance to the existing waste slag deposits is 0.7 km and to the new Slag Dump it will be 1.3 km.

The runoff from the waste slag is regarded impacted and the new Slag Dump will accordingly be appropriately lined. In order to maximise the capacity of the footprint the safe height of the deposit and accessibility to the dump are the limiting factors.

A motivation for the above site is given in Chapter 4 of this report where site alternatives are considered and discussed.

3.3.6.2 Development and Sizing

The deposition of waste slag is currently done by dump trucks and a ramp of 1v:12h is currently used. Given the new site area, the longest length of ramp that can be provided for is 280 m. This will limit the operational height of the dump to 23 m. A 1:10 ramp could elevate the dump to 28 m. Should a conveyor system be installed the slag dump height will also be in the order of 28 m - 30 m.

The available area at the site is approximately 14 ha. The development can be phased as indicated on Figure 3.3.6.1(a). The presented concept assumes that the central area is the first phase. The first development phase also include that all earthworks necessary for the grading, levelling and smoothening of the entire footprint of the site be completed. This is necessary to ensure that from the onset, that by cut and fill, the footprint is shaped allowing for the drainage of all dump phases to interface with the new Slag Dump PCD. No material needs to be imported and material balancing must be achieved within the total footprint area.

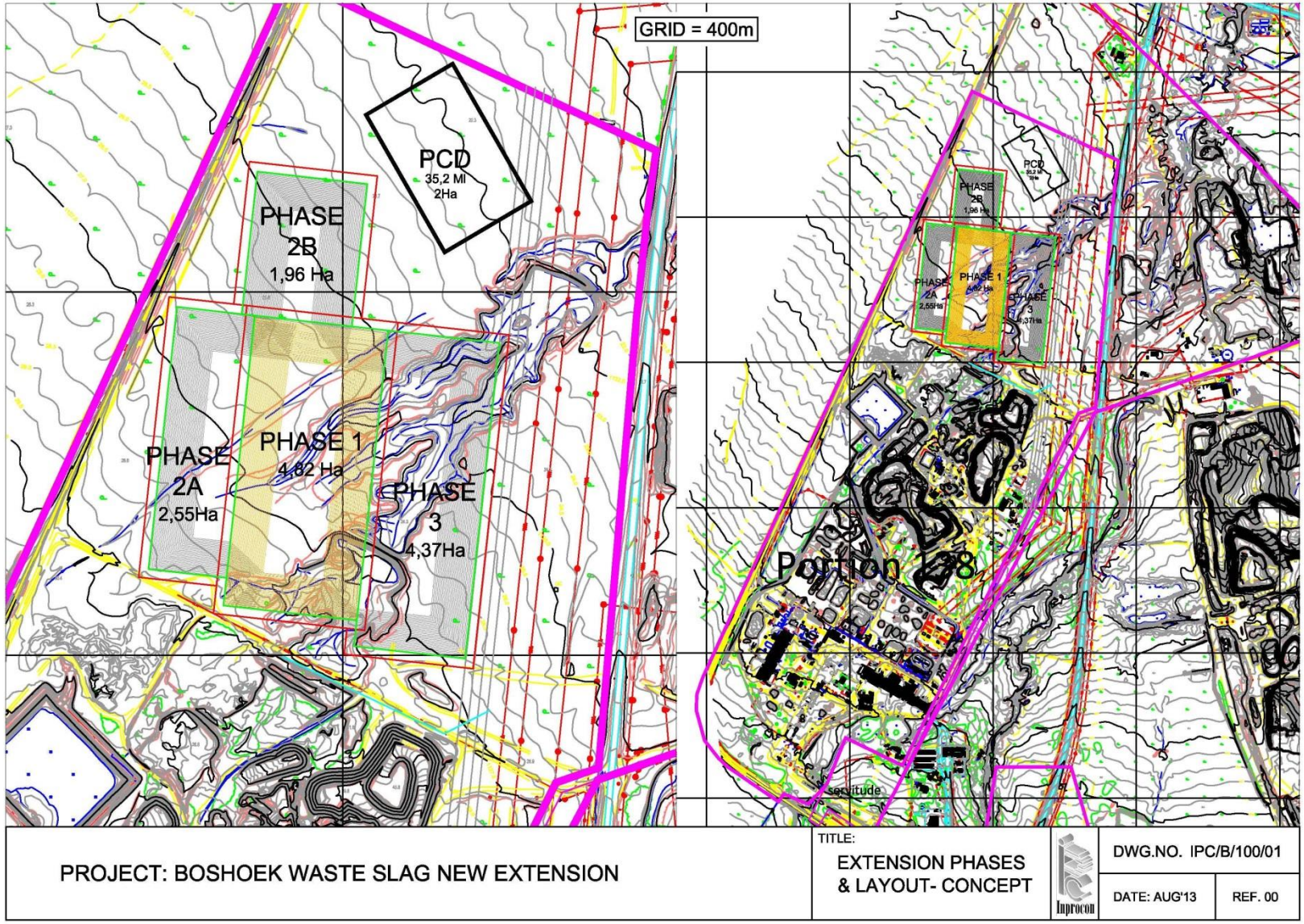


Figure 3.3.6.1(a): Locality and Proposed Phased Development of the New Slag Dump and PCD

Utilizing a dry stockpile density of 1,6 t/m^3 the stockpile capacity per phase is as shown below.

Table 3.3.6.2(a): Slag Dump Capacity at 1156 mamsl (28 m crest height)

Phase	Area (ha)	Height 1156 Volume m3	Height 1156 Volume t	Ave Rate 2003-2013 Time (yrs)	Upper limit Ave Rate 2003-2008 Time (yrs)
1	4.820	914984	1463975	7	6.3
2A	2.546	635022	1016035	5	4.4
2B	1.956	371620	594592	3	2.6
3	4.374	1163435	1861496	9	8.0
Total	**13.696**	**3085061**	**4936098**	**25**	**21.3**

Table 3.3.6.2(b): Slag Dump Capacity at 1151 mamsl (23 m crest height)

Phase	Area (ha)	Height 1151 Volume m3	Height 1151 Volume t	Ave Rate 2003-2013 Time (yrs)	Upper limit Ave Rate 2003-2008 Time (yrs)
1	4.820	795384	1272614	6	5.5
2A	2.546	552016	883225	5	3.8
2B	1.956	323044	516871	3	2.2
3	4.374	1011358	1618173	8	7.0
Total	**13.696**	**2681802**	**4290883**	**22**	**18.5**

The estimated life of the new footprint is between 18 years and 25 years depending on the production rates and the crest height. The local and international economic environment determines the demand and thus the waste slag rates. A high production road based on the average over the historical period 2003 to 2008 and the average for the 2003 to 2013 that includes an economic slump, were considered.

The depositing of waste slag by trucks or conveyor plays a part in the crest height.

Table 3.3.6.2(a) assumes that a conveyor system will be installed and a maximum crest height of 28 m will be achieved. Table 3.3.6.2(b) assumes a lower crest elevation allowing for a 1:12 ramp grade and maximum ramp length for trucks of 280 m. The total volume of the stockpile will be in the order of 4.3 million tons to 4.9 million tons depending on the deposition method adopted.

3.3.6.3 Liner

DWA has indicated that for the depositing of Ferrochrome Waste Slag, a Class C liner system is required. Regulation GNR 636 dated 23 August 2013, that resort under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008, stipulates the landfill classes and definition of each landfill class. Type 3 Waste must be disposed of at a Class C landfill or at a GLB+ landfill. Glencore has recently obtained approval at a similar facility for a modified Class C liner with the modification as defined below:

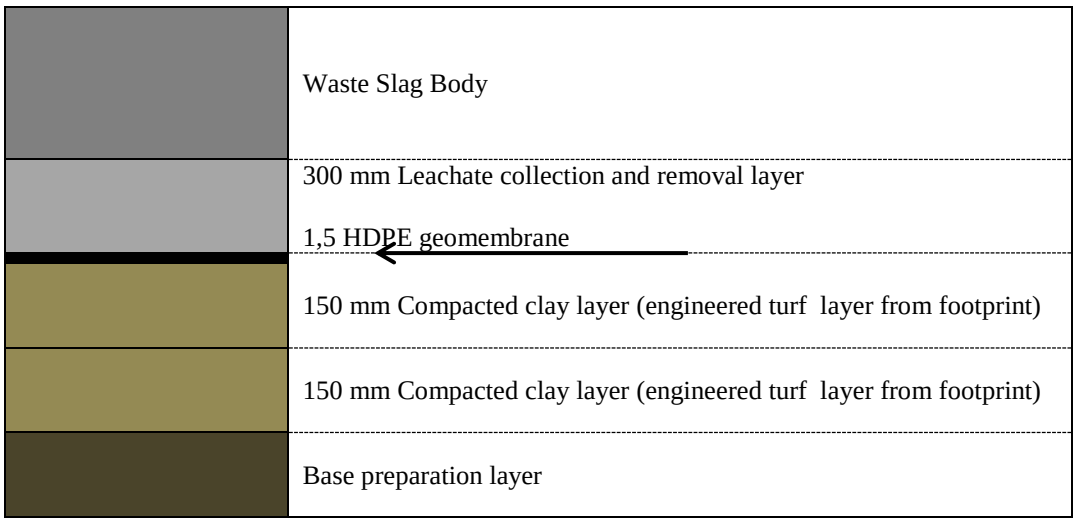


Figure 3.3.6.3(a): Proposed Liner for Slag Dump

The under drainage and monitoring system in the base preparation layer is omitted. The waste slag is highly permeable and the leachate collection layer required on top of the 1.5 mm flexible membrane (FM) consists virtually of the total slag waste body. Therefore by providing suitable base slopes an almost zero hydraulic gradient will reign thereby obtaining a very low hydraulic static pressure on top of the FM. Conceptual liner details are shown on Figure 3.3.6.3(a).

3.3.6.4 Under Drainage

The under drainage consists of a perimeter toe drain and internal interception drains constructed with washed waste slag (+6 mm) wrapped in A5 geo-fabric with perforated geo-pipe that discharge into a solution trench lined with 1.5 mm HDPE that feed to the new Slag Dump PCD. Partition berms on the base will partition runoff from the base and manage the damming during the initial stages of the dump. It will prevent runoff from the base to accumulate at low areas and overtopping of the starter walls.

3.3.6.5 Starter Walls and Paddocks

Perimeter starter earthwalls will secure the footprint and the HDPE geomembrane will anchor on the walls. The paddocks on the outside of the starter walls will intercept any runoff or spills from the waste slag side slopes.

3.3.6.6 Slag Dump Pollution Control Dam (PCD)

All leachate generated at the new Slag Dump as well as from the existing Slag Disposal Sites that drains towards the original drainage line, will be intercepted and directed to the new Slag Dump PCD. The PCD capacity must be 32 Ml to accommodate all affected runoff from both the existing as well as the new the Slag Deposits. A similar liner as for the new Slag Dump is required for the PCD. A silt trap at the inlet of the Slag Dump PCD is required to prevent silts and sediments to reduce the capacity of the Slag Dump PCD. Clean runoff at the west boundary of the site will be directed to discharge north of the Slag Dump PCD towards the Matlapyane stream.

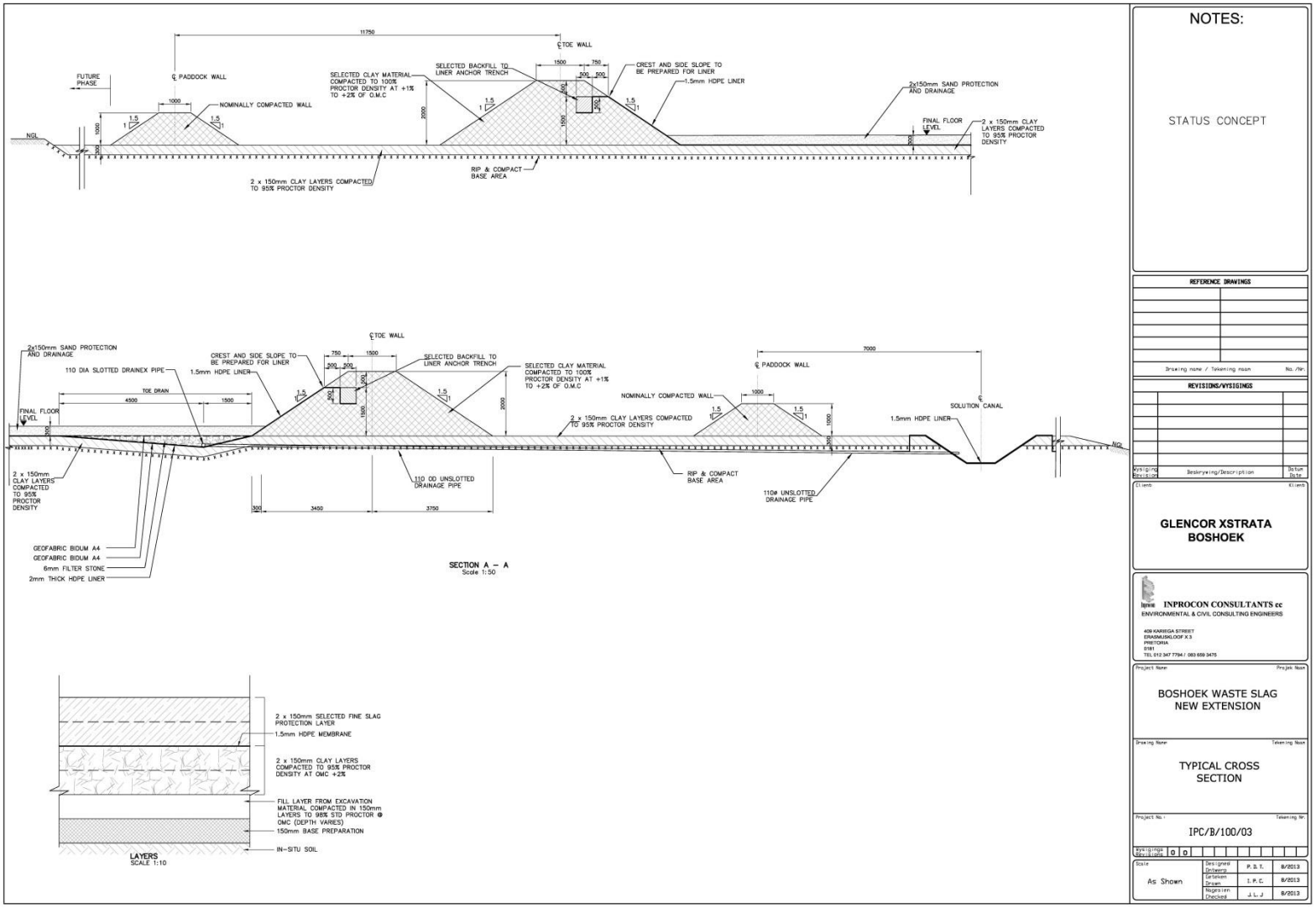


Figure 3.3.6.3(a): Details for New Slag Dump and Slag Dump PCD Liner

3.3.7 New Slag Dump Pollution Control Dam

It is quite obvious from the outcome of the Storm Water Management Assessment that the Smelting Management Area requires an additional Storm Water PCD in order to protect the lower reaches of the Matlapyane Spruit. The development of the site over the years, dictates the site where such a dam needs to be provided.

In order for the proposed Storm Water Canals SW4, SW5 and SW6 to be effective, the proposed new PCD will have to be located in the area to the north and abutting onto the existing Waste Slag Disposal Area.

The proposed locality for the new Slag Dump PCD is shown on Figure 3.3.6.1(a).

This area, although identified as a wetland area due to the presence of drainage tributaries of the Matlapyane Spruit, is currently severely impacted from both a surface water flow and surface water quality perspective. The upstream sections of these drainage lines have been destroyed by Smelting Plant infrastructure, whilst uncontrolled discharges of affected storm water currently contaminates the storm water run-off from these tributaries.

In view of the fact that the area therefore has to be used for storm water management purposes, it provided an opportunity for optimal environmental control if the new Slag Dump could also be located in this area. A detailed capacity assessment for the required Slag Dump, confirmed that both the proposed new Slag Dump and the new PCD could fit into the site.

The new PCD would then further fulfil three roles, namely an additional Storm Water PCD for the existing GMBS operations, a Leachate Collection facility for the new Slag Dump, as well as a Storm Water Management facility for the new Slag Dump.

The existing and new catchment footprints to be served by this dam are 25 ha and 17 ha respectively. The required capacity of the new Slag Dump PCD is 32 Ml.

The new Slag Dump PCD will require a similar liner system to that proposed for the new Slag Dump. The PCD will also be provided with a silt trap to prevent siltation of the dam. Liner details for the Slag Dump PCD are given in Figure 3.3.6.3(a).

A wetland off-set area has been identified for this site within the Smelting Management Area at the proposed new Lapa Dam.

3.3.8 New Slurry/Slimes Dam

The fines captured in the Air Quality Control equipment (scrubbers) at the GMBS furnaces is directed in a slurry to a clarifier located near the furnaces and the under flow of the clarifier is pumped and deposited at the Slurry Dam. The Slurry Dam also acts as a clarifier dam in that it is a flexible membrane lined facility and supernatant water at the surface is decanted by penstocks to a sump where clear water is returned via pressure line to the process water storages.

A capacity assessment of the existing facility has indicated that some 5 years of disposal remains available at the current facility. This has prompted GMBS to initiate the planning, design and authorization of a new/extended slurry disposal facility.

3.3.8.1 Slurry Waste Stream Rate

The slurry pumping rates for 2012 has been provided by GMBS. Based on the waste slag rates over the previous 10 years (2013 excluded) 2012 was close to an average year in terms of production rates with waste streams close to average. Given this background the slurry deposit rate for 2012 is adopted for planning and conceptualization as the representative rate. An allowance factor of less than 5% is added for planning purposes. The slurry metered monthly for 2012, with the measured slurry densities, are indicated below. The densities were measured and recorded on a daily basis and the average daily slurry density for each month is shown in the Table 3.3.8.1(a) below.

Table 3.3.8.1(a): Slurry Volumes and Densities

2012 Month	Tot Slurry m3		Month	SG	
Jan	21971		Jan	1	0.1395
Feb	12465		Feb	1	0.0792
Mar	12509		Mar	1.05	0.0834
April	15094		Apr	1.05	0.1007
May	19269		May	1	0.1224
June	11702		June	1.07	0.0795
July	9052		July	1	0.0575
Aug	0		August	1	0.0000
Sep	7904		Sep	1.07	0.0537
Oct	15011		Oct	1.09	0.1039
Nov	16327		Nov	1.07	0.1110
Dec	16139		Dec	1.04	0.1066
Tot 2012	**157443**		**Average**		**1.037423**

Assuming the SG of the solid grains as 2,85 t/m^3 the computed solid fraction is approximately 57,6 kg/m^3. See Table 3.3.8.1(b) below. The total solids deposited in 2012 was then close to 9069 t. With the facility close to 11 years old the estimated total slimes deposited is 99756 t.

Table 3.3.8.1(b): Calculation of Solids and Water Fraction in Slurry

Slurry Dens	solids concentration %	solids SG	Calc Slurry Dens	Delta=0	Solids kg	Water kg	Slurry
1037.42	5.56	2850	1037.42	0.00	57.6	979.8	1037.42

3.3.8.2 Capacity Requirement

GMBS has conducted cone settling tests on the slurry and the dry density was average 432 kg/m^3 in a loose state, and 574 kg/m^3 if vibrated. For the conceptualisation stage a dry density of 600 kg/m^3 is adopted. The solid fraction of the slurry in the slurry dam remains submerged as no drainage exist to drain the interstitial water from the solids. Pore pressures will remain and consolidation of the solids will displace water, which will tend to surface. However the inside dam pore pressures and the absence of a means to remove interstitial water will prolong the consolidation process. It is therefore assumed that an average dry density will, for the operational stage, be close to the adopted density.

The total storage capacity requirements over a time span of 20 years after commissioning is tabled in Table 3.3.8.2(c) below. It implies that at current rates, a 20 years capacity for solids alone, will be between 300 000 m^3 and 320 000 m^3.

Table 3.3.8.2(c): Clarifier Slurry Planning Volumes

	Historic Ave		Planning	
Slimes solids rate	756	t/month	794	5%
In-situ dry density	0.6	t/m3	0.6	t/m3
Planning Horizon (years)	Tot tons	Total Vol m3	Tot tons	Total Vol m3
5	45360	75600		
10	90720	151200		
15	136080	226800	142920	238200
20	181440	302400	190560	317600

As control an aerial survey of the Slurry Dam, with crest elevation at 1134.6 mamsl, and allowing for a 0.8 m freeboard, the remaining capacity at the Slurry Dam calculates to 99 500 m^3. The water depth at the time of the aerial survey is unknown. It should, however, be noted that the required capacity of the dam must also include the supernatant water volume for the dam to remain functional till its final stage. Hence not only the required solids storage volume should be considered.

If a water depth of 0.5 m is assumed to be required for clear water to surface to the top and slurry solids to settle out, the remainder life of the current Slurry Disposal facility is approximately 5.2 years.

3.3.8.3 The Existing Slurry Dam

The existing Slurry Dam operates as a large clarifier dam. It was developed in three stages that started off with two small separated, adjacent ponds, as Phase 1.

Phase 2 merged the two ponds with an abutting wall and also enlarged the footprint with a perimeter wall of 3.2 m in height.

Phase 3 entailed the elevation of the total perimeter walls with another 3 m, including the extension of the inside liner system.

The dam is lined comprising a 1.5 mm thick HDPE membrane underlain by a leakage detection layer and secondary geo-synthetic clay liner (GCL).

It was envisaged by GMBS that Phase 4 of the Slurry Dam will enlarge the dam capacity by widening and rising of the embankment to an additional 3 m height and also extending the liner and leakage detection system.

However, the current liner specifications do not comply with waste lagoon requirements. The former requirements as defined in the Minimum Requirements for Waste Disposal by Landfill (2nd Ed., Department of Water Affairs and Forestry, 1998) stipulates that a double liner system is required as well as a seepage detection and collection system for waste lagoons.

The most recent regulations, GNR 636 of 23 August 2013, and which resort under the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), defines four classes for landfill sites. The landfill liner for Class A has been upgraded from the previous specification to now have a double HDPE geomembrane system. A waste lagoon, such as the Slurry Dam is not specifically addressed in the recent regulations for landfill sites, but it is certain that the Slurry Dam must have a double liner system similar to the old Minimum Requirements and Class A Landfill Requirements.

3.3.8.4 Capacity Extension of the Slurry Dam

In view of the existence of the current infrastructure for slurry mixing, pumping, and return water reticulation, it is proposed that the current Slurry Clarifier Dam method of depositing and return water handling be continued, especially for the following reasons.

- GMBS is familiar to operate and manage the Slurry Dam. All Manuals and Procedures are already in place.
- No Return Water Dam (RWD) is required as the Slurry Dam functions as its own RWD – all slurry water and direct rain water is contained in the dam and clear water is decanted by penstocks in a controlled fashion.
- The outside embankment could also be regarded as part of the rehabilitation process that is completed during the operational stage. The slurry solids are contained and covered and not exposed on the side slopes and the risk of surface water contamination is virtually non-existent.

However, the following aspects must be considered in construction of a new Slurry Disposal facility:

- The outside walls should be constructed with clean soils. Construction of the walls with waste slag requires special approval from DWA as waste slag is regarded a waste that must be stockpiled on a liner system.
- The lined Slurry Dam has no under drainage system and the slimes will not be able to dry out thereby allowing maximum consolidation and utilization of available space for stockpiling solids. It is estimated that some 40% of volumetric space is lost.

- Due to the high hydraulic head inside the dam (the height measured from water surface down to the floor level is the head on top of the liner system) provision for seepage detection and recovery is mandatory.
- The hazard risk and hence the registration of the dam with a safety classification with the DSO, could become a requirement should the effective water depth increase beyond 5 m.

3.3.8.5 Options for Slurry Disposal Capacity Extension

The two options for enlarging the capacity of the Slurry Dam complex at GMBS, are simply to construct another Slurry Dam similar to the existing Phase 3 Slurry Dam, or to enlarge the existing Slurry Dam by elevating the perimeter embankment walls.

The enlargement of the existing dam is feasible if the following can be confirmed:

- The dam is currently licenced as a Water Use;
- The foundation (& strata) at the basin and at the embankment walls are sound for raising the embankment and dam capacity;
- The existing liner system is approved and complies with DWA requirements; and
- The use of waste slag for enlarging the perimeter containment embankment is approved.

The second option is to construct a new Slurry Dam next to, or away, from the existing dam. A siting fatal flaw assessment was conducted (see Geology Specialist Report) which confirmed that a new facility can be built alongside the existing one.

However, its development will require geotechnical investigation to the site and additional measures (to be approved by DWA) for utilizing waste slag for the dam embankments. The new Slurry Dam will be provided with a new requirement liner system and will be authorized through a Waste License in terms of the NEMWA.

The proposed locality for, embankment details of, as well as liner specifications for a new Slurry Dam next to the existing one, are shown in Figure 3.3.8.5(a).

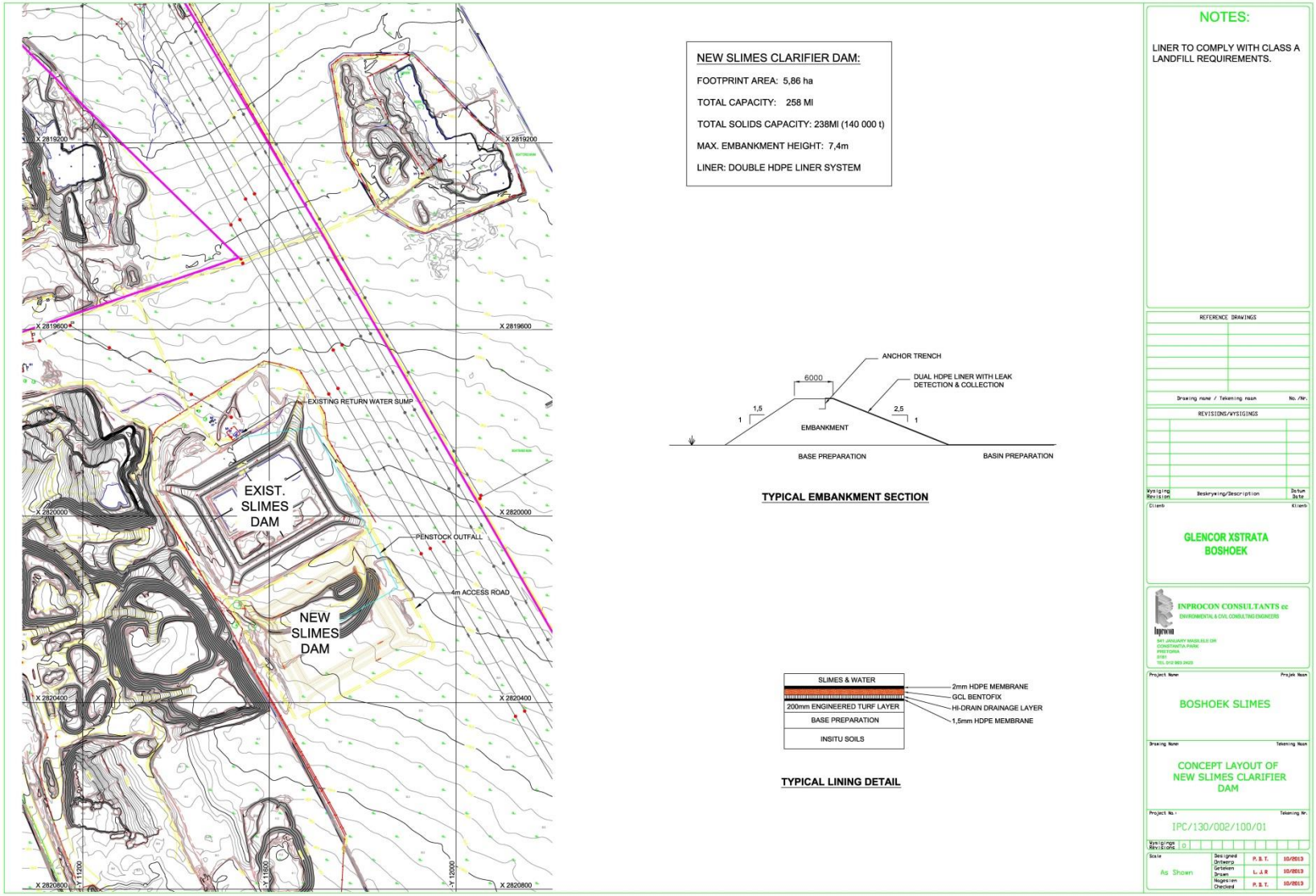


Figure 3.3.8.5(a): Proposed New Slurry Dam (Locality, Embankment and Liner Details)

3.3.9 Upgrade of Dust Control at Raw Materials Proportioning Plant

GMBS operates two closed furnaces and a pelletizing and sinter plant. Furnace feed material is prepared in a proportioning plant situated in what is known as the days bins building. The amount of dust in this building is of concern and an effective dust control system is required to contain and capture the dust to bring the amount of ambient dust down to acceptable levels.

GMBS commissioned a conceptual feasibility study from specialists, Resonant Environmental Technologies to generate proposals, including options and alternatives, for the construction and commissioning of Air Quality Control measures at the GMBS Proportioning Plant. A copy of the initial feasibility report compiled by RESONANT, is attached as **APPENDIX 3.3(A)** to this report.

In summary this report details the conceptual design of a dust control solution for the proportioning plant. Dust extraction options are given to allow for GMBS to make an informed decision as to which option they would like to proceed with.

The Air Quality Act (2010) required that for new ferro-alloy and sinter plant installations, the allowable stack emission limit is 50 mg/Nm^3. The NIOSH REL (National Institute for Occupational Safety and Health Recommended Exposure Limit) TWA (time weighted average) requirement for nuisance dust is 15 mg/Nm^3 for total dust and 5 mg/Nm^3 for respirable dust. This limit is for the allowable concentration of dust in the air inside the building above ambient conditions outside. Considering that the regulations are going to become more stringent with time, it is recommended that a dust control system be designed and implemented that results in a dust level of 30 mg/Nm^3 (above the current ambient conditions) at the stack and a dust level of 5 mg/Nm^3 within the building itself (above the current ambient conditions).

Silica is processed in this building, and can result in the release of respirable crystalline silica dust. This dust can cause silicosis, a respiratory disease. It is therefore important that all of the transfer points in the building have effective extraction. The NIOSH REL TWA requirement for crystalline silica dust is 0.05 mg/Nm^3 for respirable dust.

The dust control proposal consists of the following 3 options:

Option 1 – Optimal: Selection dampers on carefully chosen extraction points to reduce the overall extraction volume, leading to the requirement of three identical filters, with a filter velocity of 1.6 m/min.

Option 2 – Excessive: No selection dampers in the system, leading to the requirement of three differently sized filters, each with a filter velocity of 1.6 m/min.

Option 3 – Conservative: Selection dampers on carefully chosen extraction points to reduce the overall extraction volume, leading to the requirement of three identical filters with a filter velocity of 1.2 m/min.

The following main conclusions are drawn from the report:

- A dust control solution is required for the proportioning plant. Commissioning of this system will improve the current occupational health benefits, compliance with legislative requirements, as well as environmental and visual benefits.
- All enclosures must be easily accessible / removable for maintenance and operational purposes.
- Dust disposal from the bag house filter will be by means of a slurry system, directing the slurry back to the pelletizing plant thickener system (existing).
- A bag house is recommended to filter the extracted air to within legislative limits.

The following recommendations are made:

- A dust control solution must be implemented for the proportioning buildings.
- "Dust control solution Option 1 – Optimal" is an optimal solution and is recommended by Resonant Environmental Technologies.
    - This option allows for 3 new filters, identical.
    - The ducting system will be replaced, save for the existing ducting at the furnace 3 day bins, and will be designed such that the filters can be implemented in phases.
    - The system will be fitted with enclosures and extraction hoods.
- The dust disposal system recommended is as per client request and will utilize the existing sump for slurry-making purposes. The slurry will be pumped to the exiting thickener system and from there to the existing slurry dam.
- It is recommended that both orifice plates and balancing dampers be utilized to balance the system. This will ensure a lasting solution and will help to reduce duct and damper abrasion.
- It is recommended that selection dampers be used in certain areas of the plant to reduce the total extraction volume. The opening / closing of these dampers should be integrated with the process equipment.

More detailed technical and operational design information is currently being compiled and will be available during the EIA Phase of the project in order to support the detailed impact assessments, as well as the conceptual design of additional environmental management measures if any are in fact indicated.

3.3.10 Upgrade of Dust/Fume Control at Furnaces (tap hole fume extraction)

GMBS operates two closed furnaces and a pelletizing and sinter plant. The current capacity of the Furnace Tap Hole Fume Extraction System is 12 000 Nm^3/hr, which based on assessments conducted, needs to be upgraded to 24 000 Nm^3/hr.

GMBS considered different technologies and vendors for the supply and installation of the required Air Quality Control Equipment at Furnace 2 and 3, and have selected specialist vendors Tenova Pyromet to prepare a Budget Offer for the supply, installation and commissioning of the Furnace Taphole Fume Extraction System at Boshoek. The proposed system, arrived at after careful consideration of all available alternatives, comprises a Bag House Plant together with all its ancillary infrastructure and equipment.

The components of the proposed system are as follows:

3.3.10.1 Bag Filter

The bag filter offered includes for a reverse air pulse jet bag filter. The main advantages for the filter design are:

- High efficiency
- Lower investment costs
- Easy maintenance
- Lower overall dimensions

The bag filter consists of four compartments (two rows of two compartments), each comprising:

- A pyramidal dust hopper designed for suction pressure of 8 kPa.
- Dirty air plenum designed for a suction pressure of 8 kPa.
- Top entry clear air plenum with access hatches (covers) on top design for a suction pressure of 8 kPa.
- 5 mm thick mild steel cell plate, suitably stiffened with laser cut holes for filter bags.
- 4 x 300 NB compressed air manifolds, each complete with 23x 2” pulse valves.
- 1472 filter bags (3660 x 152 mm).
- Mild steel split cages (3640 x 145 mm) c/w venturi (100 mm throat) – 4 mm rings & 3 mm wires.
- 4 x single manual multi blade louver type hopper inlet dampers.
- 4 poppet type pneumatic operated clean air plenum outlet isolating dampers.

3.3.10.2 Filter Bags and Filtration

The bag filter consists of four compartments which can be individually isolated through poppet dampers on the outlet of each compartment, as well as manual louver dampers on the inlet to the dust hopper of each compartment. Each compartment comprises of a dust hopper, dirty air plenum, clean air plenum, cell plate, 23 full immersion type pulse valve / manifold combinations, blow pipes, rotary valve, knife gate and three hundred and sixty eight (368) filters bags.

The fume enters each compartment through the dust hopper. The fumes enter the dirty air plenum and then pass through the filter bags into the clean air plenum. Cell plates are attached on top of the dirty air plenum and are sealed to the steelwork to prevent air or dust leakage into the clean air plenum. The one thousand four hundred and seventy two (1472) filter bags and cages are fitted through the cell plate and snap onto the cell plates through a snap band inserted in the top of each filter bag.

The filter bags are of the polyester needle felt type with anti-static benox fibres. The filter bag cages are of a wire frame construction, split in half and are fitted with a venturi for better bag cleaning by the pulse jet system. The maximum dry operating temperature of the bags is 200 Deg C. The total filtration area of the bags is 2521 m^2 with an air to cloth ratio of 1.256 m/min.

The bags are cleaned by using a pulse action. Two rows of 16 bags each are cleaned at a time by activating the pulse valve on that specific row. Low-pressure high volume compressed air is injected in to the blowpipe running across the row of bags. This air leaves the blowpipe through 15 mm holes above the filter bags. The dust on the outside of the filter bags is then dislodged from the filter bag and drops into the hopper. 336 m^3/hr of air is supplied from the compressors and passed through a desiccant dryer to ensure that the air is dry before it is used inside the bag filter plant.

The four compartments are grouped into two rows, having two compartments on each row. Each row is fitted with a screw conveyor, which removes the dust dumped from the dust hoppers. Each screw conveyor conveys the dust to the outlet where it is passed through a rotary valve. A transfer chute is connected to the outlet of the rotary valve, which will transfer the dust into the sump to form slurry.

A sump is located between the two screw conveyors and is used to collect the dust. The dust is mixed with an agitator before being pumped to the thickener plant.

Clean air leaves the filter bags into the clean air plenums. Each plenum is connected to the inlet of the ID fan. The outlet of the ID fan releases the clean air into the atmosphere.

3.3.10.3 Isolating Compartment for Maintenance

A compartment can be taken off-line if maintenance is required on any equipment associated with the compartment, for example, rotary valve, filter bags, etc. The poppet type dampers and manual isolating damper are closed to isolate the compartment and the compartment is excluded from the cleaning cycle. The remaining quantity of filter bags is sufficient to ensure that excluding one compartment indefinitely will not affect the quality of the clean gas existing to atmosphere.

3.3.10.4 Bag Filter Compressed Air

Compressed air required for bag cleaning and auxiliaries on the bag filter is supplied by others at the bag filter. The supplied compressed air is dried through a desiccant type air drier unit. The compressed air pipe network is fitted with suitable instrumentation for plant interlocking and isolating valves for maintenance. Compressed air to each manifold is supplied at a pressure of 450 kPa (g) minimum with an approximate final manifold pressure of 300 kPa after each pulse.

3.3.10.5 Main ID Fan and Clean Gas Stack

One Main ID fan located on the clean gas side of the bag filter provides the suction required and discharges the cleaned air through a clean gas stack.

The fan's single inlet is suitably designed for this type of application with a backward curved impeller for maximum efficiency. The fan is coupled to the motor through a flexible coupling. The fan capacity is controlled by an outlet box damper operated with a motorized actuator and positioner.

Each fan is externally fitted with acoustic insulation to reduce the fan noise level to 85 dBA at 1 m.

Inlet and outlet compensators are fitted to the fan to isolate the fans from the rigid ductwork, with manual louver dampers fitted to the inlets and outlets, for maintenance isolation.

3.3.10.6 Dust Handling and Disposal System

The dust dislodged from the filter bags is collected in the bag filter hoppers and is continuously removed through rotary valves located on the outlet of the hoppers. Heavy-duty knife gates are used to isolate a hopper from the rotary valve in the event of maintenance required on the valve, with the plant in operation. These rotary valves dump the dust into the screw conveyors which discharge the dust into a water containing sump via dump chute; the dust is blended with the water by use of a turbulator to produce a pumpable slurry. The slurry is then pumped to the desired location (e.g. a thickener – supplied by others) by a submerged slurry pump where it will be further processed. Final slurry disposal is at the Smelting Plant Slurry Dam.

3.3.10.7 Ducting

Fume generated during the tapping process is extracted via the extraction hood located above the taphole and transported through the ductwork to the bagfilter for cleaning. Two (2) pneumatically operated dampers are provided to select the relevant taphole where extraction will be required.

3.3.10.8 Electrical

A 380 V MCC will house the electrical equipment / facilities necessary for the operation of the bagfilter plant such as 6.6 kV Main ID Fan Starter, stop/start stations power supply termination points, electrically powered equipment power supply termination points and area lighting power supply termination points.

More detailed technical and operational design information is currently being compiled and will be available during the EIA Phase of the project in order to support the detailed impact assessments, as well as the conceptual design of additional environmental management measures if any are in fact indicated.

3.4 LAYOUT PLAN FOR REHABILITATION AND CLOSURE COSTING

This section of the Project Description is only required for the EIA Phase of the EMPR Addendum Project, and will therefore not be populated in this Draft Scoping Report.

This section of the Project Description is only required for the EIA Phase of the EMPR Addendum Project, and will therefore not be populated in this Draft Scoping Report.

Figure 3.4 (a): Layout Plan for Rehabilitation and Closure Costing as per DMR Protocol

3.5 PROJECT PHASES AND TIME LINES

Separate discussions will be given in this section for existing operations at GMBS and the proposed new additions, upgrades and expansions.

3.5.1 Existing Operations

The existing operations comprise two main components namely:

- Open Cast Mining
- Ferrochrome Smelting

3.5.1.1 Construction Phase Activities and Time Lines

The construction phase for both mining and smelting will not be discussed as both represent existing operations.

3.5.1.2 Operational Phase Activities and Time Lines

Open Cast Mining

All active mining operations have ceased at GMBS. The southern opencast section is almost fully rehabilitated whilst the northern open cast section is in the final stages of rehabilitation.

Ferrochrome Smelting

The ferrochrome smelter has been in operation for more than ten years. The potential life span of this facility is theoretically indefinite and is fully dependent on market conditions. The smelter can function separately from the mine as it can source its ore and other raw materials independently from a host of available sources.

Activities occurring at the Ferrochrome Smelter during the operational phase have been discussed in detail in section 3.2 of this report and will not be duplicated here. Suffice to list the following main activities:

- Raw Material Stockpiling and Loading
- Pelletizing and Sintering
- Ferrochrome Smelting
- Final Product Preparation, Stockpiling and Dispatch
- Metal Extraction
- Ore Concentrating
- Waste Management
- Water Management
- Air Quality Control

3.5.1.3 Decommissioning & Closure Phase Activities and Time Lines

Open Cast Mining

Decommissioning and Closure of the two open cast sections at GMBS is all but completed. The rehabilitation comprises the following sequence of actions:

- Levelling and compaction of the spoils in the final cuts
- Re-soiling of levelled areas
- Re-vegetation of re-soiled areas
- Commissioning of final Storm Water Management Measures
- Ongoing maintenance and monitoring

Final rehabilitation will be completed within 12 months after mining has stopped after which a period of aftercare and monitoring will commence, until application is made for final closure.

Ferrochrome Smelting

The extent of decommissioning, rehabilitation and closure of the Ferrochrome Smelting Plant will depend on the final selected land use options for the site. Typical actions in this phase could include:

- All internal roads not required for the post closure land use will be scarified, rotovated, re-soiled and re-vegetated.
- All redundant plant, buildings and other equipment and infrastructure will be demolished, recycled, reclaimed and removed for sale or disposal at appropriate facilities.
- Foundations will be demolished to a predetermined depth below surface and all footprints will be rehabilitated, shaped, re-soiled and re-vegetated.
- All waste disposal facilities and water management structures will be closed and rehabilitated in terms of the respective closure plans associated with each facility as provided for in its authorization (water use license or waste license).
- Buildings and infrastructure earmarked for the future land use will be transferred to the new responsible parties associated with the future land use.

A typical time frame for decommissioning and closure of a facility of the extent and magnitude of the GMBS Smelter is between 2 and 5 years.

3.5.1.4 Post Closure Phase Activities and Time Lines

Post Closure activities at both the open cast mining sections as well as at the Ferrochrome Smelting Plant will depend of course on the finally determined post closure land use. However, GMBS will remain responsible for the site until final closure is granted by the DMR. The period between decommissioning and final closure will comprise ongoing maintenance, aftercare and monitoring to confirm that all the closure objectives have been met in a sustainable manner.

3.5.2 Proposed New Activities

The proposed new alterations, upgrades and extensions for which the current environmental authorization applications are made, all relate to activities associated with the Ferrochrome Smelter, except for the upgrade of Storm Water Management measures around the two rehabilitated open cast areas. In this section the proposed activities will all be discussed under one heading and not separate as in the previous section.

The proposed activities for which application will be made have been discussed in detail in section 3.3 and are the following:

- New Access Road to Slimes Dam and Slag Dump
- New Lapa Dam
- New Storm Water Drainage Canals/Berms (Mine and Smelter)
- Extension of Temporary Waste Storage Facilities
- Upgrade of Salvage Yard
- New Slag Dump
- New Slag Dump Pollution Control Dam
- New Slurry/Slimes Dam
- Upgrade of Dust Control at Raw Materials Proportioning Plant
- Upgrade of Dust/Fume Control at Furnaces (tap hole fume extraction system)

3.5.2.1 Construction Phase Activities and Time Lines

The construction phase for all the above activities will comprise either all, or some, of the actions listed below:

- Vegetation clear and grub
- Topsoil stripping and stockpiling
- Levelling
- Delivery of plant and materials
- Civil and/or mechanical construction of facility or plant
- Site clean-up
- Commissioning

The time frame for construction for any of the individual activities listed will not exceed 12 months, except perhaps at the Salvage Yard where the upgrades will occur over a prolonged time period.

3.5.2.2 Operational Phase Activities and Time Lines

Operation of the proposed activities has been described in detail in section 3.3 of this report and will not be repeated here.

The time frame for operation of the facilities/activities, although related to the life of the Ferrochrome Smelter, which is indefinite, will in practice be determined by either its design life or else by the longevity of the technologies used. In general it is safe to assume that recapitalization will be required after 20 years.

3.5.2.3 Decommissioning & Closure Phase Activities and Time Lines

The extent of decommissioning, rehabilitation and closure of the Ferrochrome Smelting Plant will depend on the final selected land use options for the site. Typical actions in this phase could include:

- All internal roads not required for the post closure land use will be scarified, rotovated, re-soiled and re-vegetated.
- All redundant plant, buildings and other equipment and infrastructure will be demolished, recycled, reclaimed and removed for sale or disposal at appropriate facilities.
- Foundations will be demolished to a predetermined depth below surface and all footprints will be rehabilitated, shaped, re-soiled and re-vegetated.
- All waste disposal facilities and water management structures will be closed and rehabilitated in terms of the respective closure plans associated with each facility as provided for in its authorization (water use license or waste license).
- Buildings and infrastructure earmarked for the future land use will be transferred to the new responsible parties associated with the future land use.

A typical time frame for decommissioning and closure of a facility of the extent and magnitude of the GMBS Smelter is between 2 and 5 years.

3.5.2.4 Post Closure Phase Activities and Time Lines

Post Closure activities at the Ferrochrome Smelting Plant will depend of course on the finally determined post closure land use. However, GMBS will remain responsible for the site until final closure is granted by the DMR. The period between decommissioning and final closure will comprise ongoing maintenance, aftercare and monitoring to confirm that all the closure objectives have been met in a sustainable manner.

3.6 LISTED ACTIVITIES OCCURING AT GMBS (BOSHOEK)

Due to the nature and extent of the Glencore Merafe Venture Boshoek Mine and Smelter operations, Environmental Authorizations as provided for in several sets of legislation, are required for various activities. In addition to activities identified as mining related actions in terms of the MPRDA Regulations GNR 527 of 23 April 2004, other activities include *inter alia*:

- Listed Activities in terms of the National Environmental Management Act (NEMA) as listed in Regulations GNR 544, GNR 545 and GNR 546 of 18 June 2010.
- Listed Waste Management Activities in terms of the National Environmental Management Waste Act (NEMWA) as listed in Regulation GNR 921 of 29 November 2013.
- Water Uses as defined in section 21 of the National Water Act (NWA) as well as Mine Water Management activities as provided for in Regulation GNR 704 of 4 June 1999.
- Listed Activities which result in atmospheric emissions which may have a significant detrimental effect on the Environment as listed in Regulation GNR 248 of 31 March 2010.

3.6.1 Activities Already Authorized at GMBS (Boshoek)

3.6.1.1 MPRDA Mining Related Activities

Mining as such is listed as an activity in the NEMA EIA Regulations. However, mining as a NEMA activity has not been activated and as such the EIA for mining related activities is conducted in terms of the MPRDA Regulations. The MPRDA regulations do not identify and list individual mining activities for authorization, but rather put the responsibility on the applicant to identify, assess and manage all impacts as caused by aspects related to the mining activity applied for.

All activities/aspects currently authorized in terms of the provisions of the MPRDA Regulations GNR 527 of 23 April 2004, are contained in the Approved EMPR for GMBS attached as **APPENDIX 3.2(A)** to this report.

The existing approved EMPR assessed the following activities.

3.6.1.2 NEMA Listed Activities

The current GMBS Smelter has been authorized, still in terms of the provisions of the now fully repealed Environment Conservation Act, Act 73 of 1989. The "listed activity" on the authorization is stated as:

Construction and Operation of the S A Chrome and Alloys Ltd. Horizon Smelter (*now GMBS*) Project. A copy of the EIA ROD (ref: EIA 185/00NW) issued on 07/12/2000, is attached as **APPENDIX 1.13.2(A).**

3.6.1.3 NEMWA Listed Waste Management Activities

The Salvage Yard at GMBS has been authorized as a H:H (General and Hazardous) Waste Storage Facility.

A copy of the Waste License (12/9/11/L239/7) is attached as **APPENDIX 1.13.2(A).**

3.6.1.4 NEMAQA Listed Atmospheric Emissions Activities

The GMBS Smelter currently operates under an Atmospheric Emissions License (issued November 2013) in terms of the provisions of the National Environmental Management Air Quality Act, Act 39 of 2004. The licence authorizes GMBS to continue with the following processes:

1. Sinter Plant Processes (Listed Activity 4.5)
2. Ferro-Alloy Production (Listed Activity 4.9)

A copy of the AEL license is attached as **APPENDIX 1.13.2(A).**

3.6.1.5 NWA Water Uses

The GMBS Smelter currently operates under a Water Use License issued in terms of the provisions of the National Water Act, 1998. The license authorizes the following water uses:

1.	Section 21(a) of the Act:	Taking of water from a water resource.
2.	Section 21(b) of the Act:	Storing water.
3.	Section 21(c) of the Act:	Impeding or diverting the flow of water in a water course.
4.	Section 21(g) of the Act:	Disposing of waste in a manner which may detrimentally impact on a water resource.
5.	Section 21(i) of the Act:	Altering the bed, banks or characteristics of a water course.
6.	Section 21(j) of the Act:	Removing, discharging or disposing of water found underground if it is necessary for the continuation of an activity or for the safety of people.

3.6.1.6 NWA GNR 704 Exemptions

GMBS is exempted in the Water Use License (condition 4.12 of Appendix V) from complying with regulation 4(c) of GNR 704, in as far as it relates to the backfilling of Pit 1 (jig tailings phase 1) and Pit 2 (jig tailings phase 2) with slurry.

Regulation 4: Restrictions on locality

No person in control of a mine or activity may –

(c) place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation

3.6.2 Activities Associated with this Application

3.6.2.1 MPRDA Mining Related Activities

Mining as such is listed as an activity in the NEMA EIA Regulations. However, mining as a NEMA activity has not been activated and as such the EIA for mining related activities is conducted in terms of the MPRDA Regulations. In order to support the EIA for mining, JMA has identified the following activities/aspects for assessment under the MPRDA Regulations:

All the activities described in section 3.2 and section 3.3 of this report.

3.6.2.2 NEMA Listed Activities

National Environmental Management Act, Act No. 107 of 1998			
Section 24	**Environmental Authorisation Application**		
GNR 544			
Identification of the competent authority	The competent authority in respect of the activities listed in this part of the schedule is the environmental authority in the province in which the activity is to be undertaken unless it is an application for an activity contemplated in section 24C(2) of the Act, in which case the competent authority is the Minister or an organ of state with delegated powers in terms of section 42(1) of the Act, as amended.		
Activity 9	The construction of facilities or infrastructure exceeding 1000 metres in length for the bulk transportation of water, sewage or storm water - (i) with an internal diameter of 0,36 metres or more; or (ii) with a peak throughput of 120 litres per second or more, excluding where: such facilities or infrastructure are for bulk transportation of water, sewage or storm water or storm water drainage inside a road reserve; or a. where such construction will occur within urban areas but further than 32 metres from a watercourse, measured from the edge of the watercourse.		**New Storm Water Drainage Canals**
Activity 11	The construction of: (i) canals; (ii) channels; (iii) bridges; (iv) dams; (v) weirs; (vi) bulk storm water outlet structures; (vii) marinas; (viii) jetties exceeding 50 square metres in size; (ix) slipways exceeding 50 square metres in size; (x) buildings exceeding 50 square metres in size; or (xi) infrastructure or structures covering 50 square metres or more where such construction occurs within a		**In view of uncertainty related to the development setback line, this activity is interpreted to be relevant. Determination must be made whether these activities will occur within or closer to 32m from a watercourse.** **Potential Activities:** **1. Lapa Pond** **2. New Storm Water/Slag Dump PCD**

	watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.		**3. New Slag Dump** **4. New Storm Water Drainage Canals** **5. New Slimes Dam**
Activity 18	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock from (i) a watercourse; (ii) the sea; (iii) the seashore; (iv) the littoral active zone, an estuary or a distance of 100 metres inland of the high-water mark of the sea or an estuary, whichever distance is the greater- but excluding where such infilling, depositing, dredging, excavation, removal or moving (i) is for maintenance purposes undertaken in accordance with a management plan agreed to by the relevant environmental authority; or (ii) occurs behind the development setback line.		**In view of uncertainty related to the development setback line, this activity is interpreted to be relevant. Determination must be made whether these activities will occur within or closer to 32m from a watercourse.** **Construction of Lapa Pond.**
Activity 23	The transformation of undeveloped, vacant or derelict land to - (i) residential, retail, commercial, recreational, industrial or institutional use, inside an urban area, and where the total area to be transformed is 5 hectares or more, but less than 20 hectares, or (ii) residential, retail, commercial, recreational, industrial or institutional use, outside an urban area and where the total area to be transformed is bigger than 1 hectare but less than 20 hectares; - except where such transformation takes place - (i) for linear activities; or (ii) for purposes of agriculture or afforestation, in which case Activity 16 of Notice No. R545 applies	**Undeveloped** means that no facilities, structures or infrastructure have been affected upon the land or property during the preceding 10 years. **Vacant land** means not to be occupied for the purpose of its lawful land use during the preceding 10 year period. **Derelict land** means abandoned land or property where the lawful/legal land use right has not been exercised during the preceding ten year period.	**In terms of definitions for "derelict land" and "vacant land" in the regulations, this Activity is deemed relevant for:** **1. Slag Dump plus PCD** **2. Slimes Dam** **3. Access Roads** **4. Storm Water Drainage Canals** **5. Other activities** **As a result of current Agricultural zoning.**
Activity 28	The expansion of existing facilities for any process or activity where such expansion will result in the need for a permit or license in terms of national or provincial legislation governing the release of emissions or pollution, excluding where the facility, process or activity is included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	Should a facility be expanded or be changed, **AND** a permit or an amendment to the existing permit is required, this activity will be triggered.	**Air Emissions License Amendments may be required for:** **1. Dust Control at Raw Materials** **2. Air Pollution Control Equipment (APCE) Upgrade at Furnaces (Tap Hole Fume Extraction System)** **Confirm requirement for AEL Amendments**

National Environmental Management Act, Act No. 107 of 1998		
Section 24	**Environmental Authorisation Application**	
GNR 545		
Identification of the competent authority	The competent authority in respect of the activities listed in this part of the schedule is the environmental authority in the province in which the activity is to be undertaken, unless- (a) it is an application for an activity contemplated in section 24C(2) of the Act, in which case the competent authority is the Minister or an organ of state with delegated powers in terms of section 42(1) of the Act, as amended; or (b) the activity is to be conducted in or on a mining area or is to transform the area where the activity is to be conducted into a mining area in which case the competent authority is the Minister of Minerals and Energy. The exception mentioned in (b) above does not apply to the following activities contained in this Notice: 1; 2; 5; 8; 9; 10; 12; 13; 14; 17; 24; and 25.	
Activity 5	The construction of facilities or infrastructure for any process or activity which requires a permit or license in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent and which is not identified in Notice No. 544 of 2010 or included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case that Act will apply.	**1. New Slag Dump** **2. New PCD** **3. New Slimes Dam**
Activity 15	Physical alteration of undeveloped vacant or derelict land for residential retail, commercial, recreational, industrial or institutional use where the total area to be transformed is 20 hectares or more; except where such physical alteration takes place for: (i) linear development activities; or (ii) agriculture or afforestation where activity 16 in this Schedule will apply.	**New Slag Dump**

National Environmental Management Act, Act No. 107 of 1998			
Section 24	**Environmental Authorisation Application**		
GNR 546			
Identification of competent authority	The competent authority in respect of the activities listed in this part of the schedule is the environmental authority in the province in which the activity is to be undertaken unless it is an application for an activity contemplated in section 24C(2) of the Act, in which case the competent authority is the Minister or an organ of state with delegated powers in terms of section 42(1)(d) of the Act, as amended.		
Activity 4	The construction of a road wider than 4 metres with a reserve less than 13,5 metres.	**(c) In North West:** i. Outside urban areas, in: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas identified in terms of an International Convention; (ee) Critical biodiversity areas (Terrestrial Type 1 and 2 and Aquatic Type 1) as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from a biosphere reserve. ii. In urban areas: (aa) Areas zoned for use as public open space; (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the	**Construction of Access Roads to New Slag Dump and Slimes Dam**

		competent authority or zoned for a conservation purpose; (cc) Natural heritage sites.	
Activity 12	The clearance of an area of 300 square metres or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation.	(a) Within any critically endangered or endangered ecosystem listed in terms of section 52 of the NEMBA or prior to the publication of such a list, within an area that has been identified as critically endangered in the National Spatial Biodiversity Assessment 2004; (b) Within critical biodiversity areas identified in bioregional plans; (c) Within the littoral active zone or 100 metres inland from high water mark of the sea or an estuary, whichever distance is the greater, excluding where such removal will occur behind the development setback line on even in urban areas.	**1. New Slag Dump** **2. New PCD** 3. **New Slimes Dam**
Activity 13	The clearance of an area of 1 hectare or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for: (1) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008), in which case the activity is regarded to be excluded from this list. (2) the undertaking of a linear activity falling below the thresholds mentioned in Listing Notice 1 in terms of GN No. 544 of 2010.	(a) Critical biodiversity areas and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority. (b) National Protected Area Expansion Strategy Focus areas. **(e) In North West:** i. Outside urban areas, in: (aa) A protected area identified in terms of NEMPAA, excluding conservancies; (bb) National Protected Area Expansion Strategy Focus areas; (cc) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (dd) Sites or areas	**1. New Slag Dump** **2. New PCD** **3. New Slimes Dam**

		identified in terms of an International Convention; (ee) Critical biodiversity areas (Type 1 only) and ecological support areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans; (ff) Core areas in biosphere reserves; (gg) Areas within 10 kilometres from national parks or world heritage sites or 5 kilometres from any other protected area identified in terms of NEMPAA or from the core areas of a biosphere reserve, ii. In urban areas: (aa) Areas zoned for use as public open space; (bb) Areas designated for conservation use in Spatial Development Frameworks adopted by the competent authority or zoned for a conservation purpose; (cc) Natural heritage sites.	
Activity 14	The clearance of an area of 5 hectares or more of vegetation where 75% or more of the vegetative cover constitutes indigenous vegetation, except where such removal of vegetation is required for. (1) purposes of agriculture or afforestation inside areas identified in spatial instruments adopted by the competent authority for agriculture or afforestation purposes; (2) the undertaking of a process or activity included in the list of waste management activities published in terms of section 19 of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) in which case the activity is regarded to be excluded	**(a) In Eastern Cape, Free State, KwaZulu-Natal, Gauteng, Limpopo, Mpumalanga, Northern Cape, Northwest and Western Cape:** i. All areas outside urban areas.	**1. New Slag Dump** **2. New PCD** **3. New Slimes Dam**

	from this list; (3) the undertaking of a linear activity falling below the thresholds in Notice 544 of 2010.		
Activity 16	The construction of: (i) jetties exceeding 10 square metres in size; (ii) slipways exceeding 10 square metres in size; (iii) buildings with a footprint exceeding 10 square metres in size; or (iv) infrastructure covering 10 square metres or more where such construction occurs within a watercourse or within 32 metres of a watercourse, measured from the edge of a watercourse, excluding where such construction will occur behind the development setback line.	**(c) In North West:** i. Outside urban areas, in: (dd) Sensitive areas as identified in an environmental management framework as contemplated in chapter 5 of the Act and as adopted by the competent authority; (ff) Critical biodiversity areas or ecosystem service areas as identified in systematic biodiversity plans adopted by the competent authority or in bioregional plans;	**Lapa Pond**

3.6.2.3 NEMWA Listed Waste Management Activities

National Environmental Management: Waste Act, Act No. 59 of 2008		
GNR 921 29 November 2013	**Waste License Application**	
CATEGORY B		
7	The disposal of any quantity of hazardous waste to land.	**Slimes Dam**
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.	**Slag Dump**
10	The construction of a facility for a waste management activity listed Category B of this Schedule (not in isolation to associated waste management activity).	**1. Slimes Dam** **2. Slag Dump**

3.6.2.4 NWA Water Uses

NATIONAL WATER ACT (ACT 36 OF 1998): SECTION 40	
The (32) water uses indicated in Green are existing water uses that have already been licensed (Licence No: 03/A22F/ACGIJ/580).	
The water uses indicated in Red are existing water uses that have not been licensed yet, and will need to be licensed.	
The water uses indicated in Blue are proposed new water uses and will need to be licensed.	
Section 21(a) Taking water from a water resource **Water Resource as defined in NWA:** **" water resource" includes a water course, surface water, estuary, or aquifer.** **"watercourse" means –** **(a) a river or spring;** **(b) a natural channel in which water flows regularly or intermittently;** **(c) a wetland, lake or dam into which, or from which, water flows; and** **(d) any collection of water which the minister may, by notice in the gazette, declare to be a water course,** **and a reference to a watercourse includes, where relevant, its bed and banks**	**BH31 – Borehole** **BH33 – Borehole** **GCS1 – Borehole** **GCS3 – Borehole** **Andru Mining – Borehole** **Benhaus Mining - Borehole** **MB4 – Borehole** **Southern (Andru Mining) Open Pit Final Void** **Northern (Benhaus Mining) Open Pit Final Void**
Section 21(b) Storing water	**HSEC Dam** **Recreation Dam 1** **Recreation Dam 2** **Lapa Pond**
Section 21(c) Impeding or diverting the flow of water in a watercourse **Section 21(i) Altering the bed, banks, course or characteristics of a watercourse**	**Matlapyane Upstream Bridge (Matlapyane Crossing)** **Matlapyane Upstream Walkway (Matlapyane Crossing)** **Matlapyane Middlestream Bridge (Matlapyane Crossing)** **Matlapyane Middlestream Walkway (Matlapyane Crossing)** **Matlapyane Downstream Bridge (Matlapyane Crossing)** **Matlapyane Downstream Walkway (Matlapyane Crossing)** **Furnace Clarifier Slurry Disposal Pipeline (Matlapyane Crossing)** **MEP Jig Plant Slurry Disposal Pipeline** **Access Road to Mining Management Area (Matlapyane Crossing)** **Process Water Pipe Line Stream Crossings (Matlapyane Crossing)** **Plant Security Patrol Road Northern Boundary** **Plant Security Patrol Road Eastern Boundary** **Recreation Dam 1** **Recreation Dam 2** **Lapa Dam** **Matlapyane Wetland System (New Slag Dump & Slag Dump PCD)** **Borethane Wetland System** **Southern Wetland System** **Marang Wetland System**
Section 21(g) Disposing of waste in a	**Process Water Dam 101 and 102**

manner which may detrimentally impact on a water resource. **Waste as defined in NWA:** **"waste" includes any solid material or material that is suspended, dissolved or transported in water (including sediment) and which is spilled or deposited on land or into a water resource in such volume, composition or manner as to cause, or to be reasonably likely to cause, the water resource to be polluted.** **"pollution" means the direct or indirect alteration of the physical, chemical or biological properties of a water resource so as to make it –** **(a) less fit for any beneficial purpose for which it may reasonably be expected to be used; or** **(b) harmful or potentially harmful –** **(aa) to the welfare, health or safety of human beings;** **(bb) to any aquatic or nonaquatic organisms;** **(cc) to the resource quality; or** **(dd) to property**	**Sinter Plant Slurry Pit**
	MEP Jig Plant Process Water Dam
	Jig and Spiral Tailings Quarry Dam – Phase 1
	Jig and Spiral Tailings Quarry Dam – Phase 2
	Plant Storm Water Dam (Main PCD)
	Plant Dirty Water Dam (PCD)
	Clarifier Slurry (Slimes) Dam and Return Water Sump
	Existing Slag Stockpiling and Disposal Facilities
	New Slag Dump
	New Slag Dump Pollution Control Dam
	New Slurry (Slimes) Dam and Return Water Sump
	Raw Materials Stockpiles
	Pellets Stockpiles
	Product Stockpiles
	Slag and Sand Stockpiles
	Mine Soil Stockpiles
	Mine Overburden Stockpiles
	ROM Stockpiles
	Mine Waste Rock Dumps (3)
	Spiral Plant Stockpiles
	Dust Suppression Southern (Andru) Open Pit
	Dust Suppression Northern (Benhaus) Open Pit
	Southern (Andru Mining) Open Pit Final Void
	Northern (Benhaus Mining) Open Pit Final Void
Section 21(k) Using water for recreational purposes	**Recreation Dam 1**
	Recreation Dam 2
	Lapa Pond

3.6.2.5 NWA GNR 704 EXEMPTIONS

National Water Act		
GNR 704	**Exemption from Requirements of Regulations**	
4.	**Restrictions on locality**	
4(c)	No person in control of a mine or activity may – place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation;	**1. Backfilling of Pit 1 (Jig Tailings Phase 1) with slurry** **2. Backfilling of Pit 2 (Jig Tailings Phase 2) with slurry**

GMBS is exempted in the Water Use License (condition 4.12 of Appendix V) from complying with regulation 4(c) of GNR 704, in as far as it relates to the backfilling of Pit 1 (jig tailings phase 1) and Pit 2 (jig tailings phase 2) with slurry.

Regulation 4: Restrictions on locality

No person in control of a mine or activity may –

(d) place or dispose of any residue or substance which causes or is likely to cause pollution of a water resource, in the workings of any underground or opencast mine excavation, prospecting diggings, pit or any other excavation

3.7 I&AP CONFIRMATION OF CONSULTED POTENTIAL IMPACTS

The list of potential environmental impacts provisionally identified by the EAP and Specialists, for the current and new GMBS activities, including potential cumulative impacts, is given in section 3.8 here-after.

This list, which forms part of the content of this Draft Scoping Report and Plan of Study, was provided to the I&AP's, together with the full Draft Scoping Report and Plan of Study, after the Scoping Phase Public meeting, for review, consideration and comments, for a 40 day period.

The contents of the Draft Scoping Report and Plan of Study, including the potential environmental impacts identified, was presented and explained to the I&AP's during the Scoping Phase Public Meeting.

The I&AP's were informed on how they could comment on the provisional potential environmental impacts and how their comments would be considered and appended to the list, if required. In this regard, I&AP's were also provided with comment forms on which they could indicate their comments as pertaining to the identified potential environmental impacts.

3.7.1 Confirmation of Impacts Associated with the GMBS Activities

The list of potential environmental impacts (list originally provided in the Draft Scoping Report and Plan of Study in Table 3.8(a)), was appended to include I&AP comments and suggestions and is given below as Table 3.7.1(a). This Table therefore represents the consulted and appended list of potential environmental impacts for GMBS existing and new activities.

To be completed and appended after Scoping Phase Public Participation

3.7.2 Confirmation of Cumulative Impacts

The list of potential cumulative environmental impacts (list originally provided in the Draft Scoping Report and Plan of Study in Table 3.8(b)), was appended to include I&AP comments and suggestions and is given below as Table 3.7.2(a). This Table therefore represents the consulted and appended list of potential cumulative environmental impacts for GMBS existing and new activities.

To be completed and appended after Scoping Phase Public Participation

Table 3.7.1(a): Potential Impacts for Current and Proposed New GMBS Activities (Consulted with I&AP's &Appended)

To be completed and appended after Scoping Phase Public Participation

Environmental Component	Impact Category	Description of Nature of Potential Impact/Issue	I&AP Comment
Socio Cultural	Geographic Processes (land use patterns)	Changes in land use patterns due to conversion of agricultural land to mining and industrial land use.	
	Demographic Processes (population composition e.g. age, gender, race)	Changes in population numbers and profile due to potential influx of migrant workers for construction, operation and decommissioning.	
	Institutional & Legal Processes (municipal services, public infrastructure, housing)	Changes in the demand for municipal services, transport and housing due to the increased in population.	
	Cultural Processes (social, cultural and traditional practices)	Changes in the cultural dynamics of the area due to influx of people with different cultural and social backgrounds.	
Heritage Resources	Historical and Cultural (places, buildings, structures, burial grounds, graves)	Damage to, or destruction of, graveyards and graves due to construction, mining and decommissioning activities.	
Socio Economic	Economic Efficiency (labour, employment, output and growth)	Positive changes in economic output and regional exports due to the beneficiation of chrome ore to ferrochrome at GMBS.	
	Economic Equity (poverty, income)	Positive changes in employment, tax income, increased social spending and increased incomes due to employment offered by GMBS.	
	Economic Stability (diversity, resource use)	Positive changes in economic stability through diversification due to the beneficiation of the chrome ore at GMBS.	
Land Use	Beneficial Land Use (derelict, vacant, residential, industrial, mining, agricultural, recreational, wilderness, conservation)	Changes in land use due to the transformation of the agricultural land use to mining and smelting.	
Infrastructure	Services (roads, pipelines, powerlines, raillines, telecommunications)	Damage to roads due to increased heavy transport of ore and product to and from GMBS.	
Topography	Morphology	Creation of dangerous/unstable excavations due to mining, as well as dangerous/unstable mounds/piles/dumps due to stockpiling of soil, raw materials and product and due to disposal of waste onto land.	
	Stability	Creation of areas prone to surface subsidence due to backfilling of the open cast mining pits.	
Soils	Soil Horizon	Loss of soil horizon due to site clearance for construction of roads, buildings and plant infrastructure and utilities.	
	Soil Fertility	Loss of soil fertility due to incorrect stockpiling of soils required for rehabilitation purposes.	
	Soil Contamination	Contamination of soil due to spillages of raw material, ore and product during transport or due to spillages/seepages/leakages of contaminated water from pipes, canals, sumps and dams.	
Land Capability	Land Capability (wetland, arable (dryland), arable (irrigation), grazing, wilderness, rehabilitated)	Changes in the land capability due to the construction and operation of mining and beneficiation infrastructure and processes.	

Geology	Lithology	Changes in lithology due to mining from and backfilling into the open pits.	
	Mineral Resources	Sterilization of mineral resources due to the construction of infrastructure on potential future mining areas.	
Geochemistry	Acid Mine Generation (AMD)	Due to the geochemical inertness of the chrome ore, AMD is not expected to form – confirmed with testing.	
Ground Water	Quantity (presence, flow, availability) of Ground Water	Depletion in the quantity of ground water available in the area due to the formation of cones of ground water level depression around the open mining pits, as well as around boreholes from which ground water is abstracted.	
	Quality of Ground Water	Contamination of the ground water resource due to spillages of contaminated water from tanks, sumps, pipes and dams and/or the infiltration of soluble contaminants into the subsurface through the basins of stockpiles, dumps, sumps and dams.	
Surface Water	Quantity (presence, flow, availability) of Surface Water	Depletion in the quantity of surface water due to the capture of direct rainfall in the open pits, in quarries and dams, as well as the capture of contaminated storm water run-off in Pollution Control Dams.	
	Quality of Surface Water	Contamination of the surface water resource due to contaminated run-off from “dirty areas” directly into the surface water resources and/or spillages of contaminated water from tanks, sumps, pipes and dams.	
Plant Life	Habitat	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities.	
	Bio-Diversity	Impact on, or destruction of Bio-Diversity due to a loss in habitat or as a result of contamination of soils or water.	
	Red Data List Species (sensitive, threatened, endangered)	Potential threat to identified species at GMBS if construction and operational activities are not prevented in close proximity to the identified specimens.	
Animal Life	Habitat	Impact on, or destruction of habitat due to vegetation habitat disturbance as well the construction and presences of fences.	
	Bio-Diversity	Impact on, or destruction of Bio-Diversity due to habitat disturbance or as a result of water pollution, air pollution, noise and traffic.	
	Red Data List Species (sensitive, threatened, endangered)	Potential threat to potential present threatened species at GMBS if construction and operational activities are not prevented in close proximity to identified specimens.	
Wetlands	Habitat	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities.	
	Functions and Services Provision (FSP)	Deterioration in FSP due to impact on wetland services provision attributes.	
	Present Ecological State (PES)	Deterioration in PES due to impacts on habitat as well as wetland functions and services attributes.	
Aquatic Ecosystems	Habitat (IHAS)	Impact on, or Destruction of Habitat due to impacts on habitat attributes such as water flow and water quality.	
	Bio-Diversity (SASS5, FAII, Toxicity)	Impact on, or Destruction of Bio-Diversity due to impacts on	

		habitat.	
Air Quality	Gaseous Emissions	Deterioration in Ambient Air Quality due to gaseous emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the re-cycling/utilization of gas at these facilities.	
	Particulate Matter	Deterioration in Ambient Air Quality due to particulate matter emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the cleaning of gas at these facilities.	
	Dust Fallout	Deterioration in Ambient Air Quality due to dust generated by road transport, conveyor transport, crushing, handling, stockpiling and wind entrainment of raw materials, wastes and product as well as during construction and decommissioning activities.	
Noise	Ambient Sound Level	Increase in the Ambient Sound Levels due to construction, mining, smelting, transport and decommissioning activities at GMBS.	
	Noise	Generation of Noise from specific GMBS noise generating activities.	
Traffic	Traffic Demand	Increase in Traffic Volumes due to road transport of personnel, raw materials, infrastructure and plant components, ore and final product.	
Visuals	Visual Aspects (visibility, visual exposure, visual intrusion and landscape morphology)	Impacts on visibility, visual exposure, visual intrusion and landscape morphology due to the presence of infrastructure, as well the occurrence of particulate matter and dust emissions during the construction, operation and decommissioning of infrastructure and processes at GMBS.	

Table 3.7.2(a): Potential Cumulative Impacts for Current and Proposed New GMBS Activities (Consulted with I&AP's & Appended)

To be completed and appended after Scoping Phase Public Participation

Environmental Component	Impact Category	Description of Nature of Potential Cumulative Impact/Issue	Potential Cumulative Impact Beyond GMBS Site (off site propagation) (Yes/No)	I&AP Comment
Socio Cultural	Geographic Processes (land use patterns) Demographic Processes (population composition e.g. age, gender, race) Institutional & Legal Processes (municipal services, public infrastructure, housing) Cultural Processes (social, cultural and traditional practices)	Socio-cultural Impacts caused by the GMBS operations which potentially include changes in land use patterns, changes in population numbers and profile, changes in the demand for municipal services, transport and housing, as well as changes in the cultural dynamics of the area due to influx of people with different cultural and social backgrounds.	Yes	
Heritage Resources	Historical and Cultural (places, buildings, structures, burial grounds, graves)	Damage to, or destruction of graveyards and graves due to construction, mining and decommissioning activities.	No	
Socio Economic	Economic Efficiency (labour, employment, output and growth) Economic Equity (poverty, income) Economic Stability (diversity, resource use)	Socio-economic cultural Impacts caused by the GMBS operations which potentially include positive changes in economic output and regional exports, positive changes in employment, tax income, increased social spending and increased incomes, as well as positive changes in economic stability through diversification.	Yes	
Land Use	Beneficial Land Use (derelict, vacant, residential, industrial, mining, agricultural, recreational, wilderness, conservation)	Changes in land use due to the transformation of the agricultural land use to mining and smelting.	Yes	
Infrastructure	Services (roads, pipelines, powerlines, raillines, telecommunications)	Damage to roads due to increased heavy transport of ore and product to and from GMBS.	Yes	

Topography	Morphology Stability	Creation of dangerous/unstable excavations due to mining, as well as dangerous/unstable mounds/piles/dumps due to stockpiling of soil, raw materials and product and due to disposal of waste onto land as well as the creation of areas prone to surface subsidence due to backfilling of the open cast mining pits.	No	
Soils	Soil Horizon Soil Fertility Soil Contamination	Loss of soil horizon due to site clearance for construction of roads, buildings and plant infrastructure and utilities, loss of soil fertility due to incorrect stockpiling of soils required for rehabilitation purposes and the contamination of soil due to spillages of raw material, ore and product during transport or due to spillages, seepages, and/or leakages of contaminated water from pipes, canals, sumps and dams.	No	
Land Capability	Land Capability (wetland, arable (dryland), arable (irrigation), grazing, wilderness, rehabilitated)	Changes in the land capability due to the construction and operation of mining and beneficiation infrastructure and processes.	Yes	
Geology	Lithology Mineral Resources	Sterilization of mineral resources due to the construction of infrastructure on potential future mining areas or activities which could influence access to future mining.	Yes	
Geochemistry	Acid Mine Generation (AMD)	Due to the geochemical inertness of the chrome ore, AMD is not expected to form – confirmed with testing.	No	
Ground Water	Quantity (presence, flow, availability) of Ground Water	Depletion in the quantity of ground water available in the area due to the formation of cones of ground water level depression around the open mining pits, as well as around boreholes from which ground water is abstracted.	Yes	
	Quality of Ground Water	Contamination of the ground water resource due to spillages of contaminated water from tanks, sumps, pipes and dams and/or the infiltration of soluble contaminants into the subsurface through the basins of stockpiles, dumps, sumps and dams.	No	
Surface Water	Quantity (presence, flow, availability) of Surface Water	Depletion in the quantity of surface water due to the capture of direct rainfall in the open pits, in quarries and dams, as well as the capture of contaminated storm water run-off in Pollution Control Dams.	Yes	
	Quality of Surface Water	Contamination of the surface water resource due to contaminated run-off from “dirty areas” directly into the surface water resources and/or spillages of contaminated water from tanks, sumps, pipes and dams.	Yes	
Plant Life	Habitat Bio-Diversity Red Data List Species (sensitive, threatened, endangered)	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities, impact on, or destruction of Bio-Diversity due to a loss in habitat or as a result of contamination of soils or water as well as the potential threat to identified species at GMBS if construction and operational activities are not prevented in close proximity to the identified specimens.	No	

Animal Life	Habitat Bio-Diversity Red Data List Species (sensitive, threatened, endangered)	Impact on, or destruction of habitat due to vegetation habitat disturbance as well the construction and presences of fences, their impact on, or destruction of Bio-Diversity due to habitat disturbance or as a result of water pollution, air pollution, noise and traffic, as well as the potential threat to potential present threatened species at GMBS if construction and operational activities are not prevented in close proximity to identified specimens.	No	
Wetlands	Habitat Functions &Services Provision (FSP) Present Ecological State (PES)	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities, the deterioration in FSP due to impact on wetland services provision attributes, as well as the deterioration in PES due to impacts on habitat as well as wetland functions and services attributes.	Yes	
Aquatic Ecosystems	Habitat (IHAS) Bio-Diversity (SASS5, FAII, Toxicity)	Impact on, or Destruction of Habitat due to impacts on habitat attributes such as water flow and water quality, as well as the impact on, or Destruction of Bio-Diversity due to impacts on habitat.	Yes	
Air Quality	Gaseous Emissions Particulate Matter Dust Fallout	Deterioration in Ambient Air Quality due to gaseous emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the re-cycling/utilization of gas at these facilities, the deterioration in Ambient Air Quality due to particulate matter emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the cleaning of gas at these facilities as well as the deterioration in Ambient Air Quality due to dust generated by road transport, conveyor transport, crushing, handling, stockpiling and wind entrainment of raw materials, wastes and product as well as during construction and decommissioning activities.	Yes	
Noise	Ambient Sound Level	Increase in the Ambient Sound Levels due to construction, mining, smelting, transport and decommissioning activities at GMBS.	Yes	
Traffic	Traffic Demand	Increase in Traffic Volumes due to road transport of personnel, raw materials, infrastructure and plant components, ore and final product.	Yes	
Visuals	Visual Aspects (visibility, visual exposure, visual intrusion and landscape morphology)	Impacts on visibility, visual exposure, visual intrusion and landscape morphology due to the presence of infrastructure, as well the occurrence of particulate matter and dust emissions during the construction, operation and decommissioning of infrastructure and processes at GMBS.	Yes	

3.8 POTENTIAL IMPACTS RELATED TO GMBS ACTIVITIES

Specialists involved in the compilation of the base line studies and impact assessments for this GMBS project, provisionally compiled lists of potential impacts which they believe could be associated with the current and proposed new activities at GMBS.

Interested and Affected Parties were requested to review the lists provided below and to add any impacts which they are concerned with and which they believe may occur as a result of the existing and proposed activities. A final list for inclusion into the Impact Assessment Phase of this project will then be compiled after the Scoping Phase to ensure that all concerns are addressed in the Impact Assessment Phase of this project.

Two Tables were compiled for consideration by I&APs.

Table 3.8(a): Potential Impacts Associated GMBS Activities (current and new)
Table 3.8(b): Potential Cumulative Impacts Associated with GMBS Activities

A cumulative impact is defined in GNR 543 (EIA Regulations of 18 June 2010) as:

" 'cumulative impact' in relation to an activity, means the impact of an activity that in itself may not be significant, but may become significant when added to the existing and potential impacts eventuating from similar or diverse activities or undertakings in the area."

For the purposes of this cumulative impact assessment, all potential impacts related to GMBS's existing and future activities with the potential to propagate beyond the GMBS site boundary and which could as a result of this contribute to regional impacts, were identified.

Please refer to section 3.7.1, (Table 3.7.1(a) and Table 3.7.2(a)) of the Final Scoping Report and Plan of Study for the comments and views of the I&AP's.

Table 3.8(a): Potential Impacts Associated with Current and Proposed New GMBS Activities

Environmental Component	Impact Category	Description of Nature of Potential Impact/Issue
Socio Cultural	Geographic Processes (land use patterns)	Changes in land use patterns due to conversion of agricultural land to mining and industrial land use.
	Demographic Processes (population composition e.g. age, gender, race)	Changes in population numbers and profile due to potential influx of migrant workers for construction, operation and decommissioning.
	Institutional & Legal Processes (municipal services, public infrastructure, housing)	Changes in the demand for municipal services, transport and housing due to the increased in population.
	Cultural Processes (social, cultural and traditional practices)	Changes in the cultural dynamics of the area due to influx of people with different cultural and social backgrounds.
Heritage Resources	Historical and Cultural (places, buildings, structures, burial grounds, graves)	Damage to, or destruction of, graveyards and graves due to construction, mining and decommissioning activities.
Socio Economic	Economic Efficiency (labour, employment, output and growth)	Positive changes in economic output and regional exports due to the beneficiation of chrome ore to ferrochrome at GMBS.
	Economic Equity (poverty, income)	Positive changes in employment, tax income, increased social spending and increased incomes due to employment offered by GMBS.
	Economic Stability (diversity, resource use)	Positive changes in economic stability through diversification due to the beneficiation of the chrome ore at GMBS.
Land Use	Beneficial Land Use (derelict, vacant, residential, industrial, mining, agricultural, recreational, wilderness, conservation)	Changes in land use due to the transformation of the agricultural land use to mining and smelting.
Infrastructure	Services (roads, pipelines, powerlines, raillines, telecommunications)	Damage to roads due to increased heavy transport of ore and product to and from GMBS.
Topography	Morphology	Creation of dangerous/unstable excavations due to mining, as well as dangerous/unstable mounds/piles/dumps due to stockpiling of soil, raw materials and product and due to disposal of waste onto land.
	Stability	Creation of areas prone to surface subsidence due to backfilling of the open cast mining pits.
Soils	Soil Horizon	Loss of soil horizon due to site clearance for construction of roads, buildings and plant infrastructure and utilities.
	Soil Fertility	Loss of soil fertility due to incorrect stockpiling of soils required for rehabilitation purposes.
	Soil Contamination	Contamination of soil due to spillages of raw material, ore and product during transport or due to spillages/seepages/leakages of contaminated water from pipes, canals, sumps and dams.
Land Capability	Land Capability (wetland, arable (dryland), arable (irrigation), grazing, wilderness, rehabilitated)	Changes in the land capability due to the construction and operation of mining and beneficiation infrastructure and processes.
Geology	Lithology	Changes in lithology due to mining from and backfilling into the open pits.
	Mineral Resources	Sterilization of mineral resources due to the construction of infrastructure on potential future mining areas.
Geochemistry	Acid Mine Generation (AMD)	Due to the geochemical inertness of the chrome ore, AMD is not expected to form – confirmed with testing.
Ground Water	Quantity (presence, flow, availability) of Ground Water	Depletion in the quantity of ground water available in the area due to the formation of cones of ground water level depression around the open mining pits, as well as around boreholes from which ground water is abstracted.
	Quality of Ground Water	Contamination of the ground water resource due to spillages of contaminated water from tanks, sumps, pipes and dams and/or the infiltration of soluble contaminants into the subsurface through the basins of piles, dumps, sumps and dams.
Surface Water	Quantity (presence, flow, availability) of Surface Water	Depletion in the quantity of surface water due to the capture of direct rainfall in the open pits, in quarries and dams, as well as the capture of contaminated storm water run-off in Pollution Control Dams.
	Quality of Surface Water	Contamination of the surface water resource due to contaminated run-off from "dirty areas" directly into the surface water resources and/or spillages of contaminated water from tanks, sumps, pipes and dams.
Plant Life	Habitat	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities.
	Bio-Diversity	Impact on, or destruction of Bio-Diversity due to a loss in habitat or as a result of contamination of soils or water.
	Red Data List Species (sensitive, threatened, endangered)	Potential threat to identified species at GMBS if construction and operational activities are not prevented in close proximity to the identified specimens.
Animal Life	Habitat	Impact on, or destruction of habitat due to vegetation habitat disturbance as well the construction and presences of

		fences.
	Bio-Diversity	Impact on, or destruction of Bio-Diversity due to habitat disturbance or as a result of water pollution, air pollution, noise and traffic.
	Red Data List Species (sensitive, threatened, endangered)	Potential threat to potential present threatened species at GMBS if construction and operational activities are not prevented in close proximity to identified specimens.
Wetlands	Habitat	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities.
	Functions and Services Provision (FSP)	Deterioration in FSP due to impact on wetland services provision attributes.
	Present Ecological State (PES)	Deterioration in PES due to impacts on habitat as well as wetland functions and services attributes.
Aquatic Ecosystems	Habitat (IHAS)	Impact on, or Destruction of Habitat due to impacts on habitat attributes such as water flow and water quality.
	Bio-Diversity (SASS5, FAII, Toxicity)	Impact on, or Destruction of Bio-Diversity due to impacts on habitat.
Air Quality	Gaseous Emissions	Deterioration in Ambient Air Quality due to gaseous emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the re-cycling/utilization of gas at these facilities.
	Particulate Matter	Deterioration in Ambient Air Quality due to particulate matter emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the cleaning of gas at these facilities.
	Dust Fallout	Deterioration in Ambient Air Quality due to dust generated by road transport, conveyor transport, crushing, handling, stockpiling and wind entrainment of raw materials, wastes and product as well as during construction and decommissioning activities.
Noise	Ambient Sound Level	Increase in the Ambient Sound Levels due to construction, mining, smelting, transport and decommissioning activities at GMBS.
	Noise	Generation of Noise from specific GMBS noise generating activities.
Traffic	Traffic Demand	Increase in Traffic Volumes due to road transport of personnel, raw materials, infrastructure and plant components, ore and final product.
Visuals	Visual Aspects (visibility, visual exposure, visual intrusion and landscape morphology)	Impacts on visibility, visual exposure, visual intrusion and landscape morphology due to the presence of infrastructure, as well the occurrence of particulate matter and dust emissions during the construction, operation and decommissioning of infrastructure and processes at GMBS.

Table 3.8(b): Potential Cumulative Impacts Associated with Current and New GMBS Activities

Environmental Component	Impact Category	Description of Nature of Potential Cumulative Impact/Issue	Potential Cumulative Impact Beyond GMBS Site (off site propagation) (Yes/No)
Socio Cultural	Geographic Processes (land use patterns) Demographic Processes (population composition e.g. age, gender, race) Institutional & Legal Processes (municipal services, public infrastructure, housing) Cultural Processes (social, cultural and traditional practices)	Socio-cultural Impacts caused by the GMBS operations which potentially include changes in land use patterns, changes in population numbers and profile, changes in the demand for municipal services, transport and housing, as well as changes in the cultural dynamics of the area due to influx of people with different cultural and social backgrounds.	**Yes**
Heritage Resources	Historical and Cultural (places, buildings, structures, burial grounds, graves)	Damage to, or destruction of graveyards and graves due to construction, mining and decommissioning activities.	**No**
Socio Economic	Economic Efficiency (labour, employment, output and growth) Economic Equity (poverty, income) Economic Stability (diversity, resource use)	Socio-economic cultural Impacts caused by the GMBS operations which potentially include positive changes in economic output and regional exports, positive changes in employment, tax income, increased social spending and increased incomes, as well as positive changes in economic stability through diversification.	**Yes**
Land Use	Beneficial Land Use (derelict, vacant, residential, industrial, mining, agricultural, recreational, wilderness, conservation)	Changes in land use due to the transformation of the agricultural land use to mining and smelting.	**Yes**
Infrastructure	Services (roads, pipelines, powerlines, raillines, telecommunications)	Damage to roads due to increased heavy transport of ore and product to and from GMBS.	**Yes**
Topography	Morphology Stability	Creation of dangerous/unstable excavations due to mining, as well as dangerous/unstable mounds/piles/dumps due to stockpiling of soil, raw materials and product and due to disposal of waste onto land as well as the creation of areas prone to surface subsidence due to backfilling of the open cast mining pits.	**No**

Soils	Soil Horizon Soil Fertility Soil Contamination	Loss of soil horizon due to site clearance for construction of roads, buildings and plant infrastructure and utilities, loss of soil fertility due to incorrect stockpiling of soils required for rehabilitation purposes and the contamination of soil due to spillages of raw material, ore and product during transport or due to spillages, seepages, and/or leakages of contaminated water from pipes, canals, sumps and dams.	**No**
Land Capability	Land Capability (wetland, arable (dryland), arable (irrigation), grazing, wilderness, rehabilitated)	Changes in the land capability due to the construction and operation of mining and beneficiation infrastructure and processes.	**Yes**
Geology	Lithology Mineral Resources	Sterilization of mineral resources due to the construction of infrastructure on potential future mining areas or activities which could influence access to future mining.	**Yes**
Geochemistry	Acid Mine Generation (AMD)	Due to the geochemical inertness of the chrome ore, AMD is not expected to form – confirmed with testing.	**No**
Ground Water	Quantity (presence, flow, availability) of Ground Water	Depletion in the quantity of ground water available in the area due to the formation of cones of ground water level depression around the open mining pits, as well as around boreholes from which ground water is abstracted.	**Yes**
	Quality of Ground Water	Contamination of the ground water resource due to spillages of contaminated water from tanks, sumps, pipes and dams and/or the infiltration of soluble contaminants into the subsurface through the basins of stockpiles, dumps, sumps and dams.	**No**
Surface Water	Quantity (presence, flow, availability) of Surface Water	Depletion in the quantity of surface water due to the capture of direct rainfall in the open pits, in quarries and dams, as well as the capture of contaminated storm water run-off in Pollution Control Dams.	**Yes**
	Quality of Surface Water	Contamination of the surface water resource due to contaminated run-off from "dirty areas" directly into the surface water resources and/or spillages of contaminated water from tanks, sumps, pipes and dams.	**Yes**
Plant Life	Habitat Bio-Diversity Red Data List Species (sensitive, threatened, endangered)	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities, impact on, or destruction of Bio-Diversity due to a loss in habitat or as a result of contamination of soils or water as well as the potential threat to identified species at GMBS if construction and operational activities are not prevented in close proximity to the identified specimens.	**No**
Animal Life	Habitat Bio-Diversity Red Data List Species (sensitive, threatened, endangered)	Impact on, or destruction of habitat due to vegetation habitat disturbance as well the construction and presences of fences, their impact on, or destruction of Bio-Diversity due to habitat disturbance or as a result of water pollution, air pollution, noise and traffic, as well as the potential threat to potential present threatened species at GMBS if construction and operational activities are not prevented in close proximity to identified specimens.	**No**

Wetlands	Habitat Functions &Services Provision (FSP) Present Ecological State (PES)	Impact on, or destruction of habitat due to site clearance for construction of roads, buildings and plant infrastructure and utilities, the deterioration in FSP due to impact on wetland services provision attributes, as well as the deterioration in PES due to impacts on habitat as well as wetland functions and services attributes.	**Yes**
Aquatic Ecosystems	Habitat (IHAS) Bio-Diversity (SASS5, FAII, Toxicity)	Impact on, or Destruction of Habitat due to impacts on habitat attributes such as water flow and water quality, as well as the impact on, or Destruction of Bio-Diversity due to impacts on habitat.	**Yes**
Air Quality	Gaseous Emissions Particulate Matter Dust Fallout	Deterioration in Ambient Air Quality due to gaseous emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the re-cycling/utilization of gas at these facilities, the deterioration in Ambient Air Quality due to particulate matter emissions at the pelletizing/sinter plant and the smelter, or the Improvement in Ambient Air Quality as a result of the cleaning of gas at these facilities as well as the deterioration in Ambient Air Quality due to dust generated by road transport, conveyor transport, crushing, handling, stockpiling and wind entrainment of raw materials, wastes and product as well as during construction and decommissioning activities.	**Yes**
Noise	Ambient Sound Level	Increase in the Ambient Sound Levels due to construction, mining, smelting, transport and decommissioning activities at GMBS.	**Yes**
Traffic	Traffic Demand	Increase in Traffic Volumes due to road transport of personnel, raw materials, infrastructure and plant components, ore and final product.	**Yes**
Visuals	Visual Aspects (visibility, visual exposure, visual intrusion and landscape morphology)	Impacts on visibility, visual exposure, visual intrusion and landscape morphology due to the presence of infrastructure, as well the occurrence of particulate matter and dust emissions during the construction, operation and decommissioning of infrastructure and processes at GMBS.	**Yes**

4 CONSIDERATION OF ALTERNATIVES

The Scoping and EIA Process followed for this project comprises four aspects:

- A Scoping and EIA Process in support of the EMPR Addendum as required in terms of the provisions of the MPRDA and which is required at GMBS to reflect changes in mining related activities.

  The changes relate to the fact that some of the activities foreseen in the original and now approved EMPR, were, due to essentially practical considerations, implemented and operated differently from what was originally proposed. The Addendum will therefore ensure that the EMPR is fully aligned with activities as they are currently present on site. Alternatives were considered during compilation of the original EMPR and those will merely be listed in this report. Full details on the alternatives considered are contained in section 3.2 of the approved EMPR, a copy of which is attached as **APPENDIX 3.2(A)** to this report.

- A Scoping and EIA Process in support of a several NEMA Listed Activities as triggered by the following:

  - New Access Road to Slimes Dam and Slag Dump
  - New Lapa Pond
  - New Storm Water Drainage Canals
  - Extension of Temporary Waste Storage Facilities
  - Upgrade of Salvage Yard
  - New Slag Dump
  - New Slag Dump Pollution Control Dam
  - New Slurry/Slimes Dam
  - Upgrade of Dust Control at Raw Materials Proportioning Plant
  - Upgrade of Scrubbers System at Furnaces (tap hole fume extraction system)

  Alternatives related to these activities will be discussed below.

- A Scoping and EIA Process in support of a NEMWA Waste License Application for listed Waste Management Activities as relevant to:

  - Extension of Temporary Waste Storage Facilities
  - Upgrade of Salvage Yard
  - New Slag Dump
  - New Slurry/Slimes Dam

Alternatives related to these activities will be discussed below.

As far as the different alternatives to be considered, reference is made to the definition for "**alternatives**" as contained in the Environmental Impact Assessment Regulations – GNR 543 of 18 June 2010.

"**alternative**", *in relation to a proposed activity, means different means of meeting the general purpose and requirements of the activity, which may include alternatives to –*

(a) the property on which or location where it is proposed to undertake the activity;
(b) the type of activity to be undertaken;
(c) the design or layout of the activity;
(d) the technology to be used in the activity;
(e) the operational aspects of the activity;
(f) the option of not implementing the activity.

The DMR Guideline for the Compilation of a Scoping Report, lists four alternatives to be considered:

- alternative land uses
- alternative land developments
- alternative operational aspects
- consequences of the no-go option

In order to support the DMR Guideline, as well as to include all defined alternatives, the following defined alternatives will be dealt with under "alternative operational aspects" in this report:

- the location where it is proposed to undertake the activity;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity;

The option of not implementing the activity will be dealt with under the heading of "consequences of the no-go option".

4.1 ALTERNATIVE LAND USES (property on which activity is undertaken)

All the existing and new activities which form the material content for the applications in support of which this Scoping and EIA process is conducted, occur on land on which mining and ferro-chrome smelting have both been authorized to operate. The assessment of alternative land uses is therefore not relevant to this application as the current land use will not be compromised by any of the existing or new activities associated with the current application process.

However, a Comparative Land Use Assessment has been commissioned to explore alternative land uses for the post closure scenario. The findings of this Comparative Land Use Assessment will be reported on in the EIA Phase of the project – EIAR Chapter 9.

4.2 ALTERNATIVE LAND DEVELOPMENTS (type of activity undertaken)

Apart from agricultural and mining land development, the land in proximity to GMBS is also used extensively for both rural and peri-urban settlements, both with their associated social and economic activities.

However, as already stated, all the existing and new activities which form the material content for the applications in support of which this Scoping and EIA process is conducted, occur on land on which mining and ferro-chrome smelting are both presently being conducted. The assessment of alternative land developments is therefore also not relevant to this application.

The issue of alternative land developments will, however, also be dealt with in the Comparative Land Use Assessment which has been commissioned to explore alternative land uses and developments for the post closure scenario. The findings of this Comparative Land Use Assessment will be reported on in the EIA Phase of the project – EIAR Chapter 9.

4.3 ALTERNATIVE OPERATIONAL ASPECTS

Alternative operational aspects at GMBS relate to:

4.3.1 Alternatives Considered for Existing Activities (Approved EMPR)

- The mining method
- The type, size and technology of the beneficiation (ferrochrome smelting) plant
- Access routes to mine and smelter
- Transportation method for slag
- Power supply
- Water supply
- Site selection for concentrator (spiral) and jig plants
- Residue disposal options for clarifier slurry, spiral plant tailings, jig plant tailings and slag from the smelter and the metal extraction plant
- Domestic and industrial waste disposal
- Housing of workers
- Land use options after closure
- Alternatives to river diversions

Details pertaining to these alternatives considered are contained in section 3.2 of the approved EMPr, a copy of which is attached as **APPENDIX 3.2(A)** to this report.

4.3.2 Alternatives Considered for New Activities (Approved EMPR)

Operational Alternatives were considered for the following proposed new activities/upgrades/extensions:

- New Access Road to Slimes Dam and Slag Dump
- New Lapa Pond
- New Storm Water Drainage Canals
- Extension of Temporary Waste Storage Facilities
- Upgrade of Salvage Yard
- New Slag Dump
- New Slag Dump Pollution Control Dam
- New Slurry/Slimes Dam
- Upgrade of Dust Control at Raw Materials Proportioning Plant
- Upgrade of Scrubbers System at Furnaces (tap hole fume extraction system)

The alternatives considered in Table 4.3.2(a) include:

- the location where it is proposed to undertake the activity;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity;

Table 4.3.2(a): Alternatives Considered for Proposed New GMBS Activities

ACTIVITY	LOCATION/SITE	DESIGN/LAYOUT	TECHNOLOGY	OPERATIONAL ASPECTS
New Access Road to Slimes Dam and Slag Dump.	Localities of roads dictated by localities of new Slimes Dam and Slag Dump.	Road design dictated by type of traffic. For Slimes Dam only construction and maintenance. For Slag Dump, construction, maintenance and slag transport during operation. Minimum width of 4 m indicated.	Gravel roads versus tar roads. Cost of construction and maintenance indicate gravel roads as preferred technology.	Tar roads require less ongoing maintenance and no dust suppression. However, tar road maintenance is much more expensive than ongoing gravel road maintenance and dust suppression on gravel roads.
New Lapa Pond	Location dictated by locality of stream as well as by existing infrastructure at and around lapa.	Design dictated by stream morphology as well as by local topographic and hydrological considerations.	Earth wall versus concrete wall. Earth wall will suffice and has lower environmental footprint than concrete wall.	Operates as a natural system – rainfall runoff dependent.
New Storm Water Drainage Canals	Location of canals determined by need to separate clean and dirty areas as per GNR 704.	Design and layout governed by site storm water run-off characteristics (locality, volumes, flow velocities, etc.).	Concrete versus earth plastic lined. Earth plastic lined is cheaper, lower environmental footprint and more durable in saline environments.	Operates as a natural system – rainfall runoff dependent.
Extension of Temporary Waste Storage Facilities	Location dictated by source of waste.	Determined by type of receptacle – waste bins and waste skips.	To fit in with current systems of waste recycling and final disposal.	To fit in with current systems of waste recycling and final disposal.
Upgrade of Salvage Yard	Existing facility – no site alternatives.	To fit in with current systems of waste recycling and final disposal.	To fit in with current systems of waste recycling and final disposal.	To fit in with current systems of waste recycling and final disposal.
New Slag Dump	Site selection dictated by proximity to existing infrastructure for slag handling and recovery – close to metal extraction plant – minimize transport distances. Available site already severely compromised from surface water, wetlands and aquatic ecosystems perspective. Located on Glencore Merafe Venture property.	Design and layout dictated by site geometry, disposal method and DWA and DEA requirements for waste disposal by landfill.	Dictated by DWA and DEA requirements for waste disposal by landfill.	Dictated by DWA and DEA requirements for waste disposal by landfill.
New Slag Dump Pollution Control Dam	Location dictated by topographical, hydrological, dirty water catchment considerations as well as by locality of new slag dump.	Design and layout dictated by site geometry and DWA and DEA requirements for leachate and affected storm water run-off management.	Dictated by DWA Best Practice Guidelines and by DEA requirements for leachate control at waste landfill sites.	Dictated by DWA Best Practice Guidelines and by DEA requirements for leachate control at waste landfill sites.
New Slurry/Slimes Dam	Site selection dictated by proximity to existing infrastructure for slurry handling and disposal – adjacent to existing Slurry/Slimes Dam.	Design and layout dictated by site geometry and DWA and DEA requirements for waste management.	Dictated by DWA and DEA requirements for waste disposal by landfill.	Dictated by DWA and DEA requirements for waste disposal by landfill.
Upgrade of Dust Control at Raw Materials Proportioning Plant	Location dictated by existing infrastructure at which additional dust control is required.	Dictated by existing infrastructure and processes into which it has to fit seamlessly.	Dictated by existing infrastructure and processes into which it has to fit seamlessly.	Dictated by existing processes into which it has to fit seamlessly.
Upgrade of Scrubbers System at Furnaces (tap hole fume extraction system)	Location dictated by existing infrastructure at which additional dust control is required.	Dictated by existing infrastructure and processes into which it has to fit seamlessly.	Dictated by existing infrastructure and processes into which it has to fit seamlessly.	Dictated by existing processes into which it has to fit seamlessly.

4.4 CONSEQUENCES OF THE NO-GO OPTION

4.4.1 Existing Mine and Smelter Activities

Consequences of the no-go option for closure of the mine and smelter is obvious. The closure of the mine, which is now occurring, is resulting in a significant loss to the socio-cultural and socio-economic contribution into the area. Closure of the smelter will further aggravate these negative socio-cultural and socio-economic impacts.

4.4.2 Proposed New Activities

The proposed new activities are all required to prolong the life of the smelter and to manage potential negative environmental impacts. The negative consequences of their no-go options are obvious.

5 PROJECT PLANNING AND DEVELOPMENT

5.1 PLANNING OPTIONS STEMMING FROM CONSULTATION

As far as the existing activities are concerned, the consideration of planning options stemming from consultation is not really relevant. However, as far as the new proposed activities are concerned, this Scoping Phase of the project will be used to supply I&AP's as well as authorities with the relevant project planning information as currently available and as contained in Chapter 3 of this report.

The Public and Authority consultation to be embarked upon will afford any stakeholder the opportunity to make inputs into the planning for these activities.

All comments, views and suggestions as pertaining to any planning options for the proposed new activities will be considered for inclusion into the project description that will be contained in Chapter 3 of the Final Scoping Report and Plan of Study.

A paragraph confirming that this has been done will be added to this section 5.1 in the Final Scoping Report and Plan of Study, after due consultation with relevant stakeholders.

5.2 DYNAMIC PLANNING AND DEVELOPMENT PROCEDURE

The Glencore Merafe Venture is a dynamic entity and will consider the optimal continuation of its Boshoek Mine and Smelter Operations on an ongoing basis. As with most mining and beneficiation companies, the business dynamics depend to a large degree on changing market conditions (demand for and price of product) and opportunities (new markets and possible new products).

The Glencore Merafe Venture Boshoek Mine and Smelter has, through the application for the extensions, upgrades and additions, all of which pertain to the support of ongoing sustainable operations at the Boshoek mine and smelter, demonstrated that they are fully cognizant of the fact that Environmental Considerations play a defining role in the planning, development and implementation of their business activities.

6 SCOPING PUBLIC ENGAGEMENT PROCESS

6.1 DESCRIPTION OF INFORMATION PROVIDED TO I&AP's

A Background Information Document (BID) for distribution to I&AP's, notification letters to I&AP's, newspaper advertisements as well as site notices were compiled by JMA Consulting. The BID and Comment Page used for registration of new I&AP's was translated into Setswana.

Copies of the BID, the notifications, the newspaper advertisements as placed in the newspapers, as well as the site notices are provided in the Draft Public Participation Programme Report attached as **APPENDIX 6 (A)** to this report.

6.2 LIST OF I&AP's ACTIVELY CONSULTED

A formal I&AP Data Base was compiled for the Glencore Merafe Venture Operation - Boshoek Mine and Smelter project. This data base was continually updated throughout the process and a copy of the current I&AP data base is attached as **APPENDIX 6 (A).**

6.3 I&AP VIEWS ON EXISTING ENVIRONMENT

The information pertaining to this section will be included in this report after the Scoping Phase Public Meeting, Focus Group Meetings and the Scoping Phase Public Review Period have been concluded. It will be contained in section 2.1 of this Report.

6.4 I&AP VIEWS ON IMPACTS

The information pertaining to this section will be confirmed after the Scoping Phase Public Meeting, Focus Group Meetings and the Scoping Phase Public Review Period have been concluded. It will be contained in section 3.7 of this Report.

6.5 OTHER I&AP CONCERNS RAISED

All questions asked, issues raised, concerns expressed, and comments made by Authorities and I&AP's throughout the project, either by way of verbal statement, written comment and/or formal letters addressed to the EAP or Applicant, will be captured in the Issues and Response Register.

The formal responses to each of these will be compiled by the EAP in collaboration with the relevant Specialists and the Applicant. The responses will be fully recorded in the Issues and Response Register.

An updated Issues and Response Register will be available in the Draft Public Participation Programme Report attached as **APPENDIX 6 (A)**

6.6 MINUTES OF CONSULTATION MEETINGS

Minutes of all consultation meetings conducted with Authorities, Focus Groups and I&AP's, including the first Scoping Phase Public Meeting of 16 April 2014, are attached in the Draft Public Participation Programme Report attached as **APPENDIX 6 (A)** to this report.

6.7 OBJECTIONS RECEIVED

The information pertaining to this section will be included in this report after the Scoping Phase Public Meeting, Focus Group Meetings and the Scoping Phase Public Review Period have been concluded. It will be contained in section 2.1 of this Report.

7 PLAN OF STUDY

7.1 TASKS FOR THE EIA PROCESS

7.1.1 EIA Stage 3: Environmental Impact Assessment

- Commence to Implement Plan of Study
- Continue Public Participation Process
- Conduct Specialist Studies
- Prepare EIA Report (EIAR comprising EIA, EMPr as per Regulations and Guidelines)
- EIA/EMP Public Meeting
- Make EIAR available for Review
- Capture and Consider Comments from I&AP's and Relevant Authorities
- Finalize and Submit EIAR to I&AP's and Authorities

7.1.2 EIA Stage 4: Consideration and Decision

- Authority Review & Decision
- Notification of Decision on the EIAR
- Granting of Environmental Authorization
- Inform I&AP's of Decision/Approval and of Opportunity to Appeal

7.1.3 EIA Stage 5: Appeal

- Appellant to give notice of intention to Appeal to Authority and Applicant
- Consultation between Applicant and Appellant to Resolve Issues
- Submission of appeal to Authority and Applicant
- Submission of Responding Statement from Respondent/Applicant to Authority and Appellant
- Submission of Answering Statement by Appellant to Authority and Applicant
- Acknowledgment of all by Authority within 10 days
- Processing of Appeal
- Decision on Appeal
- Notification of Decision on Appeal to Appellant and Respondents by Authority

7.2 PROPOSED SPECIALIST STUDIES OR SPECIALIZED PROCESSES

The first step in designing the Plan of Study was to identify all Specialist Studies and Description of Specialized Processes that would be required to support the Environmental Authorization Applications for GMBS.

After due consideration and consultation, the EAP Project team therefore now propose that the specialist inputs listed in Table 7.2(a) be generated in support of the EIA and EMPr. The inputs will be generated as stand alone specialist reports, which will be compiled in a specific format in order to give compliance with regulatory conditions.

The following report structure will be used:

1. Introduction
2. Details of Specialist
3. Declaration of Independence
4. Scope of Work
5. Legal Framework
6. Investigative Methodology
7. Assumptions
8. Base Line Description
9. Impact Assessment
10. Management Objectives
11. Management Measures and Costing
12. Monitoring Plan

The Specialist Studies, together with specific specialist inputs related to specialized processes, already commissioned for the GMBS Project, include the following:

Table 7.2(a): Summary of Specialist Inputs for the GMBS project

Environmental Component	Specialist Consultant	Specialist Studies and Specialized Processes
Cultural Aspects	Master Q Research	Cultural Base Line Assessment Cultural Impact Assessment Cultural Management Plan
Heritage Aspects	J C C Pistorius	Phase I Heritage Impact Assessment
Land Use	Southern Economic Development Services	Comparative Land Use Assessment
Socio-Economic Aspects	Southern Economic Development Services	Socio-Economic Base Line Assessment Socio-Economic Impact Assessment Socio-Economic Management Plan
Infrastructure Aspects Roads	ITS Engineers	Transport Base Line Assessment including current Road Conditions, Road Safety Assessment and Traffic Volume Assessment Transport Impact Assessment Transport Management Plan
Meteorology/Climate	Inprocon CC & EnviroNGaka	Meteorological Assessment (Rainfall and Evaporation) & Meteorological Assessment (Wind Fields)
Topography	JMA Consulting	Topography Base Line Assessment (Aireal Photography, Contour Mapping, View Shed Analyses) Topography Impact Assessment Topography Management Plan

Environmental Component	Specialist Consultant	Specialist Studies and Specialized Processes
Soils, Land Capability & Land Use	Red Earth CC	Soil/Land Type Distribution Assessment Land Capability Assessment Current Land Use Assessment Soil, Land Capability and Land Use Impact Assessment Soil Utilization and Rehabilitation Plan
Geology Geochemistry Palaeontology	JMA Consulting	Geological Base Line Description including aspects pertinent to Mineralogy, Lithology, Stratigraphy, Ore Body Description, Structural Aspects and Geochemistry Overburden Geochemical Classification Materials Characterization Waste Classification Paleontological Impact Statement
Ground Water	JMA Consulting	Aquifer Physical, Hydraulic, Dynamic and Hydrochemical Assessment Ground Water Use Assessment Aquifer Classification Ground Water Balance Ground Water Salt Balance Ground Water Impact Assessment (Includes modelling) Ground Water Management Plan Ground Water Monitoring Plan
Surface Water	Inprocon CC	Flood Lines Surface Water Quality Surface Water Use Surface Water Balance Surface Water Salt Balance Overall Mine Water Balance Overall Mine Salt Balance Surface Water Impact Assessment Surface Water Monitoring Plan
Plant Life	Scientific Aquatic Services CC	Floral Habitat Assessment Floral Diversity Assessment Identification of Red Data Species Identification of Protected/Endangered Species Floral Sensitivity Assessment Floral Impact Assessment Floral Management Plan
Animal Life	Scientific Aquatic Services CC	Faunal Habitat Assessment Faunal Diversity Assessment Identification of Red Data Species Identification of Protected/Endangered Species Faunal Sensitivity Assessment Faunal Impact Assessment Faunal Management Plan
Wetlands	Scientific Aquatic Services CC	Wetland Delineation Wetland Classification Wetland Functional Assessment Present Ecological State (PES) Assessment Ecological Importance & Sensitivity (EIS) Assessment Wetland Impact Assessment Wetland Management Plan
Aquatic Ecosystems	Scientific Aquatic Services CC	Water Quality Assessment Aquatic Macro-invertebrates Assessment (SASS5) Habitat Integrity Assessment (HIA) Aquatic Impact Assessment Aquatic Management Plan Bio-monitoring Plan

Environmental Component	Specialist Consultant	Specialist Studies and Specialized Processes
Air Quality	EnviroNGaka	Ambient Air Quality Assessment Air Quality Dispersion Assessment Air Quality Management Plan Air Quality Monitoring Plan
Noise	MENCO	Ambient Noise Assessment Noise Source Assessment Sensitive Receptor Identification Noise Propagation Assessment Noise Management Plan Noise Monitoring Plan
Traffic	ITS Engineers	Transport Base Line Assessment including current Road Conditions, Road Safety Assessment and Traffic Volume Assessment Transport Impact Assessment Transport Management Plan
Visual	Zeli Design	Contextual Analyses Photographic Visibility Assessment Visual Impact Assessment (VIA) Visual Management Plan
Civil Engineering Designs	Inprocon	Storm Water Management Measures New Slag Dump New Slag Dump PCD New Slurry Dam
Draft EMP	JMA Consulting	Management Objectives Management Measures Monitoring Plan Financial Provisioning Compliance/Performance Auditing
Public Participation Program	JMA Consulting	Pre-Application Phase Application Phase Scoping Phase EIA Phase Public Participation Programme Report ROD Information Phase Appeal Phase

7.2.1 Base Line Studies

The identified specialists were commissioned to conduct the required base line studies in support of this Draft Scoping Report as it is a regulatory requirement to describe the current environmental situation for inclusion in the Draft and Final Scoping Reports.

Summaries of the outcomes of the base line studies conducted to date is documented in Chapter 2 of this Report.

Base Line descriptions were compiled for Cultural Aspects, Heritage Aspects, Socio-Economic Aspects, Infrastructure Aspects (Roads), Meteorology, Topography, Soils, Land Capability and Land Use, Geology, Geochemistry, Palaeontology, Ground Water, Surface Water, Plant Life, Animal Life, Wetlands, Aquatic Ecosystems, Air Quality, Noise, Traffic and Visual Aspects.

I&AP's, as well as authorities can now review the outcomes of the base line studies and either accept the range and extent of the studies, or ask for, or recommend, additional work. If any additional work is required, this will be conducted at the outset of the EIA Phase. The updated base line work will be reported on in the EIAR.

7.2.2 Specialist Studies

The I&AP's, as well as the authorities, can either accept the proposed specialist studies listed in **section 7.2**, or ask for additional aspects to be assessed during the EIA Phase. If no requests of recommendations are received during this Scoping Phase, the Specialist Studies and Specialized Processes listed in **section 7.2** will become the Terms of Reference for the EIA Phase.

If requests or recommendations are received, they will be added to the actions listed in **section 7.2**.

7.3 DETERMINATION OF IMPACT SIGNIFICANCE AND RISK

The following Impact Significance Rating Protocol developed by JMA Consulting will be used for compilation of the Environmental Impact Assessment Report:

The assessment matrix contains all the critical elements for Environmental Impact Assessment as proposed in the formal DEAT Protocol for Environmental Impact Assessment – *DEAT (2002) Impact Significance, Information Series 5, Department of Environmental Affairs and Tourism (DEAT), Pretoria.*

The protocol comprises a series of steps in order to systematically go through a process of:

1. Identifying and Quantifying the **Significance** of an impact. **Step 1**.
2. Determining the **Probability** of an impact happening. **Step 2.**
3. Determine the **Risk Level** attached to the impact. **Step 3.**

The identification process is conducted by each individual specialist and then the Step 1 Significance Assessment is completed based on the specialist's interpretation. The interpretation is converted into the numerical rating contained in Table 7.3(a), and an Impact Significance Total is calculated. The Significance Total is converted into a Significance S Number, for population of the overall Risk Matrix. The components considered to arrive at the Significance Rating (S Number) are as follows:

- Spatial extent of the impact
- Intensity or Severity of the impact
- Duration of the impact
- Unacceptability of the impact
- Mitigatory difficulty of the impact

The sum of the numerical ratings for the above components represents the Significance Total.

Table 7.3 (a): Impact Significance Assessment Criteria

CRITERIA FOR DETERMINING SIGNIFICANCE		
Criteria	**Definition**	**Points**
Spatial Extent		
High	Widespread. Far beyond site boundary. Regional/national/international scale.	3
Medium	Beyond site boundary. Local area.	2
Low	Within site boundary.	1
Intensity or Severity		
High	Disturbance of pristine areas that have important conservation value. Destruction of rare or endangered species.	3
Medium	Disturbance of areas that have potential conservation value or are of use as a resource. Complete change in species occurrence or variety.	2
Low	Disturbance of degraded areas that have little conservation value. Minor change in species occurrence or variety.	1
Duration		
High (Long term)	Permanent. Long Term (more than 20 years). Beyond decommissioning.	3
Medium (Medium term)	Reversible over time. Lifespan of the project. Medium Term (3-20 years). Operational Phase	2
Low (Short term)	Quickly reversible. Less than the project lifespan. Short Term (0 – 3 years). Construction Phase	1
Un-Acceptability		
High (Unacceptable)	Abandon project in part or in its entirety. Redesign project to remove impact or avoid impact.	3
Medium (Manageable)	With regulatory controls. With project proponent's commitments.	2
Low (Acceptable)	No risk to public health.	1
Mitigatory Difficulty		
High:	Little or no mechanism to mitigate negative impacts.	3
Medium:	Potential to mitigate negative impacts. However, the implementation of mitigation measures may still not prevent some negative effects.	2
Low:	High potential to mitigate negative impacts to the level of insignificant effects.	1

Once a Significance Total has been calculated for a specific impact, an Impact Significance Number is determined (S-number) as completion of **Step 1**, based on the Table below:

Table 7.3 (b): Assignment of Impact Significance S-Number

Significance Total	Significance S-Number
15	S5
12 - 14	S4
9 - 11	S3
6 - 8	S2
5	S1

Table 7.3 (c): Explanation for Impact Significance Rating

EXPLANATION FOR IMPACT SIGNIFICANCE RATING		
Impact Significance	**Explanation**	**Points**
Very High	Of the highest order possible within the bounds of impacts that could occur. In the case of adverse impacts, there is no possible mitigation that could counteract the impact, or mitigation is difficult, expensive, time-consuming or a combination of these. Social, cultural and economic activities of communities are disrupted to such an extent that these come to a halt. In the case of beneficial impacts, the impact is of a substantial order within the bounds of impacts that could occur.	**>14**
High	Impact is high and substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is possible but expensive. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action will be required. In the case of beneficial impacts, the project out performs other alternatives in terms of time, cost and effort.	**12-14**
Medium	Impact is real, but not substantial in relation to other impacts that might take effect within the bounds of those that could occur. In the case of adverse impacts, mitigation is both feasible and fairly easily possible. Social, cultural and economic activities of communities are changed, but can be continued (albeit in a different form). Modification of the project design or alternative action may be required. In the case of beneficial impacts, other means of achieving this benefit are about equal in time, cost and effort.	**9-11**
Low	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts, mitigation is either easily achieved or little will be required, or both. Social, cultural and economic activities of communities can continue unchanged. In the case of beneficial impacts, alternative means of achieving this benefit are likely to be easier, cheaper, more effective and less time-consuming.	**6-8**
Insignificant	Although an impact may exist it is rated as insignificant and is not deemed to warrant any specific management measures or even monitoring.	**<6**

During **Step 2** the Probability of an impact occurring/re-occurring is assessed.

Table 7.3 (d): Probability of an Impact Occurring (P-Value)

Likelihood Descriptors		Probability Intervals	Likelihood Definitions
P1	**Unlikely**	**0 - 25%**	**Less than 25% probability that a specific impact will occur.**
P2	**Possible**	**25 - 50%**	**25% - 50% probability that a specific impact will occur.**
P3	**Probable**	**50 - 75%**	**50% - 75% probability that a specific impact will occur.**
P4	**Highly Probable**	**75 - 100%**	**More than 75% probability that a specific impact will occur.**

Finally, the overall impact is quantified in a Risk Matrix, by combining the S-Number (determined in **Step 1**) with the P-Value (determined in **Step 2**) in the Risk Matrix provided below (**Step 3**). The Risk Matrix also provides and Action Table to indicate and allocate responsibility. The matrices shown above make use of generic criteria in order to systematically identify, predict, evaluate and determine the significance of impacts resulting from project construction, operation and decommissioning. In order to enhance the accuracy and integrity of the outcome of the Impact Assessment, the suite of potential environmental impacts (to both the natural and human environments) identified in the EIA, were as far as possible **quantified during the various specialist studies conducted.**

Table 7.3 (e): Risk Classification Table

RISK MATRIX					
	Significance S1	**Significance S2**	**Significance S3**	**Significance S4**	**Significance S5**
Probability P4	**Low Risk**	**Low Risk**	**Moderate Risk**	**High Risk**	**High Risk**
Probability P3	**Very Low Risk**	**Low Risk**	**Moderate Risk**	**Moderate Risk**	**High Risk**
Probability P2	**Very Low Risk**	**Very Low Risk**	**Low Risk**	**Low Risk**	**Moderate Risk**
Probability P1	**Very Low Risk**	**Very Low Risk**	**Very Low Risk**	**Very Low Risk**	**Low Risk**

7.4 COMPILE EIA REPORTS

EIA reports will be compiled by JMA for DMR, DEA and NW-DEDET. The reports will be structured and compiled to give compliance with the MPRDA Regulations and the NEMA EIA Regulations respectively. Draft reports will be made available to the relevant authorities and I&AP's for comment prior to finalization for submission to the lead authorities for consideration and approval.

7.5 COMPILE DRAFT EMP's

EMP reports will be compiled by JMA for DMR, DEA and NW DEDET. The reports will be structured and compiled to give compliance with the MPRDA Regulations and the NEMA EIA Regulations respectively. Draft EMP reports will be made available to the relevant authorities and I&AP's for comment prior to finalization for submission to the lead authorities for consideration and approval.

7.6 CONSULTATION TIME LINE WITH COMPETENT AUTHORITIES

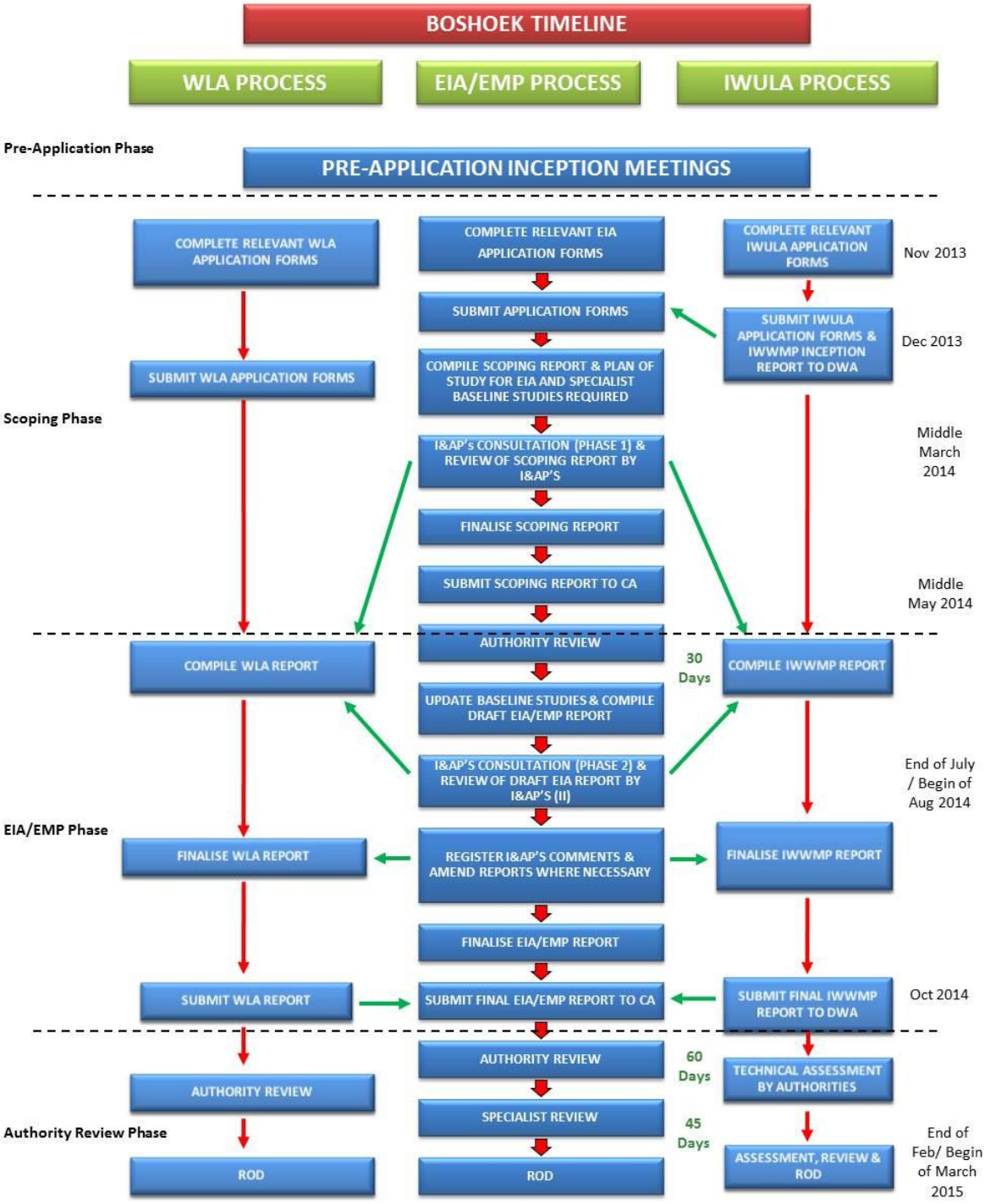


Figure 7.6(a): Process and Authority Consultation Time Line

7.7 PROPOSED PLAN FOR EIA PHASE PUBLIC PARTICIPATION

Please refer to section 6.2 of this document for details regarding the extent of the Public Participation Process followed for the scoping phase of the EIA. The Public Participation Process for the EIA phase will follow more or less the same route and be of similar dimensions and therefore no redundant repetition of facts, which have already been stated in Section 6, will be repeated in this section.

7.7.1 The Scope of the Public Participation Programme (EIA Phase)

The scope of the Public Participation Programme during the EIA phase of the project will be along the same dimensions and considerations as the one that was conducted during the Scoping Phase of the EIA.

7.7.2 Identification/Registration of Authorities and I&AP's

An extensive list/register of I&AP's and authorities will have been compiled by this phase and the same database will be used for communication with I&AP's during the EIA phase.

However should any person identified, or should any person request to be registered as an I&AP to the project, at any stage of the project, he/she will be given the opportunity to do so and be notified of the project accordingly.

7.7.3 Notification of Authorities and I&AP's

Notification of I&APs and authorities on the progress of the project will be done according to the regulations 54 – 57 as set out in GNR 543 which includes notification letters, press advertisements, and site notices. These notices and advertisements will inform the I&AP's on details of the Public Meeting during the EIA phase.

7.7.4 Information to Authorities and I&AP's

Information included in the correspondence and consultation with I&AP's and authorities will include updated information generated for the proposed project. Also it will include information and details of the EIA phase public participation process.

7.7.5 Meetings with Authorities and I&AP's

Meetings with authorities during the EIA phase will be organized on request. The I&AP's will be invited to attend a Public Meeting during which the results of the environmental impact assessment and proposed management and mitigation measures will be communicated to them. Should some of the I&AP's wish to be consulted in a Focus Group format, such meetings will be scheduled and conducted.

7.7.6 Obtaining Comments from Authorities and I&AP's

All I&APs will receive the opportunity to comment on any of the information generated during the EIA/EMP Process, in the review periods of the various documentation, which will be submitted to the relevant authorities. This includes the Draft EIA Report and Draft EMP which will be submitted to DMR and DEDET.

The IWWMP which will be submitted to the DWA is not usually presented for formal public review due to the complex and technical nature of the report, but should any I&AP wish to view this report, it will be made available to them. Irrespective of this fact the results of the IWWMP will be discussed with the I&AP's during the EIA Phase Public Meeting and possible Focus Group Meetings.

7.7.7 Responding to Comments from Authorities and I&AP's

All comments that are raised by I&AP's will be incorporated into an I&AP Comments Register. JMA will then address each and every issue or comment raised. Once this is completed the I&AP's will be notified of how their issue or comment have been addressed and the finalized report will be submitted to the relevant authorities.

7.7.8 Public Participation Report

A detailed Public Participation Report, containing information of all the actions that were undertaken with regard to the Public Participation Process (for both phases, Scoping and EIA), will be compiled for this project and be submitted along with the final reports to the relevant competent authorities.

8 IDENTIFICATION OF THE REPORT

Herewith I, the person whose name and identity number is stated below, confirm that I am the person authorized to act as representative of the applicant in terms of the resolution submitted with the application, and confirm that the above report comprises the results of consultation as contemplated in Section 16(4)(b) or 27(5)(b) of the Act, as the case may be.	
Full Names and Surname	Jasper Lodewyk Muller (Pr.Sci.Nat.)
Identity Number	571116 5104 081
Signature	