After distribution of the BIDs, I&APs were given at least 40 days to forward their comments (20 July – 3 September 2011). The response forms received are also included in Appendix E.

6.4.4 Stakeholder register

Any comments or concerns that were raised by I&APs during the process have been recorded and addressed by the EAP (Table 6-2).

Furthermore, all registered I&APs have been given an opportunity to comment, in writing, on the Reports and documentation before its submission to the competent authorities, the Department of Environmental Affairs and Department of Water Affairs.

6.4.5 Review of Reports and Documentation

All reports and documentation pertaining to this application have been made available for public review at the nearest public library (Witbank Public Library). All I&APs have been given an opportunity to comment on the Scoping Report over a period of 40 days in 2012 (19 January to 29 February 2012). Once the period for comments lapsed, the documents were collected and all comments made were included in the comments and response register. A copy of the report was also provided to DWA – Bronkhorstspruit regional offices on 19 January 2012 and DWA acknowledged receipt on 30 January 2012. Thereafter, the final Scoping Report (including all supporting documentation) was submitted to the authorities for consideration as part of the authorisation and licensing process. The scoping Report and Plan of Study for EIA was approved on 13 August 2012. The EIA Report was then placed in the Witbank Library for public review for a period of 40 days (24 August – 19 October 2012) before its submission to DEA.

6.5 Meetings

A meeting was held with DWA representatives from Regional Office (Bronkhorstspruit) and Head Office at Silicon Smelters – Rand Carbide on 22 February 2012 and this included a site visit and presentation. See attendance register, presentation and minutes included in Appendix F.

FerroAtlantica Group

SiliconSmelters

Rand Carbide

NOTICE OF APPLICATIONS FOR AN INTEGRATED WATER USE LICENCE AND WASTE MANAGEMENT LICENCE IN TERMS OF THE NATIONAL WATER ACT OF 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT OF 2008, RESPECTIVELY

Notification is hereby given to all Interested and Affected Parties in terms of Sections 54 to 57 of Regulation 543 of the National Environmental Management Act (NEMA), 1998 as amended and the National Water Act (NWA), 1998 as well as the National Environmental Management Waste Act (NEMWA), 2008 and all associated regulations and requirements, that a full Environmental Impact Assessment (EIA) process will be followed and that an EIA report, an Environmental Management Programme (EMP), as well as an Integrated Water and Waste Management Plan (IWWMP) will be submitted to the relevant authorities (Department of Water Affairs and Department of Environmental Affairs) to obtain a waste management licence and a water use licence for the activities and facilities at Silicon Smelters (Pty) Ltd Rand Carbide in eMalahleni, Mpumalanga Province of South Africa.

Application: National Water Act, 1998 (Act 36 of 1998), Section 21
Integrated water use licence for water and waste management

National Environmental Management: Waste Act, 2008 (Act 59 of 2008)
Waste management licence for the storage, recycling and/or recovery and treatment (through reprocessing) of waste material

Authorities: Water Use Licence with Department of Water Affairs, Mpumalanga on 013 932 5027
Waste Management Licence with National Department of Environment on 012 310 3920

Applicant: Silicon Smelters (Pty) Ltd - Rand Carbide

Locality: Voortrekker Road (Old Middelburg Road), eMalahleni, Mpumalanga Province of South Africa.

To register as an Interested & Affected Party or obtain further information please contact:
HydroScience cc

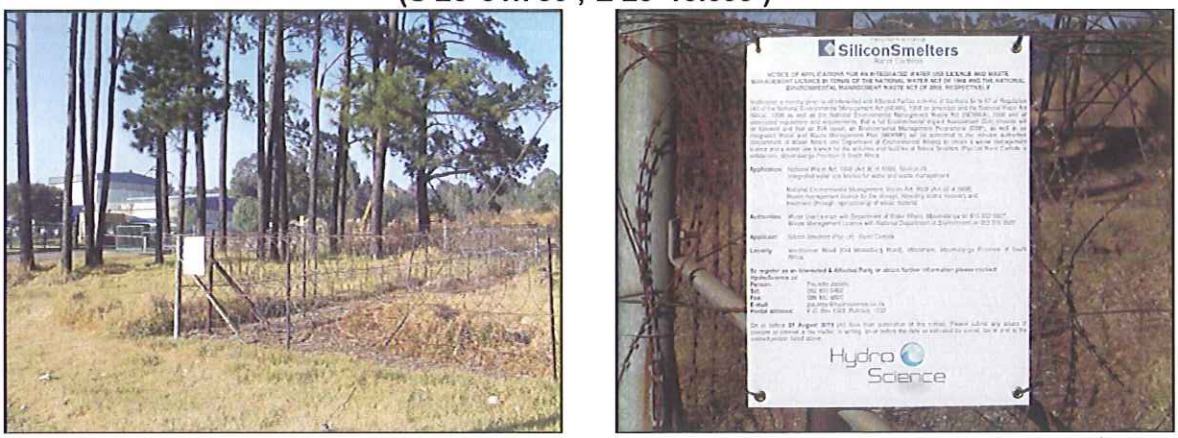
Person:	Paulette Jacobs
Tel:	082 850 5482
Fax:	086 692 8820
E-mail:	paulette@hydroscience.co.za
Postal address:	P.O. Box 1322, Ruimsig, 1732

On or before **31 August 2011** (40 days from publication of this notice). Please submit any issues of concern or interest in the matter, in writing, on or before the date as indicated by e-mail, fax or post to the contact person listed above.

Hydro Science

Plate 6-1: Wording of notices placed on site

A: Proof of notice 1, placed at the main entrance to the facility facing Voortrekker Road.
(S 25°51.753'; E 29°13.399')



B: Proof of notice 2, placed on the fence of the property facing O.R. Tambo Road.
(S 25°51.520'; E 29°13.853')

C: Proof of notice 3, placed at a secondary entrance to the facility facing Voortrekker Road.
(S 25°51.660'; E 29°13.530')

Plate 6-2: Photographs and GPS coordinates of notices placed on site

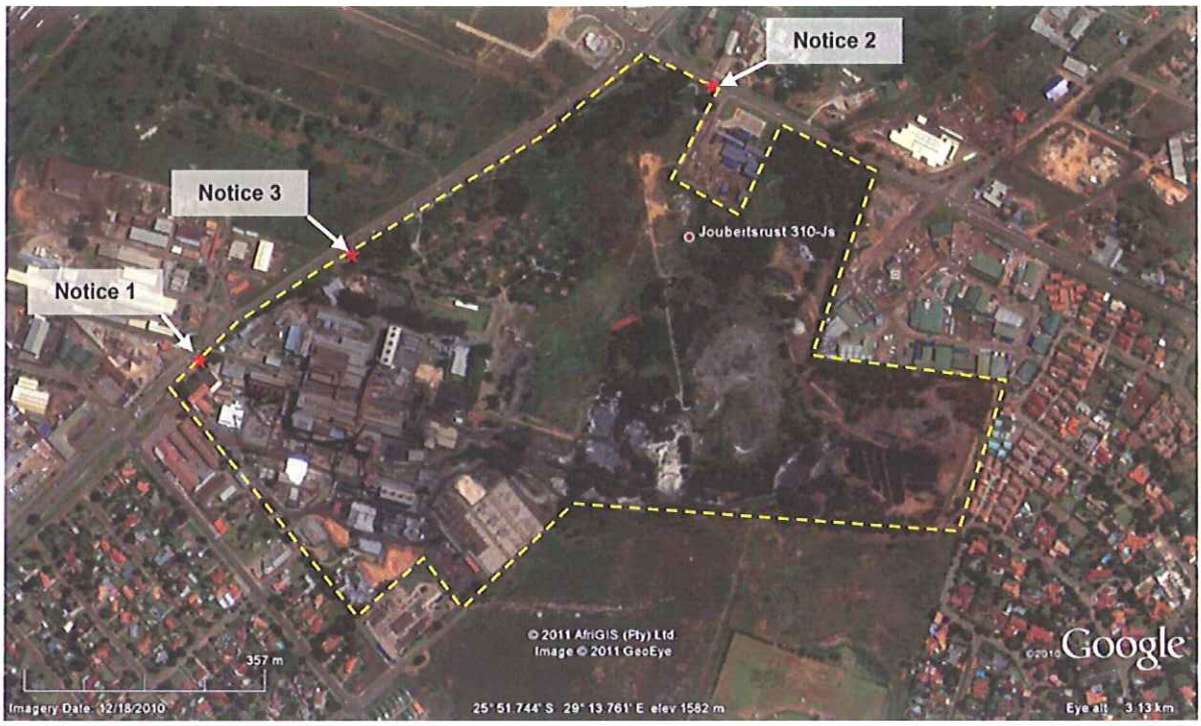


Plate 6-3: Aerial view of notices placed at various locations

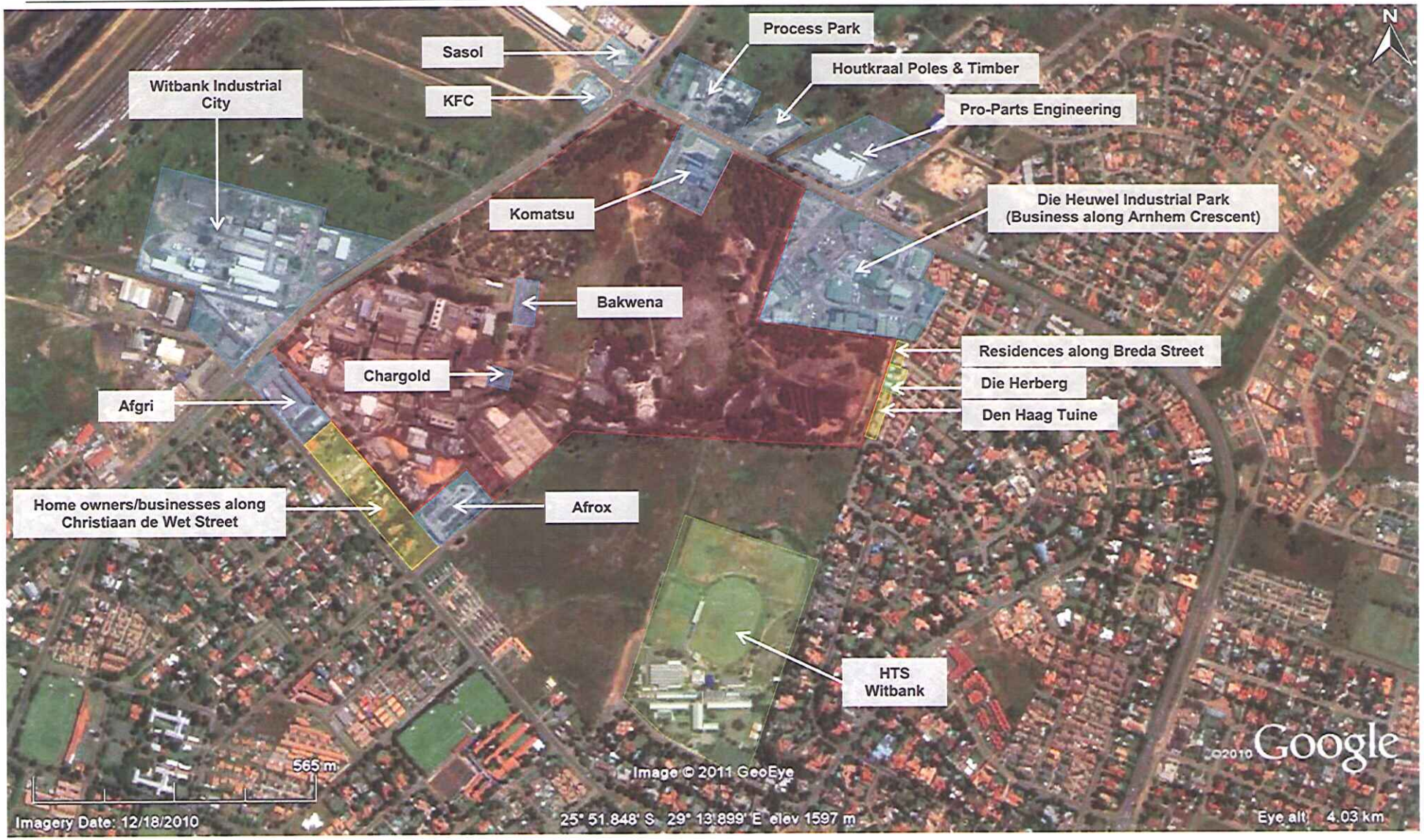


Plate 6-4: BID distribution to neighbouring properties

Table 6-1: Register of I&APs

PRIVATE AND BUSINESS						
Name	**Affiliation**	**Tel**	**Fax**	**Cell**	**E-mail** **E-mail/Postal/Physical**	**BID** **Distribution**
Home owner	Neighbouring property (south)	-	-	-	12 Christiaan de Wet Street	No one home 14:35 / 2011-07-20
Home owner	Neighbouring property (south)	-	-	-	14 Christiaan de Wet Street	No one home 14:35 / 2011-07-20
Witbank Plumbing (Natanja)	Neighbouring property/business (south)	013 656 6737	013 656 5056		admin@witplumb.co.za 16 Christiaan de Wet Street	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Home owner (Mr N.J.J. Krige)	Neighbouring property (south)	-	-	082 444 4989	18 Christiaan de Wet Street	Hand delivered BID 2011-07-20
Home owner (Mr J.J. Gilson)	Neighbouring property (south)	013 656 3527	-	-	20 Christiaan de Wet Street	No one home 14:45 / 2011-07-20 Left BID in post box
Greg Beamish Safety	Neighbouring property/Home business (south)			083 769 9210	gregb@live.co.za 22 Christiaan de Wet Street	No one home 14:40 / 2011-07-20 Left BID in post box
Home owner	Neighbouring property (south)	-	-	-	24 Christiaan de Wet Street	No one home 15:00 / 2011-07-20 Left BID in post box
Home owner Woeperdal	Neighbouring property (south)	-	-	-	26 Christiaan de Wet Street	No one home 14:55 / 2011-07-20 Left BID in post box
MacRock Distributers	Neighbouring property/Home business (south)	013 650 3259		082 338 3040	28 Christiaan de Wet Street	Left BID in post box 14:50 / 2011-07-20
Home owner	Neighbouring property (south)	-	-	-	30 Christiaan de Wet Street	No one home 14:50 / 2011-07-20 Left BID in post box
Afgri	Neighbouring business (south)	013 656 1461	013 656 4541		connie.dibb@afgri.co.za Christiaan de Wet Street	Hand delivered BID 2011-07-20 E-mailed revised BID 22-07-2011
Afrox (Amanda Botha)	Neighbouring business (south)	013 655 6300	013 656 0591		Amanda.botha@afrox.linde.com dolf.groenewald@afrox.linde.com Christiaan de Wet Street	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
HTS Witbank	Neighbouring school (south)	013 656 2041	013 656 6145		htswtb@mweb.co.za Beyers Street	E-mailed BID 2011-07-22

PRIVATE AND BUSINESS						
Name	**Affiliation**	**Tel**	**Fax**	**Cell**	**E-mail** E-mail/Postal/Physical	**BID Distribution**
Die Herberg	Neighbouring property (east)	-	-	-	6 Breda Street	Left BID in post box 13:15 / 2011-07-20
Cromhout Security Consultants	Security company patrolling neighbouring properties (east)	0861 544 444	-	-	-	Requested to distribute BID to existing clients
Den Haag Tuine Ms Sildee Padayachy	Neighbouring property (east)	013 656 3616			Den Haag Tuine, Unit no 1 Also endeavoured to supply BIDs to units 2 through 9 in complex. Eindhoven Street	Hand delivered BID 2011-07-20
Mantella Trading 310 (Nadine Higgs)	Neighbouring business Die Heuwel Industrial Park (east)	013 690 1069/3273	013 690 2153		Mantella310@mweb.co.za 4 Arnhem Crescent	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Filvent MNF (Jenine)	Neighbouring business Die Heuwel Industrial Park (east)	013 656 2726/7/8	013 656 2688		admin@filvent.co.za 6 Arnhem Crescent	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Iveco M-Tech (Thempe)	Neighbouring business Die Heuwel Industrial Park (east)	013 690 2141	013 690 2205		gdennis@mweb.co.za 8 Arnhem Crescent	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Actuator Valves & Controls (Fanus van der Walt)	Neighbouring business Die Heuwel Industrial Park (east)	013 656 0869	013 656 0892	082 824 1768	Fanusvdw.avc@gmail.com 10 Arnhem Crescent	E-mailed BID 2011-07-22
Witprint	Neighbouring business Die Heuwel Industrial Park (east)	023 656 1952	013 656 1986		14 Arnhem Crescent	No one. Number does not exist.
Bakone (Elmie)	Neighbouring business Die Heuwel Industrial Park (east)	013 656 0298	013 656 0968		bakone@telkomsa.net 16 Arnhem Crescent	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Advanced Coal Technology		013 690 1970	013 690 1976		16 Arnhem Crescent	Closed down.
Vital Power Transmission (Nina)	Neighbouring business Die Heuwel Industrial Park (east)	013 656 2306	013 656 2307		Stephen.wentzel@vitalpt.co.za 18 Arnhem Crescent	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Altech Netstar	Neighbouring business Die Heuwel Industrial Park (east)				Arnhem Crescent	Empty. No occupants

PRIVATE AND BUSINESS						
Name	**Affiliation**	**Tel**	**Fax**	**Cell**	**E-mail** E-mail/Postal/Physical	**BID Distribution**
J. Tav Ares & Sons	Neighbouring business Die Heuwel Industrial Park (east)	013 656 4916	013 656 4579		jtavares@cybertrade.co.za treza.tavares10@gmail.com	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Pro Parts Engineering	Neighbouring business (north)	013 650 1011	086 655 3754		ared@proparts.co.za Cnr Annie & O.R Tambo Road	Hand delivered BID 2011-07-20
Houtkraal Poles & Timber	Neighbouring business (north)	013 650 1888	013 650 1888	082 824 6200	O.R. Tambo Road	Hand delivered BID 2011-07-20
Komatsu (Vincent Mabena)	Neighbouring business (north)	013 656 6247	013 656 6293		louisp@komatsu.co.za	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Ilips	Neighbouring business Process Park (north)	013 650 0532	013 650 2296		witbank@ilips.co.za	E-mailed BID 2011-07-22
Engineering Supplies	Neighbouring business Process Park (north)	013 650 1591		082 332 1784	witbank@engsup.co.za	E-mailed BID 2011-07-22
Mpumalanga Lawn Mowers	Neighbouring business Process Park (north)		086 576 7673	072 943 0006	mpumagrass@vodamail.co.za	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Overnight Couriers	Neighbouring business Process Park (north)	013 650 0411	013 650 0206		ria@ilips.co.za	E-mailed BID 2011-07-22
Venom Racing (Estelle)	Neighbouring business Process Park (north)	013 650 0320		082 852 0680	venom@venomracing.co.za	Hand delivered BID 2011-07-20 E-mailed revised BID 2011-07-22
Carbon Tech	Neighbouring business Witbank Industrial City (west)	013 246 1399	013 246 1070		carbontech@lantic.net	E-mailed BID 2011-07-22
Lintal Suppliers	Neighbouring business Witbank Industrial City (west)	011 948 7967	086 547 1479		lintal@mweb.co.za	E-mailed BID 2011-07-22
Shaboni Engineering	Neighbouring business Witbank Industrial City (west)	013 656 6260	013 656 1420		shaboni@telkomsa.net	E-mailed BID 2011-07-22
Uretech	Neighbouring business Witbank Industrial City (west)	013 656 0941			witbank@uretech.co.za	E-mailed BID 2011-07-22

PRIVATE AND BUSINESS						
Name	**Affiliation**	**Tel**	**Fax**	**Cell**	**E-mail** E-mail/Postal/Physical	**BID Distribution**
Pegasus Tyres	Neighbouring business Witbank Industrial City (west)	013 656 6508	013 656 6509		pegasustyres@telkomsa.net	E-mailed BID 2011-07-22
Safric Tombstones George	Neighbouring business Witbank Industrial City (west)	013 656 6611	013 656 6611	072 783 0888		Faxed BID 2011-07-22
Johan Coetzee Inc	Neighbouring business Witbank Industrial City (west)	013 653 3500			ontvangs@ccatt.co.za	E-mailed BID 2011-07-22
Propmentum	Neighbouring business Witbank Industrial City (west)	013 653 3520			info@propmentum.com	E-mailed BID 22-07-2011
Sculpton Concrete	Neighbouring business Witbank Industrial City (west)	013 690 3216			sculptonconcrete@lantic.net	E-mailed BID 2011-07-22
Sasol Garage (Bryan)	Neighbouring business (west)			083 279 1018	Nbdlamini05@gmail.com	Hand delivered BID 20-07-2011
KFC (John)	Neighbouring business (west)	013 656 1880				Hand delivered BID 2011-07-20
EMB (Franco)	Business renting property from Rand Carbide				francob@enviroserv.co.za	E-mailed BID 2011-07-25
Bakwena Concrete (Naas Botes)	Business renting property from Rand Carbide	013 656 2169	086 273 7734	072 283 9901	bakwenconcrete@vodamail.co.za abre@live.co.za	E-mailed BID 2011-07-25

GOVERNMENT DEPARTMENT OF WATER AFFAIRS MPUMALANGA						
Name	**Affiliation**	**Tel**	**Fax**	**Cell**	**Addresses** E-mail/Postal/Physical	**BID Distribution**
Mr J.M. van Aswegen	DWA (Bronkhorstspruit) 22 Rooth Street, Bronkhorstspruit Private Bag X10580, Bronkhorstspruit, 1020	013 932 2042	013 932 2071	082 807 4198	vanaswegenj@dwa.gov.za	E-mailed BID: 2011-07-22
Ms L. Mautjana		013 932 2061		073 854 2501	mautjanal@dwa.gov.za	E-mailed BID: 2011-07-22
Mr Jacob Malesa		013 932 2061/47/64		082 603 9187	MalesaJ@dwa.gov.za	E-mailed BID: 2011-07-22
Ms Madi Moloto		013 932 2061/47/64			MolotoM@dwa.gov.za	E-mailed BID: 2011-07-22 Copy of document: 2012-01-19
Mr Stanford Macevele		013 932 2061/47/64			MaceveleS@dwa.gov.za	E-mailed BID: 2011-07-22
Ms K. Meso		013 932 2061/47/64			Mesok@dwa.gov.za	E-mailed BID: 2011-07-22
Mr Patrick Ntabeni	DWA				NtabeniP@dwa.gov.za	E-mailed BID: 2011-07-22
Mr H.S Shabangu	DWA				ShabanguS2@dwa.gov.za	E-mailed BID: 2011-07-22
Mr Zwelake Vilane	DWA				vilanez@dwa.gov.za	E-mailed BID: 2011-07-22
Mr E. Mahosi	DWA				mahosie@dwa.gov.za	E-mailed BID: 2011-07-22
Mr Fanyana Mntambo	DWA Chief Director Mpumalanga	013 759 7300	0137597525		mntambof@dwa.gov.za	E-mailed BID: 2011-07-22
NATIONAL DEPARTMENT OF AGRICULTURE, FORESTRY AND FISHERIES (DAFF)						
Mr David Kleyn	DAFF Delpen Building, Cnr Annie Botha and Union Street, Pretoria	012 319 7560	012 329 5938	082 789 6915	davidkl@nda.agric.za	E-mailed BID: 2011-07-22
Mr Steve Galane	DAFF Delpen Building, Cnr Annie Botha and Union Street, Pretoria	012 319 7960	012 319 6943		dais@daff.gov.za	E-mailed BID: 2011-07-22

NATIONAL DEPARTMENT OF ENVIRONMENTAL AFFAIRS						
Mr Albi Modise	DEA	012 310 3123	012 322 2476	083 490 2871	AModise@environment.gov.za	E-mailed BID: 2011-07-22
Mazwi Lushaba	DEA	012 310 3163	012 320 0488		MLushaba@environment.gov.za	E-mailed BID: 2011-07-22
Mr S Sebone	DEA	012 310 3646	012 310 3753		ssebone@environment.gov.za	E-mailed BID: 2011-07-22
Mr Lucas Mahlangu	DEA 315 Pretorius Street, Fedsure Forum Building, Pretoria	012 310 3536	012 310 3753		Lmahlangu@environment.gov.za	E-mailed BID: 2011-07-22
Mpho Tshitangoni	DEA (Director:Authorisations) 315 Pretorius Street, Fedsure Forum Building, Pretoria				mtshitangoni@environment.gov.za	E-mailed BID: 2011-07-22
Thizwikoni Ramavhona	DEA (Waste licences) 315 Pretorius Street, Fedsure Forum Building, Pretoria			082 307 0747	Tramavhona@environment.gov.za	E-mailed BID: 2011-07-22
Mr Dumusani Mthembu	DEA				dmthembu@environment.gov.za	E-mailed BID: 2011-07-22
SOUTH AFRICAN HERITAGE RESOURCE AGENCY						
Mr Phillip Hine	SAHRA (MPU)	013 752 2884	013 752 8498		phine@sahra.org.za	E-mailed BID: 2011-07-22
DEPARTMENT OF HEALTH						
Mr D. Phayane	Department of Health and Social Services	013 656 6251	013 690 1507	082 591 4398	davidp@social.mpu.gov.za	E-mailed BID: 2011-07-22
NKANGALA DISTRICT MUNICIPALITY						
Mr Vusi Mahlangu	Social Services & environment	0132492135			mahlanguwm@nkangaladm.org.za	E-mailed BID: 2011-07-22
Mr Ntekel Risimati	Technical Services	0132492033			ntekelefr@nkangaladm.org.za	E-mailed BID: 2011-07-22
Mr TC Makola	Municipal manager				makolatc@nkangala.org.za	E-mailed BID: 2011-07-22
Mr P.Raputsoa	Planning	013 249 2039	013 249 2145		DevelopmentandPlanningUnit@ nkangaladm.org.za	E-mailed BID: 2011-07-22

MPUMALANGA DEPARTMENT OF ECONOMIC DEVELOPMENT, ENVIRONMENT AND TOURISM						
Fikile (Cyprian) Theledi	MDEDET (Waste & Emissions) Cnr Botha Street and Rhodes Street	0137594100		0791895599	mtheledi@mpg.gov.za	E-mailed BID: 2011-07-22
Mr Joe Mabuza		0136901279		0844091825	JMMabuza@wit.mpu.gov.za	E-mailed BID: 2011-07-22
Mongi Tshikwatamba	MDEDET	0136902595		0722048256	tmtshikwatamba@wit.mpu.gov.za	E-mailed BID: 2011-07-22
Ms Charity Mthimunye	MDEDET (EIA)	013 690 1279	013 656 5465	083 255 4101	cnmthimunye@wit.mpu.gov.za	E-mailed BID: 2011-07-22
Ms Hlamarisa Mavodzi				0833717855	himavodze@wit.mpu.gov.za	E-mailed BID: 2011-07-22
Ms Dineo Tswai				0725392052	dtswai@mpg.gov.za	E-mailed BID: 2011-07-22
Ms Joyce Pakade		013 766 4046			pakadej@mpg.gov.za	E-mailed BID: 2011-07-22
Mr Garth Bachelor	MDEDET	0137594099		0827717998	GBatchelor@mpg.gov.za	E-mailed BID: 2011-07-22
Mohau Ramodibe	MDEDET	013 766 4216	013 766 2294	082 771 9950	mohauram@mpg.gov.za	E-mailed BID: 2011-07-22

EMALAHLENI LOCAL MUNICIPALITY						
Mr A.J. Engelbrecht	Acting Municipal Manager	013 690 6208			engelbrechtaj@emalahleni.gov.za	E-mailed BID: 2011-07-22
Mr Colin Brentjies	Electricity	0136906452			brentjiescbc@emalahleni.gov.za	E-mailed BID: 2011-07-22
Mr Shadrack Ndlovu	Water	0136906294			ndlovusc@emalahleni.gov.za	E-mailed BID: 2011-07-22
Mr Edwin Sedupane	Roads	0136906323			sedupaneme@emalahleni.gov.za	E-mailed BID: 2011-07-22
Mr Erald Nkabinde	Waste / environmental	0136906350			Nkabindee@emalahleni.gov.za	E-mailed BID: 2011-07-22
Mr John Makena	Environmental	0136906350			makenamj@emalahleni.gov.za	E-mailed BID: 2011-07-22
Ms Liziwe Kama Ms Hessie Mkhwanazi Mr Peter Nkambule	Storm water & roads	013 690 6401 / 6290 / 6349		071 134 6675 083 535 5269	mkhwnazih@emalahleni.gov.za nkambulemp@emalahleni.gov	Meeting: 2011-11-30 Site visit: 2011-12-08 Meeting: 2012-02-22 Copy of report: 2012-0229
Mr Paul van Castle	Office of the Speaker	013 690 6313	013 690 6556	082 375 9495	vancastlep@emalahleni.gov.za	E-mailed BID: 2011-07-22
Ms J. Rozmariek	eMalahleni Public Library	013 690 6229	013 656 3698		witlibrary@mweb.co.za	E-mailed BID: 2011-07-22

Table 6-2: Comments and response register

Comment received from:	Date received and date responded:	Comment / concern:	Response:
Neighbours on Christiaan de Wet Road	During verbal communication on 20 July 2011	Dust in houses Roofs requiring replacement due to emissions	EAP requested I&APs to put this in writing. No written comments were received. The dust problem highlights the requirement for dust suppression measures.
Department of Water Affairs (DWA) – Ms AM Rambuda (ref 16/2/7/B100/C617)	Letter dated 2 February 2012	Requirement for preliminary legal assessment to identify all water use activities	Done in 2010 by HydroScience. Section 21(g) water uses registered on 2011/03/31. Section 21(a), (g) & (j) water uses identified
		Authorisation from DWA required for water uses. Liaise with DWA.	Liaison with DWA was conducted. IWULA is required. IWWMP is 90% complete and only geohydrological investigation is outstanding. IWULA will be submitted around May 2012
		1:100 year flood-line	Refer to map. No watercourse in proximity. Site not affected by flood-lines from any watercourse.
		Wetlands, rivers and drainage lines	No streams or wetlands on site. Closest watercourse: drainage line 300m north east of the site, feeds into the Olifants River.
		Storm water management	Etek Consulting completed a comprehensive storm water management plan in 2011 and it will be included in the EIA
		Sewage management	Letter has been requested from Municipality. No additional sewage. All existing activities, no expansion planned
		Potable water supply	Letter/agreement has been requested from Municipality. Previously authorised under Water Act, 1956
		Section 21(a) water use for springs. Section 21(g) water use for storm water capturing & containment	Noted. Agreed. Already completed. Registered Section 21(g) water uses on 2011-03-31
		Waste management	Requested letter from waste removal company
		Hazardous waste	Requested safe waste disposal certificate from waste removal company: Waste Giant
		Pollution incidents	Incident register kept. No pollution incidents took place.
Ms Madi Moloto (DWA - Bronkhorstspruit Regional Office)	22 February 2012 meeting	Spring water used in process?	Process water obtained from municipality. Spring water used for dust suppression.
		Waste dumped: recently moved or moved to new location in future?	Dump never been moved. Dump currently being reprocessed. Remaining waste to Holfontein. No waste dump in 8 years.

Comment received from:	Date received and date responded:	Comment / concern:	Response:
		Any authorisation for dump?	No. ECA Section 20 permit application was submitted but never granted by DWA
		Relationship between company and Highveld	No association. Was previously owned by Highveld but sold to Ferro Atlantica Group in 2008.
		Closest water course	Olifants River: 4km NE Doornpoort dam: 7.5km away
		Housekeeping requires attention	Noted. Action: Rand Carbide
Ms Wilna Moolman (DWA – Head Office)	22 February 2012 meeting	Water quality of springs?	Springs underneath furnaces have elevated concentrations probably due to location and pollution from surface sources
		Groundwater monitoring & quality	More than 10 boreholes monitored on site. Elevated Mn in upstream borehole
		Attach groundwater quality results with IWUL	Noted. Included.
		Indicate all storage areas of waste and material on map	Noted. Action: HydroScience
		More formal type storm water management required	Etek Consulting completed a comprehensive storm water management plan in 2011 and it will be included in the EIA
		Request that spring water from B conveyor sump be kept clean by canalising	Not possible. Not a point source – seeps through area across embankment. Could increase pump rates in conveyour area to prevent seepage through embankment. Action: Rand Carbide
Ms Eunice Nemutudi (DWA: Head Office - Environmental Impact)	22 February 2012 meeting	Water balance done?	Confirmed.
		Boreholes for monitoring and / or abstraction	Monitoring only

7 WASTE CLASSIFICATION AND STORAGE

7.1 Background

Rand Carbide was originally located in Germiston but the factory was moved to the current site in Witbank in 1926. The site is, therefore, historical in that many of the past management practices, including the management of waste, did not meet the standards required by current applicable National, Provincial and Local legislation. However, old metallurgical waste disposal sites often represent a reasonable resource since historic technologies were not as effective in recovering all valuables as current technologies. Therefore, the recovery of alloy, char and other potentially valuable materials in the waste disposal site can then be used to off-set the cost of reprocessing. EMB, a joint venture between EnviroServ (Pty) Ltd and Rand Carbide, has been investigating the potential recovery of FeSi, Char and other potentially valuable materials from the Rand Carbide disposal area.

A waste classification report was compiled by Environmental and Chemical Consultants cc, regarding the different waste streams and by-products produced by Rand Carbide. This report covers a brief overview of the classification system in the Minimum Requirements, analytical procedures used and the classification and evaluation of the environmental risks associated with the waste. This chapter only provides a summary of the waste characterisation report, while the full waste classification report is appended to Appendix D.

7.1.1 Approach

The Minimum Requirements for the Classification, Handling and Disposal of Hazardous Waste (DWAF, 1998) considers any waste that contains or that can leach a potentially hazardous component as "probably" or potentially hazardous. The document contains an approach for the classification of these wastes either as a hazardous waste (see below) or a non-hazardous waste. A non-hazardous waste is one that has a similar or even lower pollution potential than a General Waste such as household waste. Potentially hazardous wastes are identified by:

- The Industrial Group or Sector that generates the waste, e.g. Chemical and Allied Industries, Metallurgical Industry, etc,
- The processes that generate the waste, e.g. Petroleum Production, Production of Primary Chemicals and Feedstocks, etc,
- The Waste Stream, e.g. Ash and Slags, Oily Wastes, Organic Wastes, etc, and
- The hazardous characteristics of the waste, i.e. Corrosivity, Flammability, Reactivity and Toxicity

The Minimum Requirements classify waste streams in terms of their chronic toxicity (teratogenicity, mutagenicity, carcinogenicity), acute toxicity in terms of the mammalian toxicity, as measured by the LD_{50} mg/kg (oral, rat) and ecotoxicity in terms of its LC_{50} mg/l/96hr for fish preferably trout. The waste or the species of concern in the waste is assigned to a Hazard Group (HG) depending on its chronic toxicity, acute toxicity and its acceptable risk concentration or level (ARL).

7.1.2 Leaching Characteristics of Solid Waste

Another innovation in the South African approach is that for a solid waste, the leachable concentration is used to calculate the impact on the environment. For a waste that is co-disposed with municipal waste, the United States Environmental Protection Agencies' Toxicity Characteristic Leaching Procedure (TCLP) is used to determine the leachability of potentially hazardous components. Whereas, for a mono-disposal site, where one type of

waste is being disposed, such as a metallurgical slag or a power station ash disposal site, then the modified Acid Rain Leaching Procedure (ARLP) can be used. In the TCLP procedure, an acetic acid buffer is used as the leach solution, in order to simulate the chemical and physical characteristics of the leachate from domestic waste sites.

The leachability of a material depends on a multitude of factors, the most important of which are:

a) The pH of the leach solution and the acid neutralisation capacity;

b) Basic chemical equilibriums, which for inorganic wastes involves:
- The "hydrolysis" reaction, where the metal ion reacts with water,
- The reaction in the inertial space within the solid – re-precipitation can occur that could prevent further leaching.
- The formation of new ionic or neutral species in solution

c) The presence of readily soluble species such as chromium (VI), vanadium (V), sodium (Na), potassium (K), sulphate (SO_4) and chloride (Cl);

d) The presence of degrading organic matter, which can have the following effects: production of dissolved organic compounds that can dissolve metal ions, the generation of CO_2 that has a neutralising effect and the development of reducing conditions;

e) The redox potential;

f) The leaching solution used. For the TCLP procedure, 0.1M acetic acid or acetic acid buffer are used to simulate the type of leachate found in a domestic waste site. This solution favours the leaching of "hard" ions such Mn (II) and Fe (III). The Acid Rain test on the other hand contains carbon dioxide and thus one would anticipate elements that form relatively insoluble carbonates or basic carbonates to be of lower leachability than in the TCLP test, e.g. Ca, Ba (II) and Pb (II);

g) The leaching tests tend to be acidic thus any material that has a reasonable alkalinity, will tend to neutralise the solution and pH values above about 8 will lead to low leachability of most metal ions. Exceptions tend to be the anionic compounds such as chromate and vanadate;

h) The physical nature of the waste, e.g. its particle size, the presence of water in the sample, etc;

i) The presence of calcium or other cations that can form relatively insoluble compounds compared to the equivalent sodium salts, e.g. calcium zincate and calcium fluoride;

7.2 Hazards

7.2.1 Physical hazards

The Rand Carbide waste streams are not flammable, corrosive or reactive in terms of SANS Code 0228, except for the quartz fines that had a pH of 5.8, i.e. marginally below the Minimum Requirements' lower corrosive limit of 6.0. Note that quartz, which is predominantly the weak acid silica, would be expected to have a pH below 6 but its buffer capacity is very low.

7.2.2 Environmental Hazards

It is a Minimum Requirement (DWAF, 1998) that all wastes or residues of waste pass through Class 6 (SANS code 0228) as part of a classification and hazard rating process. Hazard rating is the toxicity of the waste based on the risk the various constituents in the waste pose to the environment. The LC_{50} or acute ecotoxicity of a substance is used in addition to the LD_{50} or acute mammalian toxicity (risk to man) for disposal of waste. The LC_{50} is the concentration at which a substance would kill 50% of test organisms if it were disposed of directly into a body of water. If the concentration of the hazardous substance is only 10% of the LC_{50}, it should have very little harmful effect on the aquatic organisms. 0.1 X LC_{50} is therefore used to represent acceptable risk level (ARL).

It can be concluded from the results of the TCLP extractions undertaken on eighteen (18) waste streams (Environmental and Chemical Consultants) that Mn and possibly Al, Fe, Pb and Zn could pose a risk to the environment by leaching from the wastes. In addition, Ca leaches in reasonable amounts from some of the wastes and any water coming into contact with the waste could lead to an increase in the salinity of any surface and groundwater near the disposal area. The Rand Carbide waste has a relatively low acid neutralisation capacity, so repeated rainfall events would be expected to neutralise any alkalinity in the waste and extract soluble ions such as calcium (Ca), chloride (Cl), fluoride (F), sulphate (SO_4), etc. Thus, the leachability of Mn and other heavy metals may increase with time, if the waste is continually wetted. As the waste ages in the dump, any free lime can react with carbon dioxide (CO_2) from the air and the nature of the waste, at least at the surface of the dump can change.

7.3 Risk Profiling

The ARL is equal to one tenth of the LC_{50} in ppm. In simple terms, the ARL is that concentration, which when added to a body of water will provide no risk or at least an acceptable risk, if consumed by a population. The hazard groups are defined as:

- Hazard Group 1, (HG1): Extreme Hazard, e.g. Cr (VI), Hg and PCBs
- Hazard Group 2, (HG2): High Hazard, e.g. Mn and Zn
- Hazard Group 3, (HG3): Moderate Hazard, e.g. Ni and phenol
- Hazard Group 4, (HG4): Low Hazard, e.g. Ethanol
- Non-hazardous, e.g. fresh domestic waste

Results of the TCLP applied to the samples of Rand Carbide's waste are indicated in the table below. The table only contains the samples which indicated leaching of Mn, Al and Fe at concentrations above its ARL. As Mn is classified as a high hazard, all these samples classify as high hazard waste.

It can be concluded from the results of the TCLP extractions undertaken on eighteen (18) waste streams that Mn and possibly Al, Fe, Pb and Zn could pose a risk to the environment by leaching from the wastes (Table 7-1). Note that as no organic species are disposed at the waste site and there are likely to be interactions between the various wastes, the TCLP on the individual waste steams represents a worst case scenario.

Table 7-1: Results of the TCLP test applied to Rand Carbide's waste

Element	S1: Gunite Shot B	S3: Char Fines	S6: Oversize Char	S7: Stocker Detric Bricks	S8: LCGF	S9: SiC Brick	S12: Stoker 3D Brick	S13: Detric Roof S Duty	S17: Super Duty Brick	S18: Brick VR 60	HG	ARL, mg/l	Comment
10% pH	7.0	7.0	6.44	6.8	7.0	8.3	8.1	8.0	6.4	6.3			
Al	0.14	0.1	0.24	0.25	15.6	0.52	0.35	0.32	0.15	0.28	4	10	
B	0.02	0.12	0.08	0.009	0.19	0.02	<0.006	0.01	0.01	0.008	4	10	As $NaBO_3$
Ba	0.07	0.24	0.26	0.09	0.07	0.08	0.09	0.09	0.07	0.07	3	7.8	
Be	Unk	Unk	Unk	Unk	Unk	Unk	<0.002	<0.002	<0.002	<0.002	3	1.2	
Bi	Unk	Unk	Unk	Unk	Unk	Unk	<0.005	0.1	0.009	0.008	Unk	Unk	
Ca	5.5	78	45	1.5	193	72	6.7	2.3	0.64	1.9	NT		
Cd	Unk	Unk	Unk	Unk	Unk	Unk	<0.001	<0.001	<0.001	<0.001	1	0.031	
Co	0.02	0.02	0.02	0.003	0.007	0.006	0.003	0.005	0.004	0.008	2	6.9	
$Cr_{(total)}$	0.12	<0.003	<0.003	0.02	0.01	0.1	<0.003	0.07	0.02	0.02	3	4.7	
Cu	0.06	0.02	0.003	0.03	0.01	0.05	0.02	0.07	0.02	0.03	2	0.10	
Fe	7.4	<0.001	0.27	2.7	12.1	76.1	1.7	6.1	2.9	2.7	3	9	
K	<0.005	1.4	<0.005	<0.005	4.3	<0.005	<0.005	<0.005	<0.005	<0.005	4	43.5	
Mg	1.4	9.5	4.2	0.46	1.5	1.0	0.62	0.35	0.17	0.54	NT		
Mn	5.2	0.53	0.38	0.57	0.57	2.2	0.33	1.3	0.61	0.70	2	0.3	
Ni	0.08	0.03	0.04	0.02	0.02	0.08	0.008	0.03	0.02	0.01	3	1.2	
P	<0.04	0.10	<0.04	<0.04	0.66	<0.04	0.02	<0.04	<0.04	<0.04	4	10	As Phosphate
Pb	<0.01	0.02	0.01	<0.01	0.03	0.01	<0.01	<0.01	<0.01	<0.01	2	0.1	
Sb	0.02	0.03	0.03	0.01	0.05	0.02	0.01	<0.01	0.02	<0.01	3	1.0	
Si	<0.007	0.70	0.02	<0.007	17	0.23	<0.007	0.05	<0.007	<0.007	NT		As Silicate
Sr	0.01	1.5	0.79	0.02	0.16	2.2	0.13	0.03	0.009	0.01	NT	180	
Ti	Unk	Unk	Unk	Unk	Unk	Unk	<0.001	<0.001	<0.001	<0.001	2	0.73	
Tl	Unk	Unk	Unk	Unk	Unk	Unk	<0.009	<0.009	<0.009	<0.009	2	0.1	
V	0.004	0.004	0.003	0.01	0.01	0.002	0.02	0.006	0.003	0.005	3	1.3	
Zn	0.04	0.04	0.05	0.09	0.03	0.25	0.06	0.07	0.06	0.06	2	0.7	
pH Final	4.8	6.3	7.0	7.0	5.0	5.0	5.3	7.1	5.4	5.4			
NT = non-toxic; unk = unknown													

Two (2) new samples of the wastes, S1 and S2, from the disposal site were leached using both the Acid Rain Leaching Procedure (ARLP) and Distilled Water (DW). Table 7-2 gives the results of the ARLP and DW leach studies for the two samples.

Table 7-2: ARLP and DW Leach Data on two Composite samples, S1 and S2, Recovered from the Rand Carbide Waste Disposal Site, mg/l

Element	ARLP		DW		HG	ARL, mg/l	Comment
	S1	S2	S1	S2			
Total S, %	-	-	0.11	0.13			
Acidity – Total, kg/ton	-	-	3.44	4.06			
Gross Neutralisation Potential, Kg/ton	-	-	16.2	4.4			
Net Neutralisation Potential, kg/ton	-	-	12.8	0.34			
Conductivity, mS/m	Nm	Nm	64.9	65.2			
Total Alkalanity	370	167	151	110			
Bicarbonate	451	204	184	134			
Al	0.03	0.15	<0.009	<0.009	4	10	
B	0.17	0.14	0.39	0.35	4	10	As $NaBO_3$
Ba	0.12	0.19	0.12	0.11	3	7.8	
Bi	0.04	0.007	0.02	0.02	Unk	Unk	
Ca	137	78	127	118	NT		
Cd	0.002	<0.001	<0.001	<0.001	1	0.031	
Cl	16.9	14.4	21	19	NT		
Co	0.01	<0.001	0.02	0.003	2	6.9	
Cr(total)	0.005	0.004	<0.003	<0.003	3	4.7	
Cu	0.01	0.005	0.008	0.03	2	0.1	
F	0.4	0.4	1.1	1.3	3	2	
Fe	0.006	0.09	0.006	0.02	3	9	
K	3.6	3.8	6.1	3.9	4	43.5	
Mg	11.2	6.3	18.3	13.9	NT		
Mn	2.6	2.8	1.3	1.5	2	0.3	
Mo	0.004	<0.001	0.01	0.02	3	3.7	
Na	3.8	3.9	11.7	6.9	NT		
Ni	0.003	0.04	0.005	<0.003	3	1.2	
Nitrate	<0.1	0.20	2.0	1.7	3	1	
P	1.6	0.97	0.16	0.56	4	10	As phosphate
Sulphate	41	56	194	251	NT		
Se	0.10	<0.03	0.09	0.11	3	1	
Sb	0.03	0.03	0.19	0.15	3	1.0	
Si	6	3.8	11.1	5.1	NT		As Silicate
Sr	0.33	0.31	0.33	0.54	NT	180	
V	0.006	0.002	0.006	0.002	3	1.3	
Zn	0.04	0.24	0.003	0.003	2	0.7	
Zr	0.006	0.002	0.002	0.002	3	2	
pH Final	6.9	6.6	7.4	7.7			
NT = non-toxic; Unk = Unknown; Nm = Values not meaningful							

7.4 On-site storage and disposal requirements

Table 7-1: Waste streams and management summary

Type	Quantity (annual)	Handling on site	Destination
General solid			
Non-hazardous	42 m^3 6 tons	Collect in bins/skips	Removed off site by Waste Giant and taken to municipal landfill site at Witbank (eMalahleni).
Compactable	1 176 m^3 42 tons		
Hazardous solid			
Compactable	42 m^3 24 tons	Collected in skips	Removed off site by Waste Giant and taken to Rietfontein site (delisted).
Fluorescents	0.2 m^3 0.05 tons	Crushed	Removed off site by Waste Giant and taken to hazardous landfill site (Holfontein).
Oil	1 155 m^3 5.5 tons	Collect in 210 litre drums with lids in bunded area	Removed off site by OIL-X/Oilkol and taken to refinery for recycling.
Oil & grease contaminated material	23 m^3 47 tons		Removed off site by Waste Giant and taken to Rietfontein waste disposal site.
Process waste	3 700 m^3	EMB reprocess	Re-used (Rand Carbide)/ disposed (Holfontein)

Storage: The current storage of waste and raw material on the Rand Carbide site can be seen in Figure 7-1.

Raw material storage: A large number of raw materials are stored on site (refer to Figure 7-1) and can potentially contaminate soil and groundwater. Therefore, these materials were evaluated at potential sources of pollution. All these materials were sampled and analysed (distilled water leaching, XRD & XRF) by JMA Consulting (Pty) Ltd in 2011 to determine their pollution potential risk to the groundwater environment. Twenty (20) different raw material samples were collected (December 2011) and the mineralogy and elemental composition was determined through XRD (X-ray diffraction) and XRF (X-ray fluorescence) as well as distilled water leach extract analysis. *Raw materials were found to not generate leachate with adverse qualities as a result of precipitation coming into contact with the raw materials as they are stockpiled.*

Waste disposal requirement: The process waste leaches Mn, when subjected to the ARLP, and is, therefore, classified as a high hazardous waste. Currently, the waste requires a hazardous waste site for disposal - designed with a leachate management system, i.e. as an H or GB+, even though no significant amounts of leachate would be expected in a water deficit area. In terms of the current procedure for calculating the load or dose that can be disposed to a landfill or storage area, Mn would be the determining species. Using the average Mn from the two (2) new samples in Table 7-2, i.e. 2.7mg/l, ~168 tons could be disposed per hectare per month to a GB+ landfill. Note that, because the Minimum Requirements allows a total load of 100 times the monthly load, a storage area that could handle maximum of say 5 000 tons would, theoretically, only have to have an area of ~0.34 hectares.

7.5 Duty of Care

Environmental risk identified: The process waste historically disposed at the Rand Carbide waste disposal site leaches Mn when leached using the standard leaching tests, i.e.

the TCLP, ARLP and the DW procedures at a concentration above its ARL. It, therefore, classifies as a high hazard waste in terms of the Minimum Requirements. The results suggest that contamination of both groundwater and surface water can occur with salts and Mn due to the waste disposed at the site and some recent borehole results suggest that this may be occurring.

Waste disposal: The current waste dump is not lined and designed according to latest legislation and any disposal of the process waste on the site would require a new waste disposal facility. Due to the environmental risk associated with on-site waste disposal, all on-site waste disposal activities have been ceased and no waste generated by Rand Carbide is disposed on the site but all waste is removed for off-site disposal.

Historic waste dump reprocessed: The historic waste dump has been reprocessed since 2006. Re-processing of the waste from the waste dump will decrease the amount of potential leaching due to a reduction in the size of the waste dump and quantity of waste material on the dump. This will reduce environmental risk over time. The dump will be fully processed and the foot print rehabilitated in about ten (10) years.

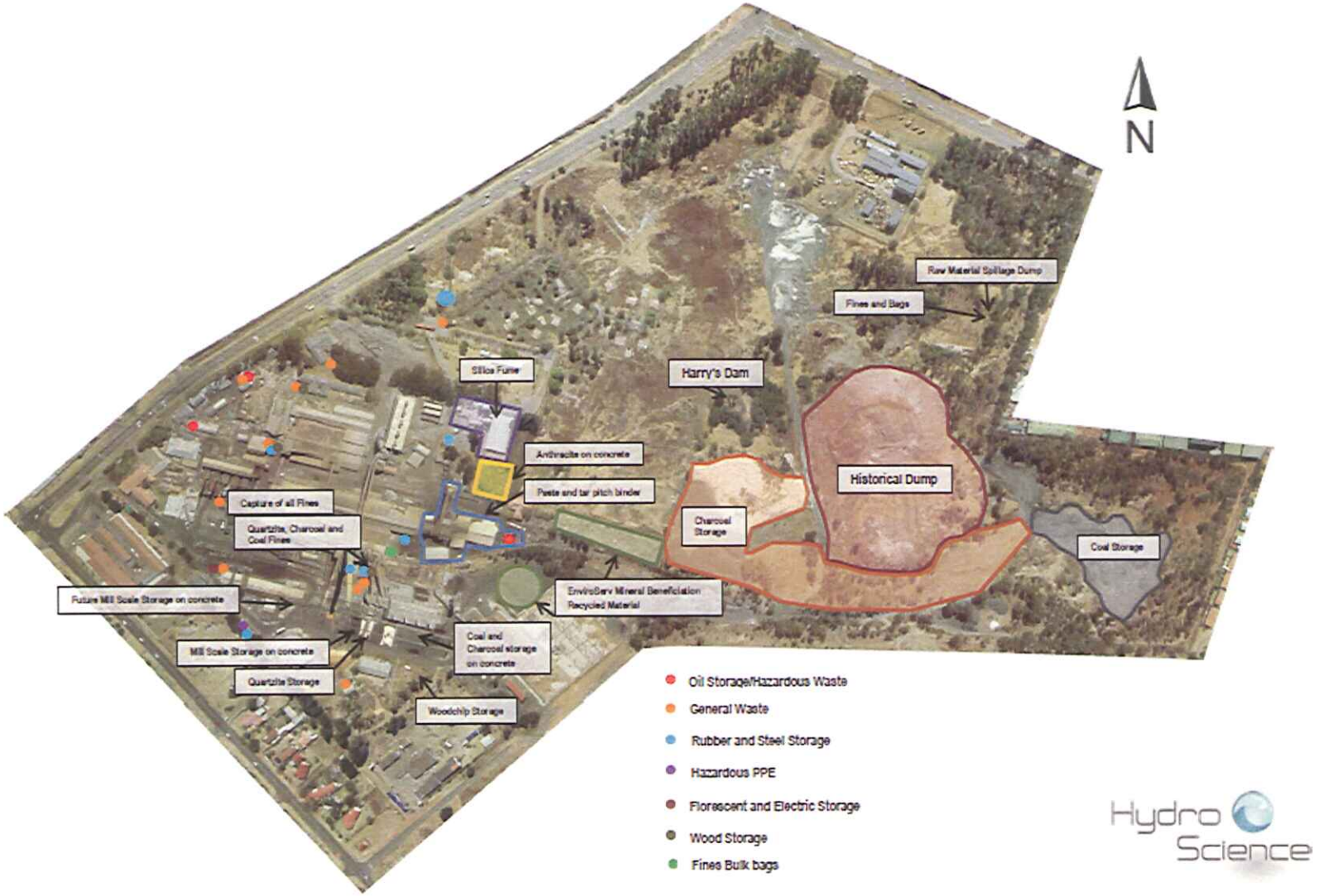


Figure 7-1: Waste Management and Storage Plan

8 ENVIRONMENTAL IMPACT ASSESSMENT (EIA) PROCESS

One of the main purposes of the EIA process is to assess the significance of potential impacts and to determine to what extent the negative impacts can be mitigated and minimized, while the positive impacts are enhanced. Based on the history of the materials handling operations, the impacts on soils, surface water, groundwater and air quality can be readily predicted and mitigated.

The EIA process for this project has been designed to comply with the requirements of the EIA Regulations promulgated on 18 June 2010 in terms of section 24 of the National Environmental Management Act (Act 107 of 1998) (NEMA) which is South Africa's framework environmental legislation. Key principles embodied in the NEMA include:

- Sustainability – development that meets the needs of the present generation without compromising the ability of future generations to meet their own needs;
- Mitigation hierarchy – avoidance of environmental impact, or where this is not possible, minimising the impact and remediating the impact; and
- The duty of care towards the environment.

The assessment of impacts has been conducted in accordance with these principles. The specific waste management activities that require environmental impact assessment in terms of the National Environmental Management: Waste Act (Act 59 of 2008) (NEMWA) are taken into account. Based on the findings of the EIA, a draft Environmental Management Programme (EMP) has been developed. When the waste management licence (WML) has been issued, the EMP will be updated to ensure incorporation of all the conditions in the WML. The EMP will be implemented to control and minimise adverse impacts during operation and decommissioning of the proposed infrastructure.

8.1 Specialist studies

Specialist studies incorporated into the EIA include:

- a comprehensive storm water management plan (Etek Consulting Environmental Engineers); and
- a geohydrological investigation (Jasper Muller Associates Consulting (Pty) Ltd) .

8.2 Impact assessment methodology

The significance of the environmental impacts identified will be assessed in terms of their:

- Duration;
- Extent;
- Probability; and
- Severity.

The above will be used to determine the significance of an impact without any mitigation, as well as with mitigation in the EIA report.

Nature of an impact: An impact's nature can be positive (+) or negative (-).

Consequence: Considers duration, extent and severity.

Table 8-1: Environmental risk and impact assessment criteria

DURATION (D)		
Short term	6 months	1
Construction	36 months	2
Life of project	29 years	3
Post rehabilitation	Time for re-establishment of natural systems	4
Residual	Beyond the project life	5
EXTENT (E) OR SPATIAL SCALE		
Site specific	Site of the proposed development	1
Local	Farm/site and surrounding farms/site	2
District	eMalahleni Local Municipality	3
Regional	Nkangala District Municipality	4
Provincial	Mpumalanga Province	5
PROBABILITY (P)		
Almost Certain	100% probability of occurrence – is expected to occur	5
Likely	99% - 60% probability of occurrence – will probably occur in most circumstances	4
Possible	59% - 16% chance of occurrence – might occur at some time	3
Unlikely	15% - 6% probability of occurrence – could occur at some time	2
Rare	<5%probability of occurrence – may occur in exceptional circumstances	1
SEVERITY (S)		
Catastrophic (critical)	Total change in area of direct impact, relocation not an option, death, toxic release off-site with detrimental effects, huge financial loss	5
Major (High)	> 50% change in area of direct impact, relocation required and possible, extensive injuries, long term loss in capabilities, off-site release with no detrimental effects, major financial implications	4
Moderate (medium)	20 – 49% change, medium term loss in capabilities, rehabilitation / restoration / treatment required, on-site release with outside assistance, high financial impact	3
Minor	10 – 19% change, short term impact that can be absorbed, on-site release, immediate contained, medium financial implications	2
Insignificant (low)	< 10 % change in the area of impact, low financial implications, localised impact, a small percentage of population	1

RISK ESTIMATION (RE) (Nel, 2002)

	SEVERITY				
PROBABILITY	Insignificant (1)	Minor (2)	Moderate (3)	Major (4)	Critical (5)
Almost certain (5)	H	H	**E**	**E**	**E**
Likely (4)	M	H	H	**E**	**E**
Possible (3)	L	M	H	**E**	**E**
Unlikely (2)	L	L	M	H	**E**
Rare (1)	L	L	M	H	H

E	Extreme risk – immediate action required, detail considerations required in planning by specialists – alternatives to be considered	4
H	High risk – specific management plans required by specialists in planning process to determine if risk can be reduced by design and management and auditing plans in planning process, taking into consideration capacity, capabilities and desirability – if cannot, alternatives to be considered, senior management responsibility	3
M	Moderate risk – management and monitoring plans required with responsibilities outlined for implementation, middle management responsibility	2
L	Low risk – management as part of routine requirements	1

IMPACT SIGNIFICANCE	
Negligible	The impact is non-existent or insubstantial, is of no or little importance to any stakeholder and can be ignored.
Low	The impact is limited in extent, even if the intensity is major; whatever its probability of occurrence, the impact will not have a significant impact considered in relation to the bigger picture; no major material effect on decisions and is unlikely to require management intervention bearing significant costs.
Moderate	The impact is significant to one or more stakeholders, and its intensity will be medium or high; therefore, the impact may materially affect the decision, and management intervention will be required.
High	The impact could render development options controversial or the entire project unacceptable if it cannot be reduced to acceptable levels; and/or the cost of management intervention will be a significant factor in project decision-making.
Very high	Usually applies to potential benefits arising from projects.

8.3 Draft environmental management plan / programme

A draft Environmental Management Plan / Programme (EMP) is encompassed into the EIA report and covers all the phases of the project as well as their durations. These phases include:

- Planning and design phase;
- Construction phase;
- Operational phase; and
- Closure and rehabilitation phase.

The EMP also includes responsibilities for management measures to be implemented during each phase and also deals with aspects such as:

- Monitoring;
- Recording;
- Reporting;
- Auditing; and
- Compliance.

EMPr's are important tools for ensuring that the management actions/measures arising from the EIA process are clearly defined and implemented through all phases of the project.
An Emergency Preparedness Plan already exists (Appendix C of the Waste Licence Application) and can be incorporated into EMP measures.

9 IDENTIFIED POTENTIAL IMPACTS

9.1 Leaching

Leaching from waste material in unlined waste disposal facilities and sediments within unlined containment dams/ponds could lead to contamination of the underlying soil and/or groundwater aquifer. As the waste dump, containing hazardous waste materials, is still on the site and unlined, leaching can occur until the dump has been fully reprocessed and the area rehabilitated. The positive impact on groundwater quality when removing the waste dump (through reprocessing) and rehabilitation of the area over time is seen in the groundwater modelling (Section 10).

Note: Raw materials were found to not generate leachate with adverse qualities as a result of precipitation coming into contact with the raw materials as they are stockpiled.

9.2 Contaminated Runoff

Contaminated runoff from the site, operations and waste dump could impact the surrounding environment (groundwater and surface water resources). A detailed Storm Water Management Plan (SWMP) was compiled by E-Tek Consulting in September 2011 and updated in 2012. This investigation revealed that the Rand Carbide site is in need of a structured storm water management plan to facilitate the effective capturing, containment, management and reuse of storm water on site.

9.3 Waste Management

The current waste dump is of a historic nature, is unlined and has not been authorised. As the proposed activity applied for relates to the legalisation of current activities (storage and reprocessing) in terms of the latest environmental legislation (NEM:WA), as well as to improve the storm water, effluent and waste management, most of the impacts associated with this application are of a positive nature. Waste management (reprocessing and rehabilitation), if implemented correctly, can have major benefits on the environment, rather than the negative impacts associated with waste disposal. The proposed activity therefore aims to manage a major source of groundwater pollution, in order to reduce and mitigate current impacts and prevent further impacts. As the size of the waste dump decreases due to the processing of the waste, the pollution potential to the receiving water environment will also decrease. The waste material from the dump will be processed and remaining waste which cannot be sold or used in the process will be disposed of at the Holfontein waste disposal facility.

9.4 Land use

No impacts are expected in terms of land use as the land use will remain the same, namely industrial. However, by reducing waste volumes on the waste dump, a positive impact on land use in general is expected as less land surface area will be occupied by waste and the area currently occupied by the waste dump on the Rand Carbide site (2.25ha) will become available for another use after reprocessing has been completed.

9.5 Soils and groundwater resource

Due to the reprocessing of the waste dump, the risk of leaching from the dump contaminating underlying and surrounding soils and/or the groundwater resource is significantly reduced. See section on leaching (Section 9.1).

9.6 Visual aspects

The reduction of waste quantities on the dump and the eventual removal of the waste dump through reprocessing will have a positive visual impact.

9.7 Floral and faunal communities

Due to the industrial nature of the site, no impacts are anticipated with regards to fauna and flora as no environmentally sensitive faunal or floral species have been recorded on or in proximity to the site. However, through the reprocessing of the historical dump, the ecological integrity is likely to improve.

9.8 Noise

This project will not contribute significantly to the existing noise levels audible on this industrial site.

9.9 Traffic

Due to the nature of the project, the rate of reprocessing and other activities on the site contributing to traffic, no significant change in traffic volumes is expected.

9.10 Air pollution

The waste dump is a source of dust pollution. The reprocessing (and subsequent reduction and disappearance) of the dump will result in the overall reduction of airborne dust from the Rand Carbide site, thus a positive impact. The EMB waste processing plant uses water that is recycled in the process and therefore is not a source of dust pollution. The separation of waste and loading of waste material at the dump for transport to the processing plant, causes some disturbance and therefore some dust.

9.11 Socio-economic

No significant socio-economic impacts are anticipated. Positive impacts include:

- Jobs have been created due to the reprocessing by EMB.
- The reprocessing provides an income to both EnviroServe and Rand Carbide because of valuable products sold.
- Material becomes available to Rand Carbide to include in their process.
- Waste requiring disposal and taking up land surface area is reduced.
- Environmental risk in terms of groundwater pollution potential, soil pollution potential and airborne dust, is reduced.
- Risk to the surrounding residence/community is reduced due to the progressive removal of hazardous waste from the area.

9.12 Cumulative impacts

The reprocessing of the historic waste dump, cumulatively, can be regarded as a positive impact for both industry and the environment.

The reprocessing of the waste dump result in Rand Carbide being able to re-utilise previously discarded materials in its process, making operations more sustainable and cost effective. At the same time, the reprocessing activities create short to medium term employment opportunities.

Finally, the reprocessing and subsequent reduction in waste volumes currently stored on site will have a positive impact on the soils and groundwater resource as the pollution potential decreases as the dump is processed. The same positive impact will be seen on air quality.

10 IMPACT ASSESSMENT

The historical dump currently unprocessed contributes to the negative impacts during the planning and construction phase as pollutants (hazardous constituents) from the dump can still freely move/leach into the environment. However, as the re-processing of the dump continues and progresses, the amount of hazardous elements is reduced and so is the cumulative impact of the pollutant on the environment. Therefore, as a whole, the reprocessing of the historical dump is a positive impact on the environment and the only negative impacts are seen if no reprocessing occurs or if reprocessing is ceased and the waste dump or a portion of it remains. As the reprocessing progresses and continues, the positive impact on the environment increases.

It must be noted that positive impacts indicated in Table 10.1 do not require mitigation, therefore significance ratings remains the same.

Table 10-1: Environmental impact assessment

Construction Phase															
Aspect and description		Impact rating (before mitigation)							Impact Rating (after mitigation)						
Aspect	Description	Nature of Impact	Spatial Scale (5)	Duration (5)	Severity (5)	Consequence	Probability (5)	Significance (75)	Nature of Impact	Spatial Scale (5)	Duration (5)	Severity (5)	Consequence	Probability (5)	Significance (75)
Groundwater	Pollution through leachate	-	3	3	4	10	4	Moderate	-	2	3	3	8	3	Low
	Contaminated Runoff	-	3	3	4	10	4	Moderate	-	2	3	3	8	3	Low
Surface water	Contaminated Runoff	-	3	3	4	10	4	Moderate	-	2	3	3	8	3	Low
Soil/Geology	Pollution through leachate	-	2	3	3	8	4	Moderate	-	1	3	2	6	3	Low
Land capability	Storage of hazardous waste	-	1	3	2	6	5	Moderate	-	1	3	1	5	3	Low
Air quality	Dust from dump	-	2	3	3	8	4	Moderate	-	2	3	2	7	3	Low
Visual	Loss of aesthetic value	-	2	3	2	7	5	Moderate	-	2	3	1	6	3	Low
Socio-economic	Creation of jobs	+	4	3	3	10	5	High	+	4	3	3	10	5	High

Operational Phase															
Aspect and description		Impact rating (before mitigation)							Impact Rating (after mitigation)						
Aspect	Description	Nature of Impact	Spatial Scale (5)	Duration (5)	Severity (5)	Consequence	Probability (5)	Significance (75)	Nature of Impact	Spatial Scale (5)	Duration (5)	Severity (5)	Consequence	Probability (5)	Significance (75)
Groundwater	Reduction of pollution through leachate	+	3	3	3	9	4	Moderate	+	3	3	3	9	4	Moderate
	Progressive reduction of contaminated runoff	+	4	3	3	10	4	Moderate	+	4	3	3	10	4	Moderate
Surface water	Progressive reduction of contaminated runoff	+	4	3	3	10	4	Moderate	+	4	3	3	10	4	Moderate
Soil/Geology	Reduction of pollution through leachate	+	2	3	2	7	4	Low	+	2	3	2	7	4	Low
Land capability	Improvement in potential land use; land becoming available for other uses	+	1	3	2	6	4	Low	+	1	3	2	6	4	Low
Air quality	Reduction in dust generated by dump, but dust due to activities still continuing	-	2	3	3	8	4	Moderate	-	2	3	2	7	3	Low

Visual	Improve aesthetic value through reduction in size	+	2	3	2	7	4	Low	+	2	3	2	7	4	Low
Flora and fauna	Progressive increase in ecological integrity	+	2	3	2	7	4	Low	+	2	3	2	7	4	Low

Decommissioning Phase															
Aspect and description		**Impact rating (before mitigation)**							**Impact Rating (after mitigation)**						
Aspect	**Description**	**Nature of Impact**	**Spatial Scale (5)**	**Duration (5)**	**Severity (5)**	**Consequence**	**Probability (5)**	**Significance (75)**	**Nature of Impact**	**Spatial Scale (5)**	**Duration (5)**	**Severity (5)**	**Consequence**	**Probability (5)**	**Significance (75)**
Land capability	Land available for other use	+	2	4	3	9	4	Moderate	+	2	4	3	9	4	Moderate
Visual	Improve aesthetic value – no dump	+	2	4	3	9	4	Moderate	+	2	4	3	9	4	Moderate
Socio-economic	Loss of jobs	-	4	5	3	12	5	High	-	3	5	2	10	3	Moderate
Fauna and Flora	Re-establishment of ecological integrity	+	2	4	3	9	4	Moderate	+	2	4	3	9	4	Moderate
	Re-vegetation of areas as part of rehabilitation	+	1	4	4	9	4	Moderate	+	1	4	4	9	4	Moderate

10.1 The waste dump

The historic waste dump is not lined and waste has therefore been disposed of directly on top of the land surface. The dump contains a mixture of materials (heterogeneous), some of which are considered hazardous (such as manganese). Refer to Section 7. The dump is currently being processed by EMB and remaining waste is disposed off-site.

10.2 Groundwater model predicting groundwater quality impacts (JMA, 2012)

10.2.1 Objective of modelling

The objective of the groundwater flow and transport model was to simulate the transport of a potential contamination plume in the aquifer from potential sources on surface at Rand Carbide as well as to determine the use of natural attenuation as a means of remediation.

10.2.2 Groundwater flow

Elevations: The groundwater elevations were calculated by subtracting the recorded groundwater level from the surveyed collar elevation. The calculated groundwater elevations were then statistically contoured using the Kriging interpolation method. The groundwater elevation contours generated are statistical representations of numerical values and as such will enable calculation of the quantum of the groundwater gradients and will also reflect the regional groundwater flow direction across the site.

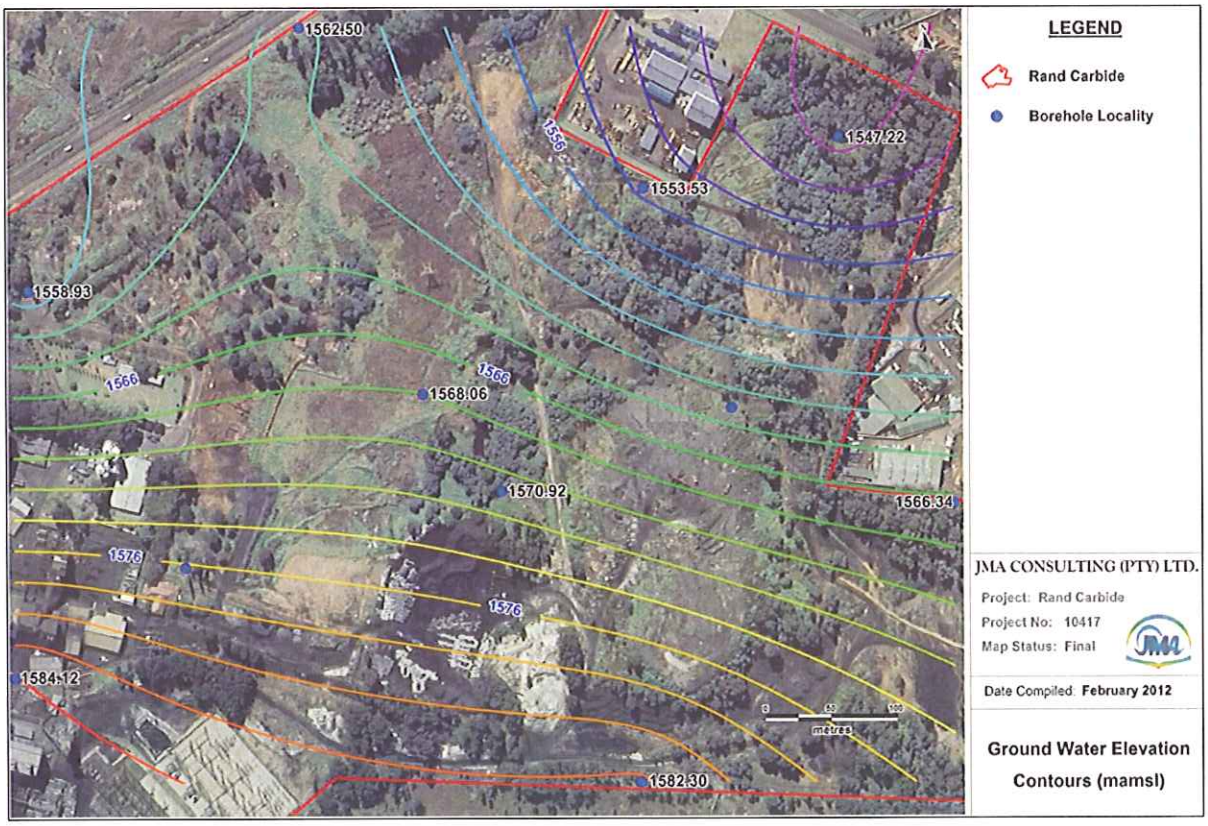


Figure 10-1: Groundwater elevations and contours (mamsl) (JMA, 2012)

Flow direction: Due to the nature of unconfined weathered zone aquifers, the groundwater flow directions are generally perpendicular to the surface contours and flow velocities are determined with reference to the calculated groundwater elevations (hydraulic heads) and

associated gradients. The groundwater will flow from areas of high to low groundwater elevations at right angles to the groundwater elevation contours. The predominant groundwater flow direction at Rand Carbide is from the south towards the north and north-east. The recorded groundwater elevations show a good correlation with surface topography and the unconfined conditions were therefore assigned to the top layer (weathered zone) in the numerical groundwater model.

Flow velocity: The flow/seepage velocity (Vs) was calculated as it represents the most realistic expression of the actual groundwater flow velocity. The specific seepage velocity will be influenced by the hydraulic gradient (i), effective porosity (n_e) and permeability (k) of the shallow weathered zone aquifer and will therefore continuously vary across the extent of the study area. Using the calculated average groundwater elevation gradient of 0.07, subject to the estimated bulk aquifer permeability of 0.04 m/day, and an effective porosity of 0.02 the average bulk groundwater seepage velocity for the shallow weathered zone aquifers at Rand Carbide is calculated as 0.14 m/day (51 m/year).

10.2.3 The model

Modelling software: The software used during the groundwater modelling was Visual Modflow Premium 4.3, a graphical user interface for MODFLOW. MODFLOW is an acronym for the USGS Modular Three-Dimensional Groundwater Flow Model and groundwater flow within the aquifer is simulated using a block-centred finite-difference approach. Layers are simulated as confined, unconfined, or as a combination of both.

Figure 10-2: Model area (aquifer boundaries) (JMA, 2012)

The aquifer boundaries assigned to the model are groundwater divides of the local sub-catchment area and have been incorporated into the model as drain boundaries.

Table 10-2: Model layer properties

Layer	Layer Type	Depth (m)	Porosity (fraction)	Effective Porosity (fraction)	Hydraulic Conductivity (m/day)
Layer 1: Shallow weathered zone aquifer	Unconfined /Confined	0 - 11	0.03	0.02	0.04
Layer 2: Fractured aquifer	Confined	11 - 100	0.01	0.001	0.004

In the transport model, Layer 2 was further subdivided into 9 sub layers - all with the same properties.

The initial head assigned to the steady state model was interpolated from the groundwater levels recorded in the aquifer during December 2011. The simulated steady state heads of the aquifer were then further used as the initial heads for the subsequent transient state models.

Recharge: The recharge to the aquifer was calibrated to range between 0 - 11 mm/year in the model which corresponds to a groundwater recharge of between 0 and 1.5% of the MAP.

Seepage: The recharge through the footprints of the delineated surface stockpile areas and waste dump was taken as 3% whilst in operation and as 1.5% after rehabilitation/closure.

Model scenarios:

1. Steady state model used to depict the modelled groundwater elevations and flow directions.
2. Transient state model used during the groundwater impact assessment to depict the potential development of a groundwater contamination plume as well as the natural attenuation thereof, once the identified impact sources have been removed over a 200 year period.

Steady state model: The steady state groundwater model indicates that the groundwater levels are the deepest at the topographical higher areas and shallowest at the topographically lower areas, close to surface water features and drainage lines. The groundwater elevation below Rand Carbide ranges between 1 590 mamsl and 1 540 mamsl according to the simulation and the groundwater flows in a north-easterly direction. The simulated average groundwater gradient below Rand Carbide is 0.06 in a north-easterly direction.

Transient state model: 200 years were run to observe the long-term impact. Seepage from sources has been simulated for a 100 year period.

Year 0 – 100: Recharge of 21mm/year; contaminant value of 100 mg/l
Year 101 – indefinite: After rehabilitation, recharge was taken as background and a contaminant value of 0% was used.

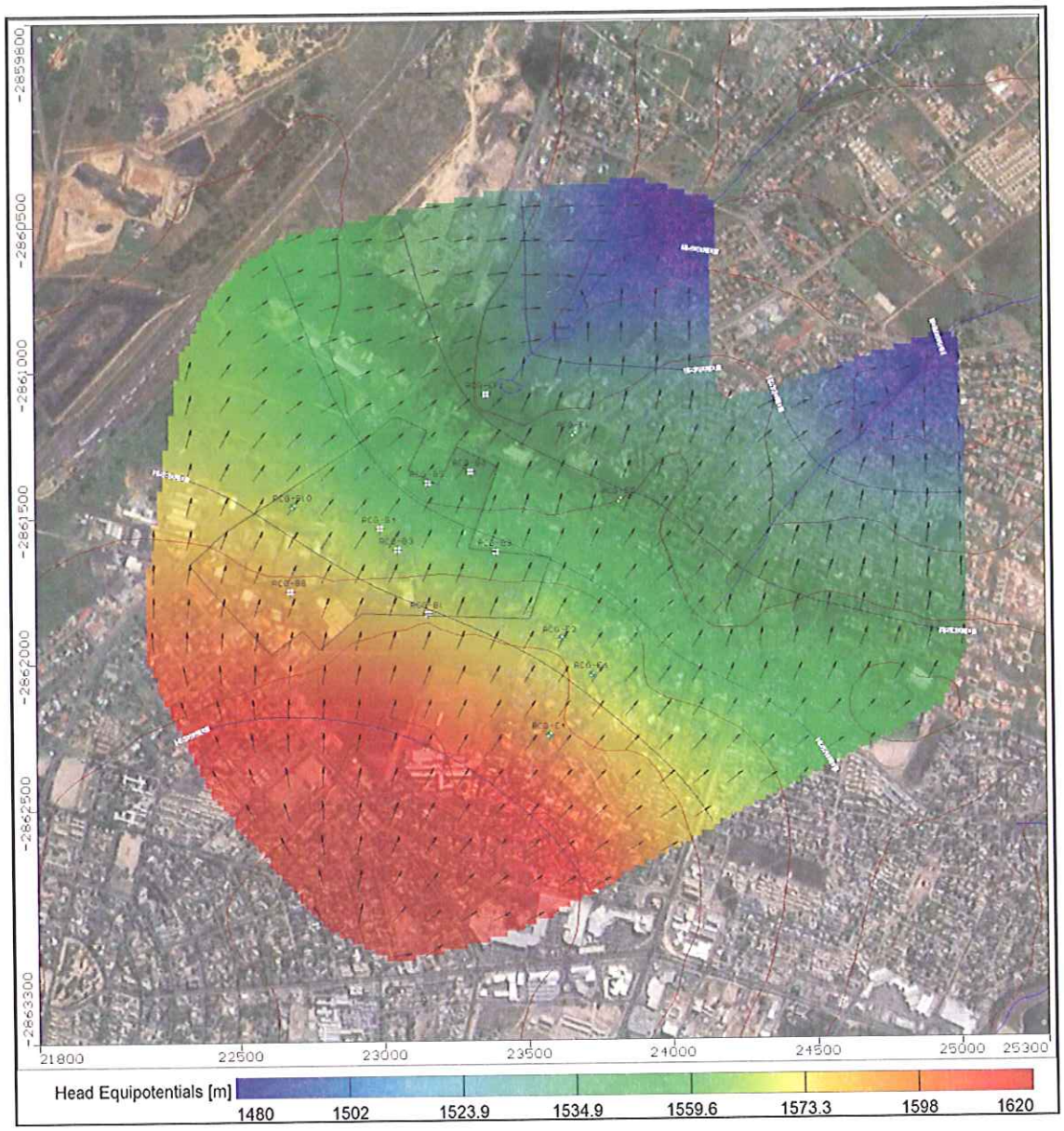


Figure 10-3: Simulated steady state model - elevations & flow directions (JMA, 2012)

10.2.4 Impact prediction

Contamination plume: Although no significant groundwater contamination plume could be delineated, it is suspected that the slightly elevated SO_4 (and probably Ca) concentrations observed in the groundwater is related to contamination from one or more of the delineated surface contamination sources. The major contamination source is identified as the historical waste dump, which will however need to be verified during future groundwater monitoring programmes.

Existing contamination: It is indicated from the model results, that the simulated contamination plume was almost static from between 40 - 50 years and onwards when the contaminants that seeped from the sources were comparable to those that flow out at surface water features down gradient of the site and that very little groundwater contamination is deemed to have occurred at Rand Carbide over the past 100 years.

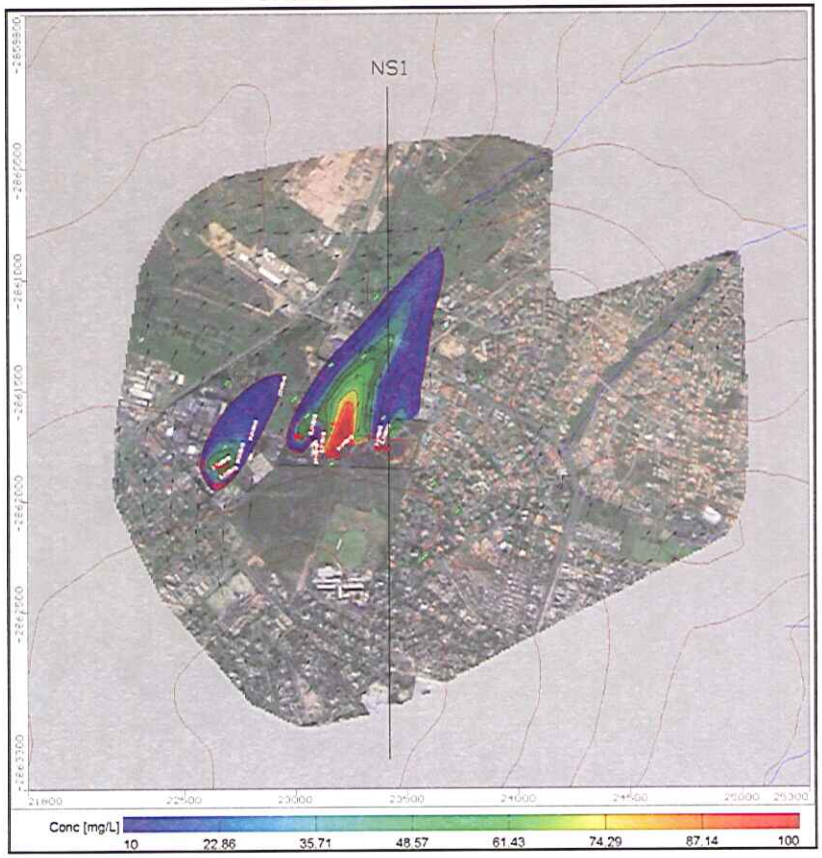
Future contamination: After 100 years (effectively 2026), all the potential pollution sources are deemed to have been completely removed and rehabilitated and the simulated pollution plume will decrease significantly after 10 years and is almost absent after 20 years.

Management: Based on the simulated results, it is deemed that removal and rehabilitation of the historical waste dump along with good housekeeping practices may be viewed as an effective groundwater management measure at Rand Carbide and will need to be continually verified during future groundwater monitoring.

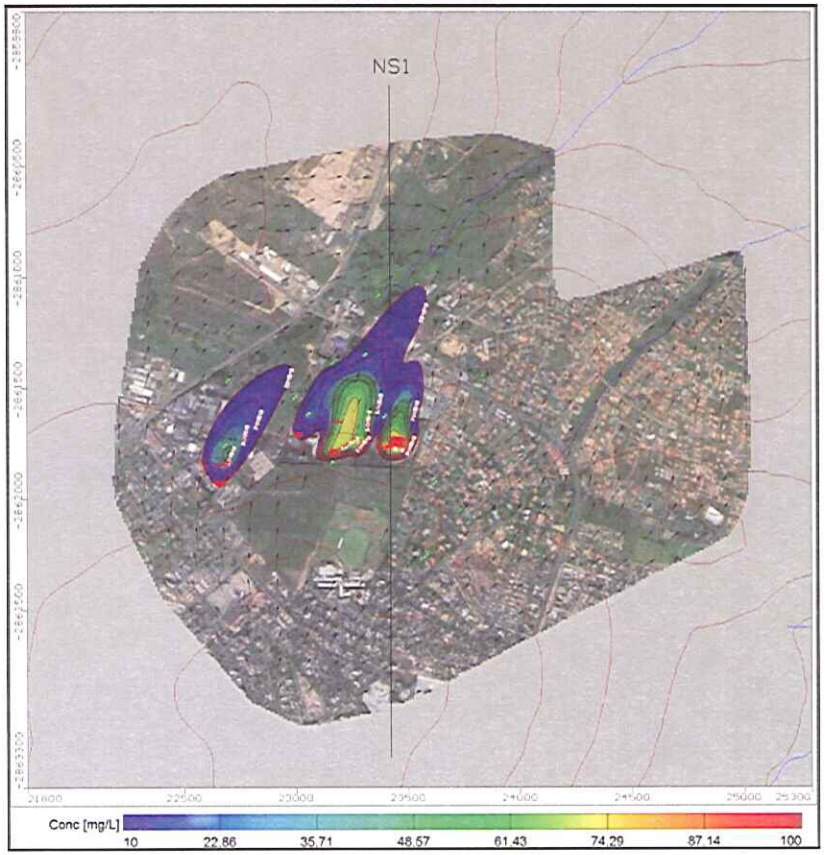
The recharge from the sources is stored in the aquifer over the first 100 years, up until the simulated removal and rehabilitation of the sources. After removal and rehabilitation of the sources, the release in storage from the aquifer is only slightly higher than all the cumulative seepage from the sources into the aquifer over the first 100 years.

It is calculated that after 50 years, the mass of the contaminants stored in the aquifer is 4 300 (normalized percentage). This increased with only 22% to 5 242 after year 100 and explains why so little change occurs in the simulated plume after 40 – 50 years of the model run time. After 30 years from removal and rehabilitation (model year 130), the mass of the contaminants within the aquifer is simulated to decrease by 46%. After a further 70 years (model year 200) it will only decrease by a further 37 %.

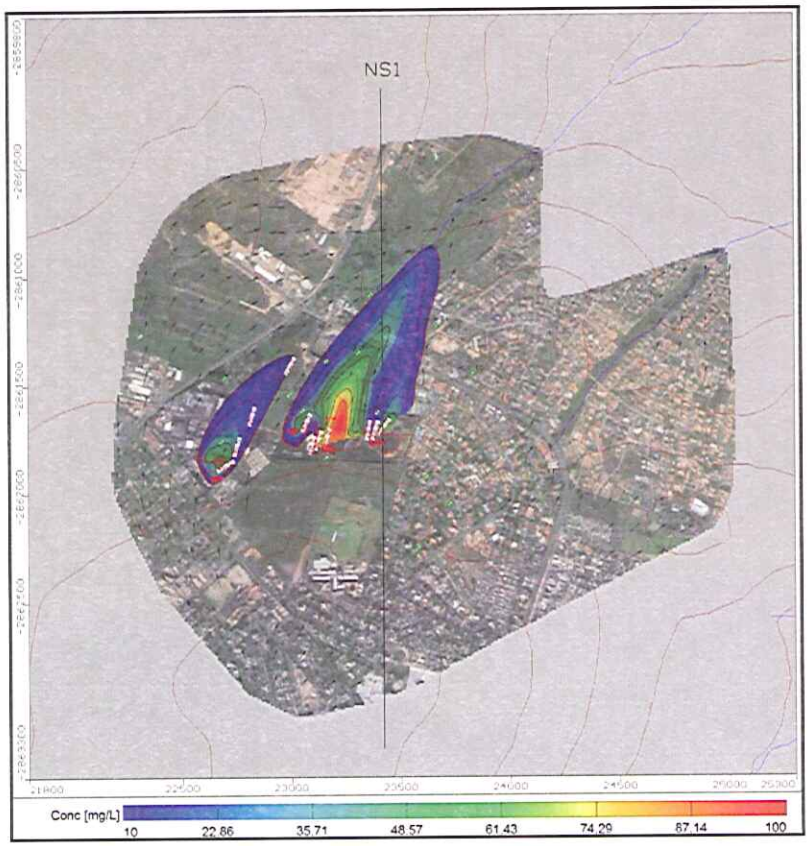
Shallow weathered zone

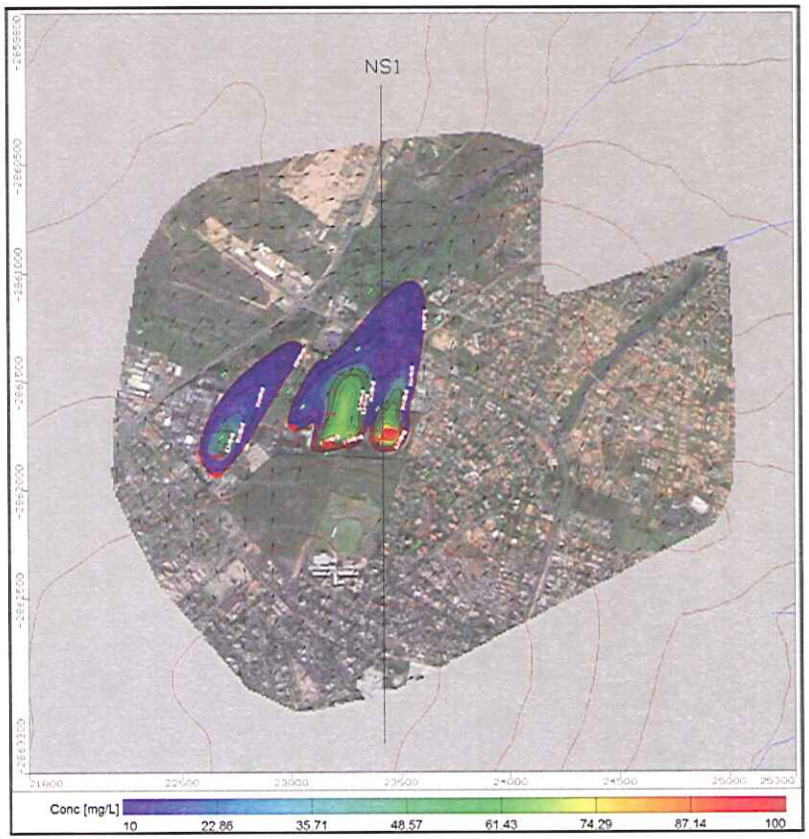


Fractured zone

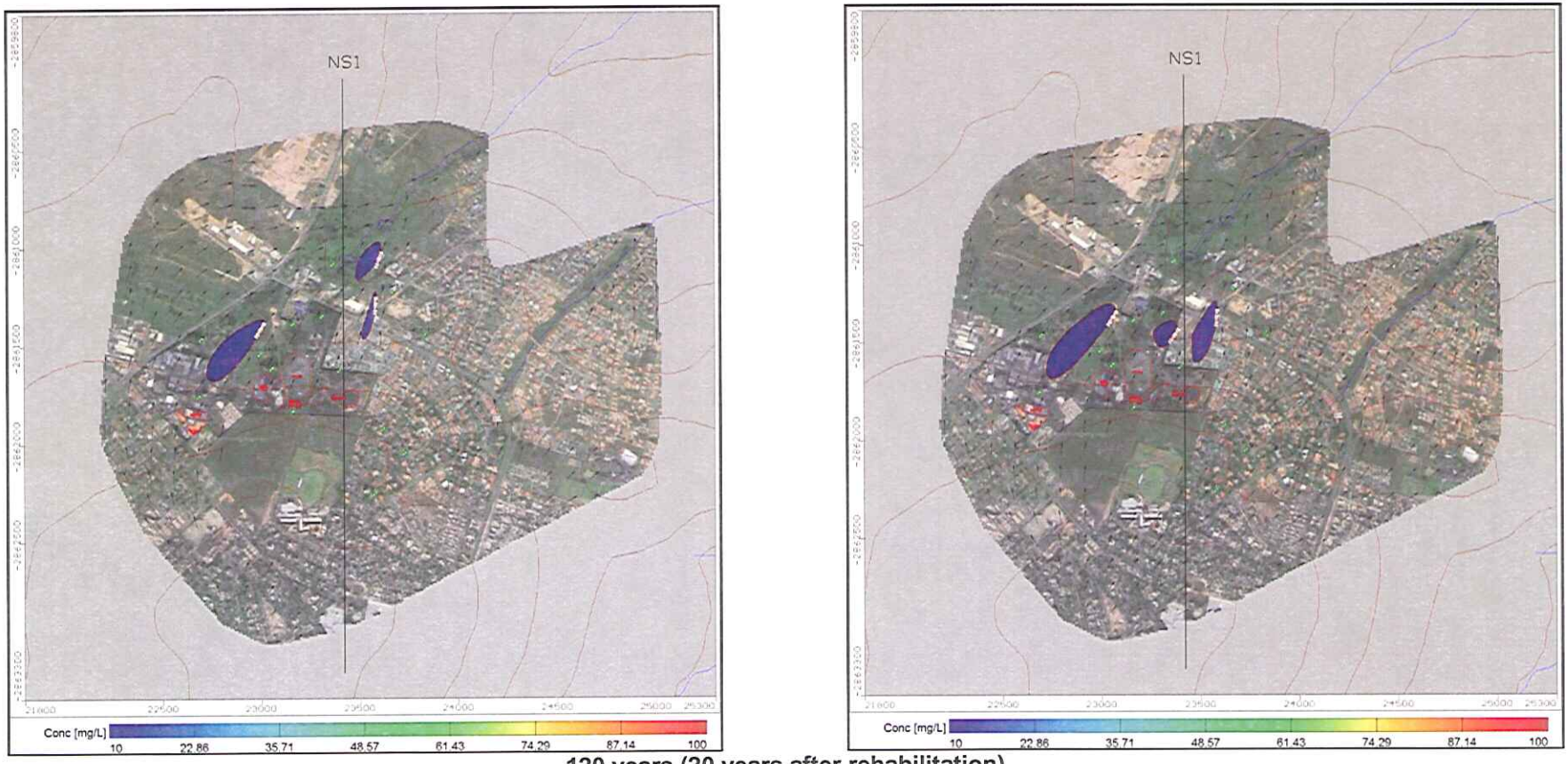


40 years


NS1
Conc [mg/L]
10
22.86
35.71
48.57
61.43
74.29
87.14
100


NS1
Conc [mg/L]
10
22.86
35.71
48.57
61.43
74.29
87.14
100

100 years



120 years (20 years after rehabilitation)

Figure 10-4: Pollution plume development (JMA, 2012)

11 ENVIRONMENTAL MANAGEMENT PLAN / PROGRAMME (EMP)

The purpose of the Environmental Management Programme or EMPr is to:

- Ensure that undue or reasonably avoidable adverse impacts of the project are prevented;
- Manage those impacts that cannot be prevented in order to reduce their significance; and
- Enhance the positive benefits that the project might have.

The EMPr is therefore structured in such a way that it:

- Defines the various measures to be taken during the life of the operation that will enhance positive impacts, minimise adverse environmental impacts and meet the necessary performance specifications;
- Defines the actions needed to implement the above mentioned measures;
- Describes how the above will be achieved; and
- Allocates responsibilities for these various aspects.

11.1 Responsibility

The applicant (Rand Carbide) will be responsible for the implementation of all mitigation and management measures as well as the compliance with this EMPr. Rand Carbide must employ a site manager (or person in a similar capacity such as the general manager) to which Rand Carbide delegates its responsibilities in terms of the requirements of the EMPr. The site/general manager must comply with the EMPr and can appoint a Manager's Representative (the title may vary), who is responsible for the on-site implementation of the EMPr (or relevant sections of the EMPr).

The Manager's Representative can be:
- A site agent;
- A site engineer;
- A dedicated environmental officer (EO); or
- An independent consultant.

The manager will ensure that the Manager's Representative is suitably qualified to perform the necessary tasks and is appointed at a level such that he/she can interact effectively with other site contractors, labourers, the Environmental Control Officer (ECO) and the public. The Manager's Representative ensures that all sub-contractors working under the Manager abide by the requirements of the EMPr.

In the event of the Manager appointing an EO, or officers, their primary role will be to coordinate the environmental management activities on site. The EO may also be required to perform the following roles:

- Support the Environmental Control Officer (ECO) in the monitoring and execution of the EMPr by maintaining a permanent presence on site;
- Inspect the site as required to ensure adherence to the management actions of the EMPr;
- Complete Site Inspection Forms on a regular basis (e.g. weekly);
- Provide inputs to the regular (e.g. monthly) environmental report to be prepared by the ECO;
- Liaise with the relevant personnel on issues relating to implementation of, and compliance with, the EMPr;

- Maintain a record of environmental incidents (spills, impacts, legal transgressions etc.) as well as corrective and preventive actions taken; and
- Maintain a public complaints register in which all complaints are recorded.

The conditions of the environmental authorisation, WML and EMPr must be brought to the attention of all persons (employees, workers, consultants, contractors etc.) associated with the undertaking of these activities and Rand Carbide must take such measures that are necessary to bind such persons to the conditions thereof (contracts and agreements with penalties for non-compliances).

Rand Carbide can further enforce this by running training programs with all employees/contractors in order to comply not only with the EMPr, but also to the National Norms and Standards for Waste management. These training programs should be set out with the following in mind:

- Training must be provided continuously to all employees working with waste and all contract workers that might be exposed to waste.
- The training programme must amongst others include the following:
  - Precautionary measures that need to be taken;
  - Procedures that they need to apply to their particular type of work;
  - Procedures for dealing with spillages and accidents;
  - Appropriate use of protective clothing; and
  - The risks of the hazardous substances, which they are likely to be exposed to, to their health.
- A sufficient number of employees must receive training to cover for leave periods, absences due to illness and public holidays.
- An attendance register must be kept and signed by each employee at each training session.
- Only trained persons must be allowed to handle hazardous waste.

11.2 Audits, recording and reporting

Accurate and up-to-date records will be kept (by the EO or other appointed representative) of all malfunctions resulting in non-compliance with the EMPr and environmental authorisation or licence conditions. The applicant will also, within 24 hours, ensure that the relevant authorities are notified of the occurrence or detection of any incident which has the potential to cause, or has caused pollution of the environment, health risks or which is a contravention of any EMPr or environmental authorisation or licence condition. The applicant is then to submit an action plan indicating measures which will be taken to:

- Correct the impacts resulting from the incident;
- Prevent the incident from causing any further impact; and
- Prevent a recurrence of a similar incident.

A complaints register will be kept on site and all complaints from the public will be noted therein as well as measures taken to rectify the situation as described above.

11.2.1 Auditing

- Internal audits must be conducted bi-annually and on each audit occasion an official report must be compiled by the relevant auditor to report the findings of the audits, which must be made available to the external auditor.
- An independent external auditor must be appointed to audit the facility annually and this auditor must compile an audit report documenting the findings of the audit, which must be submitted to the authority.

- The audit report must:
  - specifically state whether conditions of the licence are adhered to;
  - include an interpretation of all available data and test results regarding the operation and all its impacts on the environment;
  - specify target dates for the implementation of the recommendations to achieve compliance;
  - contain recommendations regarding non-compliance or potential non-compliance and must specify target dates for the implementation of the recommendations and whether corrective action taken for the previous audit non conformities was adequate; and
  - show monitoring results graphically and conduct trend analysis.
- The relevant authority responsible for waste management has the right to audit and/or inspect the facility without prior notification at any time.
- Any records or documentation pertaining to management of the facility must be available to the authority upon request, as well as any other information he/she requires.
- The findings of these audits or inspections must be made available to the authority within 30 days of the end of the audit or inspection.

11.2.2 Reporting

- Any incidences must be dealt with and be reported in accordance with sections 28 and 30 of NEMA.
- An action plan which includes a detailed time schedule, and resource allocation to address any incident must be signed off by the senior management of the organization and submitted within 14 days to the relevant authority.
- Complaints register and Incident report must be made available to the external auditor, and the authority.
- Each external audit report must be submitted to the authority within 30 days from the date on which the external auditor finalized the audit.

11.2.3 Records

- Each storage facility must be able to provide documentation that verifies:
  - The amount of waste stored in containers/tanks within the facility;
  - The date of collection; and
  - Authorized collector/s and proposed final point of treatment or disposal.
- Any deviations from the approved integrated industry waste management plan must be recorded.
- Records must be kept for a minimum of five (5) years and must also be available for inspection.

11.2.4 Alterations to the EMPr

As EMPr's should remain dynamic and flexible, certain conditions may require the EMPr to be revised. These conditions may include the following:

- Changes in legislation;
- Occurrence of unanticipated impacts or impacts of greater significance, intensity and extent than predicted;
- Inadequate mitigation measures, i.e. where the level of an environmental parameter is not conforming to the required level despite the implementation of the mitigation measure; and
- Secondary impacts which occur as a result of the mitigation measures.

Table 11.1: Identified potential impacts, risks and proposed management measures.

Construction phase	
Groundwater	
Potential impact:	**Pollution through leachate and contaminated runoff** • Raw material storage is not considered a major pollution source impacting on groundwater. • As the plant surface area is extensively covered with tarred roads, buildings with roofs, cement and concrete foundations, it is not considered a major pollution source that can impact on groundwater quality; however this does not eliminate the fact that pollutants from the plant area do contaminate groundwater. • The major surface contamination source impacting on groundwater quality is identified as the historical waste dump.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	A monitoring plan needs to be implemented as described in the geohydrological specialist study in Appendix B, Section 9 of the report as well as in Section 12 of this report. Within the monitoring plan the following aspects are highlighted: • The locality of monitoring points that that need to be included in the monitoring programme; • The sampling technique used for the different tests that need to be conducted; • The groundwater variables/constituents that need to be included in the analyses; and • The suggested timeframe in testing for groundwater variables, which is six monthly and a bi-annual report will need to be submitted. Other mitigation includes: • The historical waste dump needs to be reworked (reprocessed) and eventually be removed (and the area be rehabilitated) which encompasses the motivation for the project; and • Waste quantities processed and removed for off-site disposal needs to be monitored to ensure progress is made as planned.
Impact Significance : (Post mitigation)	**Low**

Surface water	
Potential impact:	**Contaminated Runoff** Contamination of the surface water resources through site runoff and precipitation that is contaminated and not contained.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	A storm water management plan will need to be implemented. The detailed plan can be seen in the specialist study by Etek in Appendix C. It includes: • The construction of diversion berms to divert clean runoff around Rand Carbide operations and facilities to prevent its contamination and release the clean water back into the receiving environment; • Upgrading and maintaining existing storm water conveyance structures (pipes and drains); • Establishing new storm water conveyance structures (drains & pipes) to ensure all potentially contaminated storm water from Rand Carbide is captured and conveyed to a containment facility; • Construction of a pollution control dam or storm water dam to contain potentially contaminated storm water from the Rand Carbide site for reuse; and • The establishment of sediment traps in strategic areas (plant and at entrance of dam) to capture and contain fines and prevent other structures (such as dam, drains & pipes) from being silted and experiencing reduced capacity. Other mitigation includes: • To clean and re-vegetate previous stockpile areas.
Impact Significance : (Post mitigation)	**Low**

Soil/Geology	
Potential impact:	**Pollution through leachate and contaminated runoff** Leachate from the historical waste dump that is not lined causing pollution of soil. Filtration of contaminated surface water runoff through the soil.
Impact Significance: (Prior to mitigation)	Moderate
Management Measures:	• Implementation of the storm water management plan; • Implementation of groundwater monitoring; and • To clean and re-vegetate previous stockpile areas.
Impact Significance : (Post mitigation)	Low
Land capability	
Potential impact:	**Storage of hazardous waste** The historical waste dump currently stores hazardous waste which restricts current land use and capability on site and the surrounding sites, as hazardous material pollutes the surrounding environment (dust and leachate).
Impact Significance: (Prior to mitigation)	Moderate
Management Measures:	Mitigation includes the removal and reprocessing of the material on the historical waste dump, which encompasses the motivation for the project. Therefore, the operational phase is the mitigation for the negative impact that the historical waste dump currently has.
Impact Significance : (Post mitigation)	Low
Air quality	
Potential impact:	**Dust generated from the current historical waste dump** Dust generated from the historical waste dump spreading to the surrounding environment.
Impact Significance: (Prior to mitigation)	Moderate
Management Measures:	Dust must be suppressed on roads and on the waste dump site, especially during dry periods, through the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of runoff. Rand Carbide has sprinklers and a watering truck for the purpose of dust suppression.
Impact Significance : (Post mitigation)	Low

Visual	
Potential impact:	**Loss of aesthetic value** The presence of the historical waste dump impacts the aesthetic value of the site as it remains visually disturbed. Only once the waste dump is reprocessed (fully) will the site visually improve.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	The reprocessing of the waste dump will increase the aesthetic value of the site, which is not only a suitable mitigation but in line with the goal/objective of the project.
Impact Significance : (Post mitigation)	**Low**
Socio-economic	
Potential impact:	**Creation of jobs** Reprocessing and rehabilitation efforts will create new job opportunities which will increase the current socio-economic standards.
Impact Significance: (Prior to mitigation)	**High**
Management Measures:	No mitigation required as this is a positive impact.
Impact Significance : (Post mitigation)	**High**

Operational phase	
Groundwater	
Potential impact:	**Reduction of leachate and therefore pollution** The reprocessing of the historical waste dump will result in the reduction of the amount of possible contaminants that can impact the groundwater quality. This will be constantly reduced until the dump is completely reprocessed and rehabilitated which will eliminate this source of pollution.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Positive impact, no mitigation is required.
Impact Significance : (Post mitigation)	**Moderate**
Surface water	
Potential impact:	**Progressive reduction of contaminated runoff** The reprocessing of the historical waste dump will result in the reduction of the amount of possible contaminants that can impact the surface water quality. This will be constantly reduced until the dump is completely reprocessed and rehabilitated which will eliminate this source of pollution. The storm water management plan (Etek, 2011 in Appendix C) will prevent contaminated runoff from contaminating other surface water resources through containment.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Storm water management plan (Appendix C). No further mitigation as the impact is positive.
Impact Significance : (Post mitigation)	**Moderate**
Soil/Geology	
Potential impact:	**Reduction of pollution through leachate and contaminated runoff management** The reprocessing of the historical waste dump will result in the reduction of the amount of possible contaminants that can impact the soil and geology. This will be constantly reduced until the dump is completely reprocessed and rehabilitated which will eliminate this source of pollution.
Impact Significance: (Prior to mitigation)	**Low**
Management Measures:	Positive impact so no mitigation is required.
Impact Significance : (Post mitigation)	**Low**

Land capability	
Potential impact:	**Improvement in potential land use** By reducing waste volumes destined for disposal as well as reducing waste volumes on the waste dump through reprocessing, a positive impact on land use and capability in general is expected as less land surface area will be used for disposal and the area currently occupied by the historic waste dump on the Rand Carbide site (2.25ha) will become available for another use.
Impact Significance: (Prior to mitigation)	Low
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	Low
Air quality	
Potential impact:	**Reduction in dust generated by dump, but dust due to reprocessing activities still continuing** Dust generated from the historical waste dump will be reduced as the amount of dump waste material is reduced through reprocessing. However, dust will be generated by vehicles and reprocessing activities.
Impact Significance: (Prior to mitigation)	Moderate
Management Measures:	Dust must be suppressed on roads used for transporting waste from the waste dump to the reprocessing plant and on the waste dump site, especially during dry periods, through the regular application of water. Water used for this purpose must be used in quantities that will not result in the generation of runoff. Rand Carbide has sprinklers and watering trucks to suppress dust.
Impact Significance : (Post mitigation)	Low
Visual	
Potential impact:	**Improve aesthetic value** The presence of the historical waste dump impacts the aesthetic value of the site as it remains visually disturbed. As the waste dump is reprocessed and then rehabilitated, the aesthetic value will be improved.
Impact Significance: (Prior to mitigation)	Low
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	Low

Flora and Fauna	
Potential impact:	**Progressive increase in ecological integrity** The historical waste dump currently affects surrounding natural areas with the spread of contaminants via surface water. With the reprocessing of the waste dump, the amount of contaminants is reduced and therefore pollution sources are reduced whereby the ecological integrity of the surrounding natural area can improve and be restored.
Impact Significance: (Prior to mitigation)	Low
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	Low

Decommissioning phase	
Land capability	
Potential impact:	**Improvement in potential land use** By reducing waste volumes destined for disposal as well as reducing waste volumes on the waste dump through reprocessing, a positive impact on land use and capability in general is expected as less land surface area will be used for disposal and the area currently occupied by the historic waste dump on the Rand Carbide site (2.25ha) will become available for another use.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	**Moderate**
Visual	
Potential impact:	**Improve aesthetic value** The presence of the historical waste dump impacts the aesthetic value of the site as it remains visually disturbed. As the dump site is completely reprocessed and the area then rehabilitated, the aesthetic value will improve.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	**Moderate**
Socio-economic	
Potential impact:	**Loss of jobs** Reprocessing and rehabilitation efforts that first created jobs are now complete and therefore job losses will follow as the plant will operate at reduced capacity (only processing current arisings).
Impact Significance: (Prior to mitigation)	**High**
Management Measures:	To use staff in other sections of operational areas within the industrial complex.
Impact Significance : (Post mitigation)	**Moderate**

Flora and Fauna	
Potential impact:	**Re-establishment of ecological integrity** The historical waste dump currently affects surrounding natural areas with the spread of contaminants via surface water. With the reprocessing of the waste dump, the amount of contaminants is reduced and therefore pollution sources are reduced whereby the ecological integrity of the surrounding natural area can improve and be restored.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	**Moderate**
Potential impact:	**Re-vegetation of areas as part of rehabilitation** Re-vegetation of the site forms part of the historical waste dump rehabilitation. This will include the removal of exotics and establishment of indigenous species were needed.
Impact Significance: (Prior to mitigation)	**Moderate**
Management Measures:	Positive impact, no mitigation required.
Impact Significance : (Post mitigation)	**Moderate**

12 EMP ACTION PLAN

12.1 Rand Carbide specific objectives and strategies

Objective 1: Prevent/minimise contamination of the groundwater resource by removing major surface contamination sources.

Strategy 1:

- Raw material storage is not considered a major pollution source impacting on groundwater.
- As the plant area is extensively covered with cement, buildings, tarred roads and concrete foundations, it is not considered a major pollution source that can impact on groundwater quality.
- The major surface contamination source impacting on groundwater quality is identified as the historical waste dump.
- No waste is currently disposed of on the Rand Carbide site or onto the historic dump.
- All waste currently generated on the site is recycled or removed off site for disposal.
- The dump has been reprocessed since 2005 (reclamation).
- The reprocessing will continue for approximately another 10 years.
- Waste is sorted and separated where after it is recycled, reprocessed (EMB plant or Rand Carbide plant) or removed for off-site disposal.
- After the entire dump has been reprocessed, the footprint will be rehabilitated.

Objective 2: Prevent/minimise contamination of the surface water resources by containing potentially contaminated water on the site for reuse. Refer to storm water management plan (Etek, 2011)

Strategy 2:

- **Diversion & discharge of clean water:** Build diversion berms to prevent clean water from entering the Rand Carbide site and potentially becoming contaminated. Refer to storm water management plan (Etek, 2011). An additional berm is required on the southern boundary to prevent clean water from the area of the school finding its way onto the Rand Carbide site and potentially becoming contaminated, thereby increasing the volumes of water to be managed by Rand Carbide. The water will then be diverted around the Rand Carbide site's potential contamination sources (on the eastern side) with existing structures and will discharge to the municipal storm water infrastructure (located along the old Middelburg road), which will in turn replenish the surface water resources (Olifants River).
- **Containment of process spillages:** Rand Carbide does have bunds within their plant area to contain spillages in areas of high pollution potential. All bunded areas should be equipped with a sump-and-pump system to allow any spillages to be returned to its origin. Storage areas with pollution potential are also bunded.
- **Capture and contain contaminated storm water:** All areas containing Rand Carbide infrastructure, facilities and operations are considered dirty areas. Any rainfall on these areas and surface water runoff from these areas can therefore be potentially contaminated and may therefore not be fit for release and needs to be captured and contained. Existing infrastructure (drains, pipes etc) for capturing will be upgraded and maintained. Additional infrastructure will be established to divert the potentially contaminated storm water from the plant area to a containment facility (pollution control dam) which will be built. The storm water containment dam (pollution control dam) will be 19 986 m^3 to contain the 1:50 year daily flood event from the plant area with a bottom width of 63m and a depth of 4m. A 0.8m freeboard should be maintained at all times to allow capacity for the 1:50 year storm event.

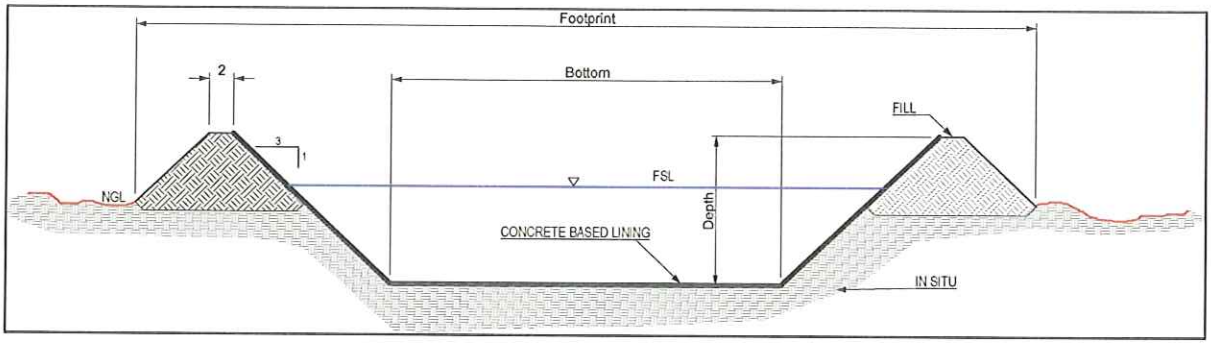


Figure 12-1: Storm water containment dam (Etek, 2011)

- **Reuse contained storm water:** Water contained in the storm water dam (pollution control dam) will be used for process purposes, specifically dust suppression, to reduce the amount of municipal water required on the site (water conservation). Provision for the transfer of at least 9m^3/hour (equivalent of maximum monthly inflow of 7 082m^3/month) from the storm water containment dam (pollution control dam) to the plant should be made to provide for peak demand periods.
- **Sediment traps:** The Rand Carbide site has a high amount of fine particles on the site. These particles will be carried with the storm water runoff to the containment dam. To ensure the containment dam remains free of silt that will reduce its holding capacity, sediment traps will be required. Sets of two (2) sediment traps are proposed to provide for desilting (cleaning) of one trap while the other is used. The volume is the maximum of the average monthly flow converted to a daily volume. The overflow from the sediment traps will be conveyed to the storm water containment dam (pollution control dam). Sediment traps will be 9m wide and 1.5m deep with 1V:2H side slopes and a capacity of 229m^3. Access for cleaning purposes should be considered and addressed during detailed design.
- **Reuse spring water:** Some springs are evident on the Rand Carbide site. Due to the location of these springs in the plant area (underneath furnace buildings), these are contaminated and the water is therefore not fit for release into the environment. Rand Carbide should use the contaminated spring water for dust suppression rather than discharging it into the storm water management system and importing municipal water for dust suppression purposes (water reclamation).

Objective 3: Monitor effectiveness of management measures implemented.

Strategy 3:

- Monitor the eleven (11) boreholes on the Rand Carbide property six-monthly.
- Monitor the spring off-site as well as the three (3) springs on site.
- Monitor surface water and storm water on the property as well as any discharges.

An Action Plan summary can be seen in Table 12 -1.

Table 12-1: Summary of actions, timeframes and budget

Objective / goal:	Strategy (actions):	Timeline:	Budget:
Groundwater management	Redrill / open RCG-B2 (currently blocked)		R50 000.00
	Remove groundwater contamination sources: Rework / remove historic waste dump (raw material storage poses no risk)	2007 - 2020	On-going operational cost
	Monitor boreholes (six monthly)	2012 (on-going)	R32 000.00 (annual)
	Include off-site spring in monitoring programme	2012 (on-going)	R2 000.00 (annual)
	Include on-site springs in monitoring programme (3 springs)	2012 (on-going)	R6 000.00 (annual)
	Contain and reuse contaminated water to prevent off-site movement and pollution of surrounding environment: Reuse spring water due to contamination	2012 (on-going)	No cost Duty of care
Waste management	Collect (bins/skips), separate (different colored bins/skips), recycle (plastic, glass, paper) and/or dispose of all general waste (Kriel waste disposal facility)	2012 (on-going)	R505 000.00 (annual)
	Collect (bins/skips), recycle (oil) and/or dispose of all hazardous waste (Holfontein waste disposal facility)	2012 (on-going)	
	No on-site disposal: Dispose of all new arisings industrial waste off-site (Holfontein waste disposal facility)	2012 (on-going)	
	Rework / remove historic waste dump	2007 - 2020	Self-sufficient
Surface water management	Reuse spring water for dust suppression to prevent contaminated water from moving off-site and reduce municipal water intake	2012 (on-going)	No cost Duty of care
	Separate clean and dirty water	2013 - 2017	(included below)
	Divert clean water and discharge: Construct earth berms and diversion trenches to divert clean storm water around and away from Rand Carbide activities & facilities and discharge to municipal storm water infrastructure to replenish surface water resources as per regulation 704.		
	Contain and reuse contaminated water: Capture (drains/pipes) and contain (storm water or pollution control dam) potentially contaminated storm water that has been in contact with Rand Carbide activities & facilities and reuse water (for dust suppression) to reduce municipal water intake.		
	Construct new & upgrade existing drains / trenches	2013 (R1-R5)	R 1 500 000.00
		2014 (R6-R9)	R 3 500 000.00
	Construct storm water containment dam	2015 - 2016	R 2 600 000.00
	Storm water management around historic waste dump	2017	R 1 000 000.00
	Monitor surface water (monthly)	2012 (on-going)	R60 000.00 (annual)

12.2 MONITORING

12.2.1 Monitor reclamation of materials from historic waste dump

Waste from the historic heterogeneous, hazardous, unlined waste dump located on the property is sorted, separated, reprocessed and disposed of off-site. Due to the mixed (heterogeneous) and possible hazardous nature of materials historically disposed on the site as well as the fact that the dump was never lined, the dump poses a risk for environmental pollution. No waste currently generated on the site is disposed at the facility and all waste generated is reprocessed, reused/recycled or disposed of off-site. The throughput of material through the EMB plant should be monitored to ensure the material is reprocessed and removed from site at an acceptable rate in order to have the dump removed and area rehabilitated within the next 8 – 10 years. Rand Carbide should keep record of all materials removed from the historic waste dump, all materials removed off site for disposal (include destination) or recycling as well as material reprocessed and used.

12.2.2 Monitor water quantity

Water usage (volumes) should be monitored (through the installation of flow meters) so as to ensure efficient water use. All water taken from the municipal water supply line should be accounted for. Water used from the municipal water supply should be minimised to reduce cost and make this water available to other users (domestic users). Water already contaminated by Rand Carbide's operations, such as storm water and spring water, should be used in preference to municipal water. Rand Carbide should establish and maintain (update) a water balance for the site.

12.2.3 Monitor water quality

Water utilised for potable and process use as well as waste water that get discharged must be monitored to ensure compliance with both environmental legislation (NEMA, 1998) as well as applicable municipal by-laws and to prevent any human health risk. Groundwater quality should be monitored to refine and update the groundwater model. Groundwater quality should further be monitored to establish groundwater pollution levels and movement of the contamination plume to allow management actions to be taken in cases where pollution reach unacceptable levels or move beyond the site boundary.

12.2.4 Monitoring strategies & principles

The following monitoring strategies and principles apply:

- Compile a sampling protocol for water monitoring, especially in terms of groundwater monitoring. Develop procedures (including criteria) for field measurements and sampling.
- Rainfall should be recorded on the site.
- Monitor outflows and discharges to identify water reuse options.
- Water use of different plant water users should be monitored and the data used in the water balance.
- Water reticulation diagram should indicate all water flow meters used for daily water quantity monitoring.
- Monitoring programme to include the following:
  - Meteorological data (rainfall).
  - Map with monitoring positions.
  - Monitoring frequency.
  - Monitoring parameters based on potential pollution sources, indicator contaminants and constituents of concern (depending on objectives).

  - Analyses according to approved methods (internationally accepted or SANS approved).
  - Baseline monitoring points.
  - Downstream monitoring points to determine impacts.
  - Storm water monitoring points.
  - Groundwater monitoring across the area to ensure representative monitoring and assessment of impact of all possible pollution sources.
  - Compliance monitoring points.
- Monitoring positions should be split into categories indicating the reason for their sampling, for example compliance monitoring, impact monitoring, environmental monitoring etc.
- Quantifiable objectives and performance indicators must be developed for each category above, based on applicable standards and on-site/downstream requirements. Monthly performance reviews of the monitoring results should be performed.
- Establish an operating and maintenance programme for the water monitoring system. Ensure that instrumentation such as water flow meters are maintained and regularly calibrated to ensure accurate measurements. Additional water flow meters are required. Introduce preventative maintenance and regular inspections to ensure effective operation of the monitoring system.
- Data management system (one database) for all water quantity and quality data, which should be made available to all relevant parties requiring access. This will also allow for quick action when errors do occur (re-analysing of samples, corrective action, investigations or management measures).
- Quality control and assurance measures should be implemented to verify results and ensure data reliability. Include duplicate sampling, standards, blanks, cation-anion balances etc.
- Develop non-compliance reporting structure and contingency measures.
- Review or audit and revise monitoring system annually and ensure compliance with any licence conditions, including any licences to be applied for and issued in future. This means reassessing objectives of monitoring, the location of monitoring points, the frequency of sampling, the parameters analysed, the procedures, quality control measures, data management and reporting.

12.2.5 Water monitoring

Water monitoring is a legal requirement and generates baseline and background data, identifies pollution sources, determines the extent of pollution, monitors water usage by different plant water users (cost control), can be used to calibrate and verify prediction and assessment models (to plan for closure and make financial provision), helps with identification of water reuse opportunities, can assist with identification of appropriate water treatment technology, helps with the control of unit processes (water-and-salt balances), determines and evaluates the success of implemented management measures, and assesses compliance (with standards and legislation) and the impact on the receiving water environment.

To ensure that the data collected through the water monitoring system is reliable and appropriate, the following is required:

- **Consultation** with interested and affected parties (I&APs) to address their concerns, specifically downstream users to assess the risk of water pollution and its associated impact.
- Clear definition of objectives of **management actions** that drive the monitoring programme.

- A detailed **design** of a water monitoring system, which specifies location of monitoring points (map), data to be collected (flow, variables, frequency), data collection procedure (sampling protocol), management (database, storage, assessment) and reporting.
- **Audit** to ensure implementation is according to detailed design and that the objectives are achieved.
- Data that represents the actual situation by covering the area in sufficient detail and using procedures that will provide **representative** data.
- An **operating and maintenance programme** to ensure the water monitoring system functions properly.
- A **data management system**, which is accessible to all relevant users and ensures that data is used optimally.
- **Quality control and assurance measures** to ensure reliable and verifiable data.

12.2.5.1 Groundwater monitoring

Monitoring points: Rand Carbide has eight (8) existing monitoring boreholes spread across the site (see Figure 12-1 & Table 12-2; BH1 – BH6; lab borehole & UST borehole). As the plant area and some other areas are not covered in sufficient detail to determine potential pollution sources, impacts, extent of pollution etc, an additional five (5) monitoring boreholes were drilled in 2011 (see Figure 12-1 & Table 12-2; BH7 – BH11).

Plate 12-1: Example of a monitoring borehole

Monitoring frequency: Boreholes are generally monitored three (3) times a year. Monitoring frequency will be increased to quarterly to represent the four (4) seasons.

Monitoring parameters:

Physical: pH
Electrical Conductivity (EC) in mS/m
Oxidation-Reduction Potential (ORP)

	Water level (metres below ground level)
Major cations:	Calcium (Ca) Magnesium (Mg) Sodium (Na) Potassium (K)
Major anions:	Nitrate (NO_3 as N) Sulphate (SO_4) Chloride (Cl) Fluoride (F)
Organics:	Hydrocarbons (HC)
Other:	Total Dissolved Solids (TDS) Alkalinity (Alk as $CaCO_3$) Acidity Iron (Fe) Aluminium (Al) Manganese (Mn) Barium (Ba) Zircon (Zr) Silica (Si) Zinc (Zn) Lead (Pb) Cobalt (Co) Copper (Cu) Nickel (Ni)

The following parameters are currently also being monitored:
Chromium (Cr), Mercury (Hg), Arsenic (As), Cadmium (Cd), Vanadium (V), Silver (Ag), Phenolic compounds.

Table 12-2 below provides a summary of monitoring points, localities, purpose of monitoring, frequency of monitoring (six-monthly), sampling depth and parameters analysed at Rand Carbide.

Table 12-2: Groundwater monitoring points

Monitoring point	Locality & collar elevation:	Purpose:	Sampling depth (mbgl):	Parameters:
Existing monitoring points (drilled in 1989):				
Lab	25°52.547' S 29°13.514' E	Reference borehole		**Frequency of sampling:** Six-monthly **Physical:** pH; EC; ORP; water level **Major cations:** Ca; Mg; Na; K **Major anions:** NO_3 & NO_2; SO_4; Cl; F **Organics:** HC **Other:** TDS; Alk; Fe; Al; Mn; Ba; Sr; Zr; Si; Zn; Pb; Co; Cu, Ni
BH UST	Proximity to diesel and petrol UST	Monitoring containment of hydrocarbons in UST.		
BH 1	25° 51.864' S 29° 13.862' E 1 597.18 mamsl	South of waste dump; on perimeter (school); upstream of waste dump (no impact).	20	
BH 2 blocked	25° 51.707' S 29° 13.905' E 1 567.73 mamsl	North east of waste dump; impact of waste dump. Monitor spread of potential pollution plume towards residential areas.	18	
BH 3	25° 51.743' S 29° 13.799' E 1 576.18 mamsl	North west of waste dump; south of Harry's dam.	18	
BH 4	25° 51.709' S 29° 13.769' E 1 572 mamsl	North of Harry's dam; impact of Harry's dam.	20	
BH 5	25° 51.623' S 29° 13.864' E 1 556.25 mamsl	South of Komatsu. Monitor potential pollution plume from Rand Carbide towards north.	30	
BH 6	25° 51.601' S 29° 13.953' E 1 551.27 mamsl	East of Komatsu. North east corner of site (OR Tambo road). Lowest point on site.	12	
New monitoring points: (drilled November 2011 to intersect shallow weathered zone aquifer)				
BH 7 Artesian 0.2l/s	25° 51.778' S 29° 13.656' E 1 583.11 mamsl	East of plant; north of EMB	tap	**Frequency of sampling:** Six-monthly **Physical:** pH; EC; ORP; water level **Major cations:** Ca; Mg; Na; K; NH_4 **Major anions:** NO_3 & NO_2; SO_4; Cl; F **Organics:** HC **Other:** TDS; Alk; Fe; Al; Mn; Ba; Sr; Zr; Si; Zn; Pb; Co; Cu; Ni; Cr
BH 8	25° 51.824' S 29° 13.584' E 1 585.43 mamsl	In plant area; north of raw materials stockpiles	10	
BH 9	25° 51.751'S 29° 14.009' E 1 572.92 mamsl	Perimeter (monitor potential pollution plume moving off site); raw materials in eastern section of site	15	
BH 10	25° 51.664' S 29° 13.587' E 1 573.93 mamsl	North of plant.	25	
BH 11	25° 51.557'S 29° 13.730'E 1 562.75 mamsl	Northern perimeter – Middelburg road; monitor potential pollution plume moving off site	26	

Red indicates additional/new/recommended monitoring

12.2.5.2 Surface water monitoring

Monitoring points: Rand Carbide has three (3) existing surface monitoring points (see Table 7-3). The surface water monitoring was extended by adding another seven (7) points (see Table 7-3).

Plate 12-2: Example of surface water monitoring point: Spring water underneath Furnace E

Monitoring frequency: Points should be monitored monthly though monitoring currently takes place biannually.

Monitoring parameters:

Physical:	pH
	Electrical Conductivity (EC) in mS/m
	Flow / volume
Major cations:	Calcium (Ca)
	Magnesium (Mg)
	Sodium (Na)
	Potassium (K)
Major anions:	Nitrate (NO_3 as N)
	Sulphate (SO_4)
	Chloride (Cl)
	Fluoride (F)
Organics:	Hydrocarbons (HC)
Other:	Total Dissolved Solids (TDS)
	Alkalinity (Alk as $CaCO_3$)
	Acidity
	Iron (Fe)
	Aluminium (Al)
	Manganese (Mn)

Barium (Ba)
Zircon (Zr)
Silica (Si)
Zinc (Zn)
Lead (Pb)
Cobalt (Co)
Copper (Cu)

Table 12-3 below provides a summary of monitoring points, localities, purpose of monitoring, frequency of monitoring and parameters analysed at Rand Carbide.

Table 12-3: Surface water monitoring points

Monitoring point	Locality:	Purpose:	Frequency:	Parameters:
Spring 1	Furnace E	Reuse possibility	Monthly	**Physical:** pH; EC; flow/volume **Major cations:** Ca; Mg; Na; K; NH_4 **Major anions:** NO_3 & NO_2; SO_4; Cl; F **Organics:** HC **Other:** TDS; COD; SS; Alk; Fe; Al; Mn; Ba; Sr; Zr; Si; Zn; Pb; Co; Cu; Ni; Cr
Spring 2	Furnace F			
Spring 3	B9 conveyor sump.			
Harry's dam inlet	Inlet to dam	Storm water quality		
Harry's dam outlet	Discharge from dam.	Storm water discharges; discharges to veldt.		
Catchment sumps inlet	Inlet to sump 1	Storm water quality from plant		
Catchment sumps outlet	Outlet from sump 6	Effectiveness of sediment precipitation.		
Inlet to new Storm Water Control dam	Inlet to dam	2013; Storm water quality		
Outlet new Storm Water Control dam	Discharge from dam – only 1:50 year storm.	2013; Storm water discharge (if any)		
Washbay	At washbay	Hydrocarbon removal efficiency.		
Panorama				
Swartbos		At OR Tambo road (previously Swartbos)		

Red indicates additional/new/recommended monitoring

12.2.5.3 Bio-monitoring

There are no surface water bodies in close proximity to Rand Carbide and therefore no bio-monitoring is conducted.

Figure 12-1: Groundwater monitoring points (existing white; 2011 drilled - red)

12.2.6 Data management and reporting

Data collection: Rand Carbide does the surface water sampling. Regen Waters does the groundwater sampling according to a set programme and protocol for quality control and assurance purposes. All analyses are conducted by Regen Waters (Witbank) according to nationally (SANAS) or internationally approved methods. Regen Waters is a SANAS accredited laboratory and also conducts their own in-house quality control and assurance measures such as the following to validate their data:

- Duplicate analyses
- Blanks
- Standards
- Cation-anion balance
- Prescribed standard methods for analyses etc.

Data storage: The data from the laboratory is captured in an Excel database which has a spread sheet for each monitoring point indicating the following:

- Company name and site
- Name of monitoring point
- Frequency of monitoring (date of sampling)
- Parameters determined
- Units parameters are measured in
- SANS 241 standards / water quality objectives for the reserve
- Data from laboratory

Coordinates (locality) of monitoring points should also be included in this spread sheet in order to have all relevant information together. The coordinates of the boreholes are available and indicated on the site layout plan.

Data interpretation: Rand Carbide should do time-series graphs on specifically the main constituents of concern:

- Total Dissolved Solids (TDS) or Electrical Conductivity (EC)
- Sulphate (SO_4)
- Calcium (Ca)
- Manganese (Mn)

Rand Carbide compares these to SANS 241 guidelines currently. These parameters should be compared to the receiving/reserve water quality objectives (RWQO).

Reporting: Results should be reported and graphs presented during monthly meetings.

12.2.7 Waste monitoring

12.2.7.1 Solid process wastes

Waste materials: Material on the historic dump includes the following:

- Contaminated Ferro-silicon (40 tons/annum)
- Amorphous silica fume
- Tarry materials
- Oil soaked calcined anthracite
- Paste
- Char (80 tons/annum)
- Slag (64 tons/annum)
- Coal fines/dust (52 tons/annum)

- Aluminium (18 tons/annum)
- Silica/Quartz fines
- Char/coal fines
- Anthracite fines/dust
- Sweepings (coal dust etc.)
- Stoker refractory (large lumps)
- Stoker ash (fly ash)
- Ladle refractory
- Carbon stoker mix fines
- Refractory bricks
- Paper/wood

Analyses: Materials at EMB were independently analysed. Analyses from M&L Laboratory Services (Pty) Ltd indicated results for 5% TCLP extract of samples from the silo and cyclone crushed to -9.5mm (EPA 1311). The following metals were found to leach at detectable concentrations: Al, Mn, Fe, Zn, Pb, Co, Cu, Si, Sr, B, P, Ba, K, Mg, Ca. Refer to Appendix D for laboratory certificates.

12.2.8 Environmental Management System

Rand Carbide holds an ISO 14001:2004 certificate (valid until May 2014) for the manufacturing of ferrosilicon, silicon metal, electrically calcined anthracite, silica fume and Söderberg electrode paste. Please refer to Appendix A.

12.2.9 Recording of incidents

12.2.9.1 Incident investigation reports

All incidents (injuries, spillages etc.) will be recorded as per defined Safety, Health, Environment and Quality (SHEQ) standards. A standard format (incident investigation report) should be completed for each incident to allow further investigations into the matter.

The incident investigation report should contain the following information:
- Particulars and description of incident;
- The investigation panel;
- Root cause of incident;
- Corrective and preventative measures to prevent incident from recurring;
- Witness and Insured's statements;
- Photos and Work Instructions; and
- Risk assessments carried out for the tasks performed.

12.2.9.2 Emergency and contingency measures

Emergency and contingency plans are in place in conjunction with the necessary equipment and personnel on stand-by to manage such situations as and when necessary. Water is available for fire fighting (booster pumps) in the unfortunate event of a fire breaking out on the plant. Rand Carbide has no emergency water storage when the raw water supply from eMalahleni Municipality is interrupted for whatever reason. Operating procedures and planned maintenance systems will be established for inspection, maintenance, and to ensure effective and continuous operation and early detection of any malfunction or emergency incident. The existing Emergency Preparedness Plan can be seen in Appendix C of the Waste Licence Application.

12.2.10 Environmental Impact Register

Records of all the accident/incident investigations should be retained in and environmental impact register for a period of three years at the SHEQ Department.

13 EAP PROFESSIONAL OPINION

In accordance with the EIA Regulations GN R543 31 (2) (n), the Environmental Assessment Practitioner (EAP) must provide an opinion as to whether the activity should or should not be authorised/licenced, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorization must be stated.

An impact assessment has been undertaken, which has incorporated consultation with and participation of the interested and affected parties. It is the EAP's opinion that due process has been followed. Where impacts have been found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed.

It was found that the construction and implementation of the project would:

- Not give rise to any adverse biophysical or socio-economic impacts that cannot be adequately mitigated;
- Improve waste management; and
- Potentially have a positive environmental impact resulting from the reprocessing of the historical waste dump which is also the suggested mitigation in regard with the current spread of pollutants.

It is the opinion of the EAP that, subject to compliance with the recommended mitigation measures, which are detailed in the EMP, the project has significant positive aspects and acceptably low negative impacts and should be approved. The authorization/licence should be subject to the following conditions:

- The project should remain in full compliance with the requirements of the EMP and with all regulatory and legal requirements;
- The EMP should be implemented by senior qualified environmental personnel that have competence and credibility to interpret the requirements of the EIA and the EMP, and must be issued with a written mandate by a senior management member to provide guidance and instructions to the contractors;
- Stakeholder engagement must be maintained during the construction, operational and decommissioning phases of the project, with the emphasis on on-going provision of information pertaining to the project, and with the goal of maintaining constructive and mutually respectful stakeholder relations;
- A detailed record of all activities related to environmental and social management, as well as stakeholder engagement, should be retained for review and audit by independent parties for all phases of the project. The audit findings should be made available to the relevant environmental and local authorities; and
- Any substantive changes to the project configuration should be the subject of environmental assessments and should result in amendments to the EMP. Information related to any such changes should be made available to the authorities as well as for public review in the spirit of full disclosure.

14 ENVIRONMENTAL IMPACT STATEMENT

This Section is presented in accordance with Regulation 31 (2) (o) of the EIA Process Regulations (GNR 543 of 2010). It summarizes the findings of the EIA and provides a comparative assessment of the positive and negative implications of the project.

14.1 Need and Desirability

The need for and desirability of the WML project are discussed in Section 2.2 (Historic Waste Dump) and Section 3.2 (Activity Alternatives). In summary, the current historical waste dump is a source of pollution to the surrounding environment, specifically the soil, groundwater and surface water which indirectly impacts other environmental attributes.

14.2 Summary of Findings

The EIA process did not indicate any fatal flaws or negative impacts of high significance that could make the project non-feasible from a legal, biophysical or socio-economic perspective. The proposed Integrated Water and Waste Management project will result in mainly positive effects, but also some minor negative impacts, of which the positive effects can be enhanced and the negative impacts can be minimised by the implementation of the recommended mitigation measures. These measures have been formalised in the EMP.

14.2.1 Positive impacts

The positive impacts include:

- Employment creation during construction and operational phase;
- Improvement of aesthetics and land use capabilities during operational and decommissioning phase;
- Removal of hazardous materials from the environment and associated liabilities;
- Improved management of and control over material storage and handling, process water and site runoff;
- Decreased potential for contamination of surface and groundwater resources during operational and decommissioning phases;
- Improvement of ecological integrity during decommissioning phase; and
- Elimination of pollution source.

14.2.2 Negative impacts

The negative impacts include:

- Contamination of the surrounding environment (air, groundwater & surface water) if the historical waste dump is not processed;
- The spread of dust during operation if not mitigated;
- Potential contamination of surface and ground water resources by spillages from containment/storage areas during the operational phase; and
- Loss of jobs during the decommissioning phase.