mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

Draft Environmental Impact Assessment and Environmental Management Programme

For The

Amendment of the Existing EMP and Inclusion of Listed Activities Associated with Operations at Kloof Mining Right Area, Sibanye Gold Limited

DMR Reference Number: GP 30/5/1/2/2 (66) MR

January 2016

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 (ACT NO. 107 OF 2008) (NEMA) AND THE NATIONAL ENVIRONMENTAL MANAGEMENT: WASTE ACT, 2008 (ACT NO. 59 OF 2008) (NEM:WA) IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT NO. 28 of 2008) AS AMENDED (MPRDA).

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DIGBY WELLS
ENVIRONMENTAL

This document has been prepared by Digby Wells Environmental.

Report Type:	**Draft Environmental Impact Assessment and Environmental Management Programme**
Project Name:	**Amendment of the Existing EMP and Inclusion of Listed Activities Associated with Operations at Kloof Mining Right Area, Sibanye Gold Limited**
Project Code:	**GOL2376**

Name	Responsibility	Signature	Date
Duncan Pettit	Report Writer		October 2015
Marcelle Radyn	Project Manager		November 2015
Grant Beringer	Project Sponsor		January 2016
Michael Hennessy	Legal Review		January 2016

IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) as amended (MPRDA), the Minister must grant a Prospecting or Mining Right if among others the mining "will not result in unacceptable pollution, ecological degradation or damage to the environment".

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment (EIA) and an Environmental Management Programme (EMP) report in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA), it cannot be concluded that the said activities will not result in unacceptable pollution, ecological degradation or damage to the environment.

In terms of section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the Competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

It is therefore an instruction that the prescribed reports required in respect of applications for an Environmental Authorisation for listed activities triggered by an application for a right or a permit are submitted in the exact format of, and provide all the information required in terms of this template. Furthermore please be advised that failure to submit the information required in the format provided in this template will be regarded as a failure to meet the requirements of the Regulation and will lead to the Environmental Authorisation being refused.

It is furthermore an instruction that the Environmental Assessment Practitioner (EAP) must process and interpret his/her research and analysis and use the findings thereof to compile the information required herein. (Unprocessed supporting information may be attached as appendices). The EAP must ensure that the information required is placed correctly in the relevant sections of the Report, in the order, and under the provided headings as set out below, and ensure that the report is not cluttered with un-interpreted information and that it unambiguously represents the interpretation of the applicant.

OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The objective of the EIA process is to, through a consultative process: -

- determine the policy and legislative context within which the activity is located and document how the proposed activity complies with and responds to the policy and legislative context;
- describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
- identify the location of the development footprint within the preferred site based on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
- determine the: -
  - nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
  - degree to which these impacts: -
    - can be reversed;
    - may cause irreplaceable loss of resources, and
    - can be avoided, managed or mitigated.
- identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
- identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
- identify suitable measures to manage, avoid or mitigate identified impacts; and
- identify residual risks that need to be managed and monitored.

EXECUTIVE SUMMARY

Digby Wells Environmental (Digby Wells) was appointed by Sibanye Gold Limited (SGL) to conduct the Environmental Impact Assessment (EIA) process for the West Rand Tailings Retreatment Project (WRTRP) in Gauteng, South Africa.

The EIA is considered a tool with which to identify and manage potential impacts on the environment as a result of a particular project. Environmental risks associated with such a project or development is also identified and mitigation measures are proposed. The completion of an EIA is a regulatory requirement in terms of the provisions of the National Environmental Management Act, 1998, as amended (NEMA) and the EIA process which is regulated in accordance with the Environmental Impact Assessment Regulations, 2014[1] (the EIA 2014 Regulations). The overarching purpose of the EIA process is to determine, assess and evaluate the consequences (positive and negative) of a proposed development, activity or project. The objectives of this EIA and EMP report are to:

- Detail policies and legislation relevant to the activity;
- Motivate the need and desirability of the proposed activity;
- Detail and confirm the preferred activity and alternative(s);
- Determine and assess the significance of the potential impacts of the project including the nature, consequence, extent, duration and probability of the impacts;
- Determine the most ideal location for the activity;
- Determine suitable measures to manage, avoid or mitigate identified impacts; and
- Determine residual risks that need to be managed and monitored.

The Scoping Report for the project was compiled and submitted for public review from 15 September to 6 November 2015. Comments and issues raised by Interested and Affected Parties (I&APs) were recorded and responded to before the Scoping Report was updated and submitted to the Department of Mineral Resources (DMR) on 13 November 2015. In parallel to the scoping phase specialist studies were undertaken to determine the baseline of the receiving environment. Following the acceptance of the Scoping Report, specialist studies were finalised and all additional requirements of the IAPs and competent authorities taken into consideration. The studies assessed the significance of the potential impacts associated with the project's activities and proposed mitigation and management measures to mitigate adverse impacts and enhance benefits.

[1] GN R982 published in Government Gazette 38282 of 4 December 2014

Project Overview

The broader West Rand, including Carletonville in the far west to Randfontein in the northeast and including Westonaria centrally, contains an estimated 1.3 billion tonnes of surface gold and uranium tailings with approximately 170 million pounds of recoverable uranium and 11 million ounces of recoverable gold. SGL, as the current majority owner of these resources, plans to exploit the tailings to develop a strong, long life and high yield surface mining business. Key to the successful execution of this business growth and development strategy is the West Rand Tailings Retreatment Project (WRTRP).

Project Applicant

GFI Mining South Africa (Pty) Limited, (Registration Number 2002/031431/07) was, prior to February 2013, a subsidiary within the Gold Fields Group. In early 2013, Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines in the Free State to create SGL (Registration Number 2002/031431/06), listed as a fully independent company on both the JSE and the NYSE Stock Exchanges.

In parallel in 2012, Gold One International Limited (Gold One) acquired Rand Uranium Limited (Rand Uranium) and in the same year acquired Ezulwini Mining Company (Pty) Ltd (Ezulwini) in an agreement with First Uranium Corporation.

Subsequently, in October 2013, SGL acquired the interest held by Gold One in Rand Uranium and Ezulwini. These Gold One assets are now part of Sibanye Gold, and comprise the Cooke Operations (underground mining and reclamation operations), that currently produce gold and uranium.

Table I: Contact details for SGL

Company name:	Sibanye Gold Limited
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Environmental Consultants

Digby Wells was appointed by SGL as the independent Environmental Assessment Practitioner (EAP) to undertake the Scoping and EIA processes. The contact details for Digby Wells are set out in Table II.

Table II: Contact Details for Digby Wells

Company name:	Digby Wells Environmental
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Project History

Prior to the creation of SGL, Gold Fields had embarked on a project known as the West Wits Project (WWP), aimed at retreating Tailings Storage Facilities (TSFs) on the West Rand. Its intention was to recover residual gold, uranium and sulfur through a central processing plant, where viable, and storing the residual tailings on a proposed Centralised TSF (CTSF) near South Deep's existing Doornpoort TSF.

Similarly Rand Uranium had embarked on the Cooke Uranium Project (CUP) which endeavoured to treat the Cooke TSF for gold, uranium and sulfur and ultimately deposit the residual tailings on to the proposed Geluksdal TSF. The CUP and WWP were essentially two independent projects with similar broad objectives, processing infrastructure and deposition sites and within a 25 km radius of each other.

Elements of the CUP and WWP projects have been approved and authorised, as indicated in Table III, although not in their entirety. Stakeholders and departments expressed concern over the implementation of two similar projects in proximity to one another and the accumulation of their impacts. It was proposed that these projects be combined to provide a consolidated solution for the region.

The WRTRP therefore integrates the WWP and CUP into one project, where up to 13 current and historical TSFs and current arising tailings will be centrally processed through a new proposed Central Processing Plant (CPP) and the residue deposited onto a new proposed Regional TSF (RTSF). A Return Water Dam (RWD) will be constructed adjacent to the RSTF to contain any potential water runoff, with the water to be treated at an Advanced Water Treatment Facility (AWTF).

As stated, should one of the elements of the WRTRP not be authorised, the entire project would be unable to proceed. In this case SGL will revert back to the CUP and WWP projects and further pursue the approval of the outstanding applications.

Table III: CUP and WWP Authorisation Status

Authorisation/Application	Cooke Uranium project		West Wits Project	
	Title	**Status**	**Title**	**Status**
Environmental authorisation (under the NEMA)	Environmental Impact Assessment (EIA) For The Proposed Uranium Plant And Cooke Dump Reprocessing Infrastructure	Approved never implemented	Final Environmental Impact Report	Approved never implemented
	Geluksdal TSF and Pipeline EIA & EMPR	Approved never implemented		
Water use licence (under the NWA)	Geluksdal TSF and Pipeline IWULA and IWWMP	Suspended upon further investigation	Integrated Water Use Licence Application Proposed new Centralised Tailings Storage Facility and associated infrastructure	Pending approval
	Geluksdal Pipeline General Authorisation	Approved never implemented		
EMP Amendment (under the MPRDA)	Environmental Impact Assessment (EIA) For The Proposed Uranium Plant And Cooke Dump Reprocessing Infrastructure	Approved never implemented	Amendment: Driefontein, Kloof and South Deep Mine West Wits Project Environmental Management Programmes	Suspended upon further investigation
	Geluksdal TSF and Pipeline EIA & EMPR	Suspended upon further investigation		
Authorisation change request	CoR226 Authorisation Change Request -049	Approved never implemented	Unknown	

Project Description

There is a long history of gold and uranium mining in the broader West Rand area which has resulted in tailings containing in excess of 170 million pounds of uranium and 11 million ounces of gold. SGL, through the unbundling from Gold Fields and the acquisition of Gold One and Ezulwini, currently owns the majority of the tailings in the area and its gold and uranium resources.

The key to capitalising these resources successfully relies on the execution of the WRTRP. The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, environmental studies, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The implementation of the WRTRP will be done in phases to achieve the objectives of the ultimate project. The Ultimate Project and the Initial Implementation are detailed below.

Ultimate Project

SGL's historical TSF holdings in the West Rand can be divided into four Mining Rights: the Cooke, Ezulwini, Kloof and Driefontein Mining Rights. Each of these Mining Rights (other than Ezulwini) contains a number of historical TSFs which will ultimately be reclaimed during the life of the WRTRP:

- Kloof Mining Right area: Kloof 1 TSF, Kloof 2 TSF, Leeudoorn TSF, Libanon TSF, Venterspost North and Venterspost South TSFs. Venterspost North and South TSFs will be processed with the concurrent construction of Module 2 floatation and gold plants of the CPP. The remainder of the TSFs will be processed once Module 3 has been constructed. It must be noted that although the reclamation of Venterspost North and South TSFs are not part of this EIA, the inclusion of the TSFs into the Kloof Mining Right area is part of this EIA and Section 102 amendment submitted to the DMR;
- Driefontein Mining Right area: Driefontein 1, 2, 3, 4 and 5 TSF. Once the Driefontein 3 and 5 TSFs have been reclaimed, the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 TSFs, will be processed through the CPP;
- Cooke Mining Right area: C4S TSF, Cooke TSF and the Millsite Complex (38, 39 and 40/41 and Valley) TSFs. Millsite Complex will be processed with the concurrent construction of Module 2 floatation and gold plants; and
- Ezulwini Mining Right area: No TSFs fall within the Ezulwini Mining Right. Uranium will be processed at the Ezulwini Plant and new pipelines will be constructed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 million tonnes per month (Mt/m) (1 Mt/m from Driefontein 3 TSF, followed sequentially by Driefontein 5 and C4S TSFs and 0.5 Mt/m from Cooke TSF). Reclamation and processing capacity will ultimately ramp up to 4 Mt/m over an anticipated period of 8 years. At the 4 Mt/m tailings retreatment capacity, each of the Mining Right areas will be reclaimed and processed simultaneously.

The ultimate WRTRP involves the construction of a large-scale CPP for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases/modules to treat eventually up to 4 Mt/m of tailings inclusive of current underground arisings. The resultant tailings will be deposited on a TSF with a modern engineering design, called the RTSF.

The tailings material will be centrally treated in the CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulfuric acid, an important reagent required for uranium leaching. The CPP footprint will ultimately occupy approximately 75 hectares when fully constructed. The CPP will be developed in phases to treat eventually up to 4 Mt/month of tailings and current underground arisings. The CPP will eventually comprise the following:

- Gold Plants;
- Floatation plants and associated infrastructure;
- Uranium Processing Plants;
- Multiple Roasters and associated infrastructure;
- Acid Plant and associated infrastructure;
- Uranium and sulfide concentrate storage facilities;
- Loading facilities for uranium concentrate; and
- Water storage facilities.

A new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original WWP and CUP (the proposed Geluksdal TSF is associated with the CUP). The “deposition area” on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

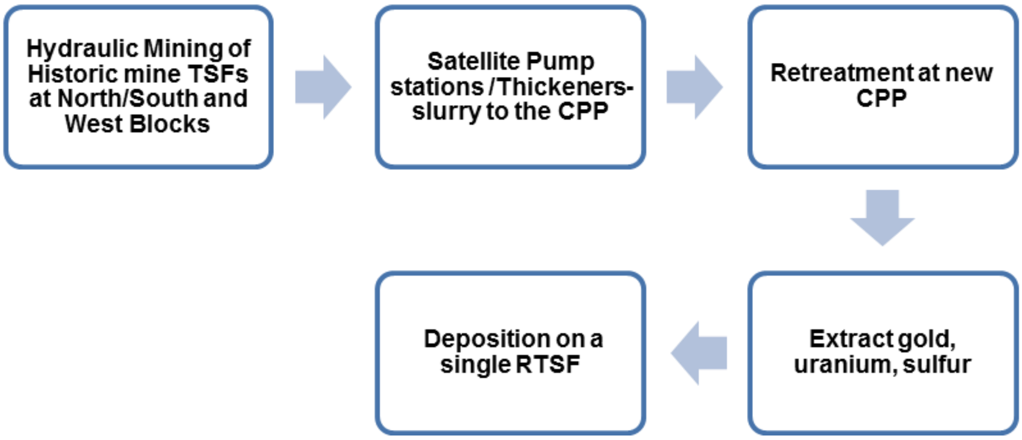

Figure I: Summary of WRTRP

The AWTF will be located adjacent to the RTSF and will treat the return water generated from the RTSF and essentially replace the normal return water systems conventionally adopted with a view to optimising capital and aligning the WRTRP with SGL's overall water management strategy. The AWTF uses three stages to create an overall water recovery of 93% with the solid waste discharged as stable pellets at an approximate water content of only 5%. The water will be treated to potable water standards and discharged into the Leeuspruit, subject to an approved IWUL.

Initial Implementation

To ensure the successful start-up phase, the upfront capital required for the WRTRP will be limited; only essential infrastructure will be developed during Initial Implementation. This entails the design and construction of:

- The hydraulic mining infrastructure at the Driefontein 3 and 5 TSFs and the C4S TSF, including slurry and water pump stations;
- Driefontein and Cooke Mining Right area overland inter connecting pipe works, thickeners and process water supply and storage;
- The CPP Module 1 within the Kloof Mining Right area comprising:
  - Gold Plant;
  - Floatation Plant;
  - Uranium Plant,
  - Acid Plant; and
  - A roaster.
- The RTSF, RWD and AWTF within the Kloof Mining Right area.

This first module of the CPP will receive two reclaimed slurry streams and will retreat up to 1.0 Mt/m from the Driefontein 3 and 5 TSFs and C4S TSF in sequence over 11 years. In addition to and concurrently with the Driefontein 3 and 5 and C4S TSFs, up to 0.5 Mt/m of the Cooke TSF will be mined for a period of 16 years. The resultant tailings from the CPP will be deposited onto the first phase of the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50 kilotonnes per month) for the extraction of uranium and gold. The tailings from this process will be deposited on the existing operational Ezulwini North TSF. The schematic of the Initial Implementation is provided in Figure II.

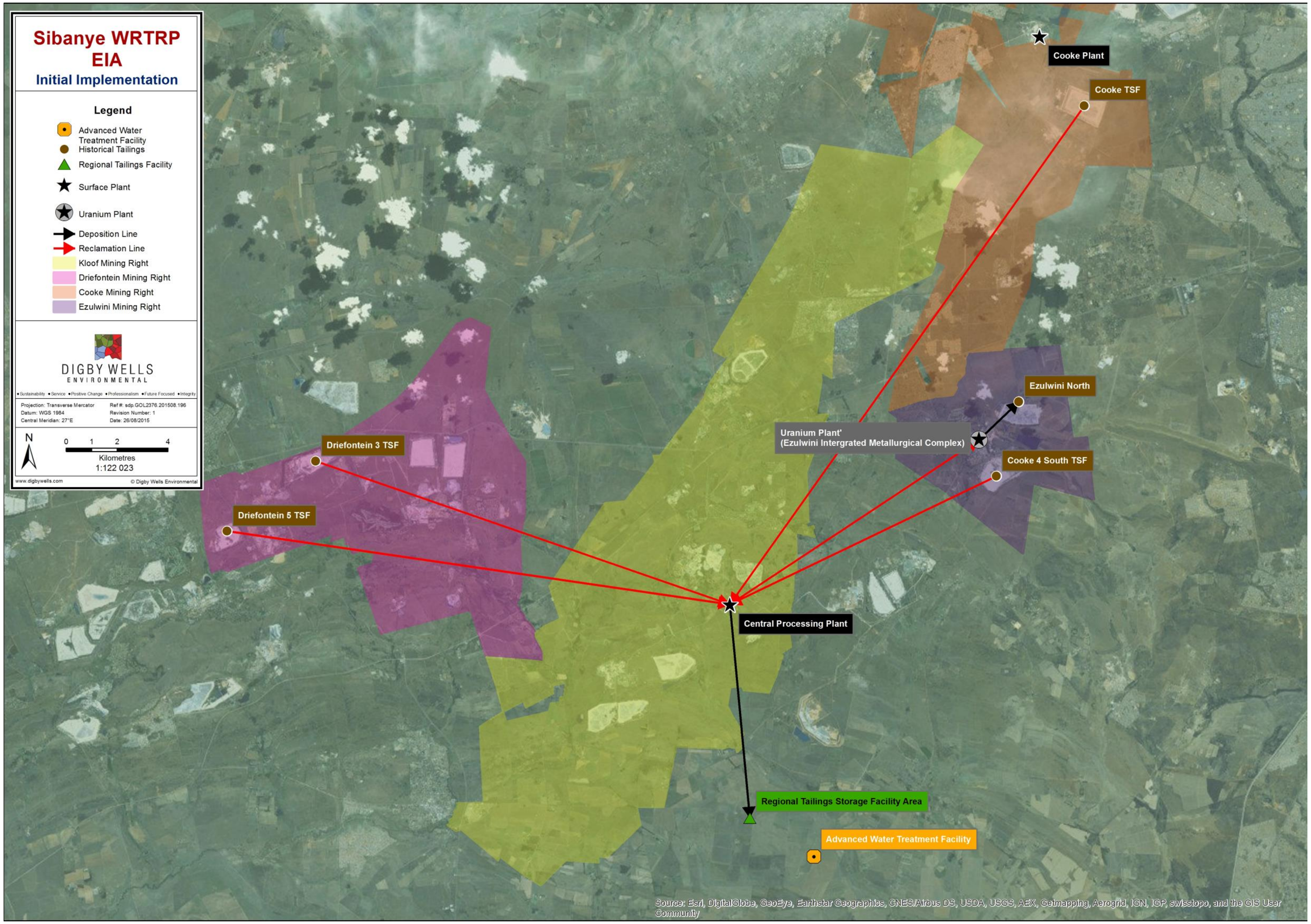

Figure II: Initial Implementation Phase

Kloof Mining Right Area

The focus of this application is the authorisation of those activities associated with the Initial Implementation of the WRTRP that occur within the Kloof Mining Right or are to be included in the Kloof Mining Right. Authorisation for this component of the Initial Implementation phase (Kloof) will require the amendment of the Kloof Mining Right, Mining Work Programme (MWP) and EMP to cover the processing of reclaimed slimes at the CPP and the deposition of the resultant tailings on the RTSF.

The Kloof Mining Right will be amended to include:

- The construction and operation of the CPP including the gold, uranium and Roaster/acid plants[2];
- The construction and operation of the RTSF and the associated RWD[3];
- Abstraction of makeup water from the K10 shaft;
- The construction and operation of the AWTF;
- The construction and operation of roads, power lines, pipelines and pump stations associated with the above listed infrastructure; and
- The inclusion of Venterspost North and South into the Kloof Mining Right Area.

The intention of this EIA report is, therefore, to identify these activities within the current and expanded Kloof Mining Right area, to assess the potential impacts that they may have on the receiving environment and to provide mitigation measures and monitoring plans for the potential impacts.

Project Alternatives

Alternatives for the various aspects of the WRTRP have been assessed during the pre-feasibility of the Project. The alternatives considered include location, technology and processes of the CPP, RTSF and associated RWD and AWTF, the pipeline dimensions and routes, the location and capacities of the BWSFs, thickeners and reclamation of the TSFs. The alternatives for the above activities have been detailed in the scoping reports for the respective Mining Right areas. **This EIA and EMP report, however, details the alternatives considered specifically for the Kloof Mining Right area.**

[2] This application will consider the construction and operation of the entire CPP i.e. Modules I, II and II, so as to determine the impacts of the plant at full operation and avoid incremental authorisation.

[3] This application will consider the construction and operation of the entire RTSF and RWD so as to determine the impacts of the facilities at full operation to avoid incremental authorisation.

RTSF Site Alternatives

Two independent, parallel TSF site selection processes were completed by Golder Associates (Golder, 2010) for Rand Uranium's CUP (Geluksdal TSF) and Metago (Metago, 2009) for Gold Fields' WWP. These processes entailed the selection of a suitable site for a TSF required for the respective proposed projects.

The site selection undertaken by Golder Associates for Rand Uranium, identified the proposed Geluksdal TSF, for which authorisation was applied. The ranking process for the Geluksdal TSF, however, indicated that sites 33 and 34 (coinciding with the proposed RSTF site) would be the most suitable sites, but had already been earmarked by Gold Fields as a potential alternative TSF site and were therefore unavailable to Rand Uranium.

In a parallel site selection process undertaken by Metago for Gold Fields, the social, environmental and economic screening and subsequent ranking determined that sites B2/B3 (coinciding with the proposed RTSF site), as well as the Doornpoort TSF contiguous A sites (ultimately selected for the WWP), were the most economically viable and the preferred sites from an environmental and social perspective.

Importantly and fortuitously, the two TSF areas identified by Metago, as B2/B3, overlie areas identified by the Golder Associates site selection process for Rand Uranium, which they called area 33 & 34. These areas, B2/B3 and 33/34, represent the proposed area identified for the RTSF for the WRTRP.

In summary the two independent processes resulted in the identification of a common area for the construction of a new TSF that can accommodate the residue from the proposed CPP and therefore based on the outcomes of these two processes it has been concluded that the site, now referred to as the RTSF, will be taken forward as the preferred site.

Treatment Alternatives

A site selection process was undertaken by Golder Associates (Golder, 2013) for the CPP. A total of 100 candidate site areas were identified, of which 25 candidate sites were in compliance with the site selection criteria and taken forward for further analysis. The Top Two sites were then identified as the preferred and alternative sites respectively. The sites were called Site T2 (Preferred Option) and Site T9 (Alternative). The preferred option Site "T2" will be assessed as part of this study.

Technology alternatives were considered purely from a "best fit" and cost effective perspective, particularly in terms of the AWTF and CPP. Considerations to be made in the selection of a suitable AWTF include different potential technologies such as electrodialysis, reverse osmosis, freeze desalination and electrocoagulation.

Pipeline Alternatives

The pipeline routes and supporting infrastructure need to be located where the feed sources, current infrastructure, services and proposed infrastructure including the CPP and RTSF are located. Alternative pipeline routes between the CPP and the RTSF have been identified.

Premised on the primary requirement of the pipe routes being selected being the shortest distance between the CPP and the RTSF, alternative routes were considered which capitalised on the following:

- Following existing routes where possible;
- Avoiding identified environmental sensitive areas, predominantly wetland areas;
- Crossing existing impacted land;
- Maximising mine owned land; and
- Assessing the operating costs pertaining to topographical considerations on pumping costs.

The preferred pipeline route was determined using the above criteria and overlaying sensitive areas, such as wetlands, over the proposed routes. The preferred pipeline route has been selected based on the location of current servitudes, the bypassing of Kloof Main Shaft due to the high costs involved with pumping and crossing national roads and the locations and frequency of wetlands.

No-Go Option

In terms of the "No-go" option, the primary land uses for the region are mining, agriculture, and in some areas, residential. The proposed location of the RTSF is currently used for agriculture. If not used for mining (the no-go option), possible alternative land uses for the proposed RTSF and associated infrastructure site include commercial agriculture, grazing, or low-cost housing.

Existing / historical TSFs will remain *in situ* and will continue to impact on the environmental and social landscapes, as per the status quo. The impacts relating to the surface water quality and PES of the wetlands and aquatic habitats are particularly relevant in this regard. None of the envisioned benefits (described in Section 7) will come to fruition, such as environmental clean-up, job opportunities, investment into the local and regional economy, treatment of currently impacted water and a reduction in the health impacts posed by the historical TSFs. The existing impacts include:

- Leaching contaminants e.g. uranium and sulfur, into the sensitive dolomitic aquifers;
- Risk to community health and an increased potential for AMD in the Western Basin;
- Further weakening of the West Rand's economy as mining declines; and

- The AWTF will not be funded which will result in mine affected water not being treated to potable standards (SANS 241:2011). This results in water quality resources continuing to be impacted upon by contaminated water, impacting on the receiving environment and downstream water users.

The Kloof Mining Right area houses the primary infrastructure required for the implementation of the WRTRP. If any component of it is not approved the entire project will be abandoned.

Public Participation Process

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent.

Taking cognisance of the project's regional locality and complexity, the PPP ensured early information availability and also enabled open dialogue with I&APs in an effort to understand I&APs concerns. Prior to and during the Scoping Phase this was embodied by a combination of focus group and open house meetings undertaken to facilitate the participation from various sectors of society.

The Scoping Reports were made available at seven public libraries throughout the West Rand, as well as on the Digby Wells website, for a period of 30 days from 15 September 2015 to 15 October 2015. In addition, focus group meetings and public meetings were held from 6 October 2015 to 14 October 2015. Comments received from I&APs were recorded and responses provided, as outlined in this EIA and EMP report.

Summary of the Kloof Mining Right Area Environment

The Kloof Mining Right area falls within quaternary catchments C23J, C22J and C23D. The project area is drained by the Wonderfonteinspruit, Leeuspruit and the Loopspruit. The overall surface water quality for the WRTRP area indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the Vaal Dam Receiving Water Quality Objectives (RWQO). This indicates that rivers within this area are already impacted; the majority of river systems associated with the project area are largely modified.

Wetlands within the Kloof Mining Right area are characterised by valley bottom systems. In addition, in the midslopes and valley heads of the catchments, there are pan and seep systems associated with the landscapes. The identified wetlands and aquatic ecosystems are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems. The wetlands have been demarcated a Present Ecological Status (PES) of D (largely modified) and an Ecological Importance Sensitivity (EIS) of low to moderate, with aquatic ecosystems determined to have a PES Class D and E, which is moderately to seriously modified.

The aquifers underlying the proposed RTSF complex are characterised as low yielding, semi-confined weathered and fractured aquifer systems; this indicates that the groundwater flow rate is limited and the contamination plume migration will be limited. The plume will migrate very slowly but high concentrations are expected to remain in the aquifer for long periods of time. All of the boreholes sampled fall within the recommended (Class I) standards for drinking water (SANS 241:2011) with only ammonia and manganese concentrations exceeding the Class I limits for borehole CDVBH2.

The regional vegetation of the WRTRP area consists of the Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Rand Highveld Grassland and Soweto Highveld Grassland, with the two former vegetation types being classified as Vulnerable and the Highveld Grassland vegetation types classified as Endangered. The infrastructure associated with the Kloof Mining Right area, namely the RTSF complex, the CPP and pipelines associated and between the CPP and RTSF complex, is located within grassland, wetland, agricultural (cultivation and grazing) and transformed areas.

No Red Data mammal or bird SSC were identified during the field survey, although the Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder, 2008) and is expected to occur within the wetland habitats identified within the project area. Reptile Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*) (Vulnerable) and the Striped Harlequin Snake (*Homoroselaps dorsalis*) (Rare). Invertebrate Red Data species expected to occur on site include the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey.

Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger, regional area. Stone Age lithics recorded have been found as surface scatters outside of any discernible context, limiting the overall significance of these resources. Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg. The heritage resources identified of significance within the Kloof Mining Right area were two burial grounds which were determined to have a cultural significance of very high. The two sites contained a combined at least 31 graves and are located within the proposed RTSF development. In addition, a further two burial grounds were located that may be impacted upon by the pipeline route from the CPP to the RTSF and were also deemed to have a high cultural significance.

Potential Impacts

It must be noted that the presence of historical TSFs on the landscape are a permanent source of pollution on the surrounding environment. The TSFs are a source of dust generation which reduces the ambient air quality, as well as impacting on surrounding soils, wetlands and surface water resources due to the mobilised contaminants. In addition, the leaching and seepage of contaminants have significant impacts on the groundwater resources, specifically as the historical TSFs are located on sensitive dolomitic aquifers. The reclamation of these historical TSFs will result in long term positive impacts as the permanent pollution sources are removed from the regional landscape, although reclamation activities will result in operational impacts. This EIA report associated with the Kloof Mining area does not include the reclamation of historical TSFs, however it is pertinent to note the potential negative and positive impacts associated with the overall WRTRP and reclamation of numerous TSFs throughout the West Rand.

The activities associated with the Kloof Mining Right area, which may result in potential impacts, include the construction and operation of the CPP, RTSF, RWD and AWTF and its ancillary infrastructure and activities. The ancillary infrastructure and activities include pipelines, roads, transmission lines, as well as the pumping of mine affected water from K10 Shaft for use during the reclamation activities and the pumping of slurry from the CPP to the RTSF.

The establishment of the RTSF and CPP will result in the clearance of agricultural land and wetland areas. This will result in the loss of topsoil as a resource, land capability and wetland habitats. The loss of land capability and wetland habitats cannot be mitigated, although the loss of wetland areas will be compensated for through a wetland offset strategy. Impacts to soils will be mitigated through the correct stripping, stockpiling and use of the soil resources.

The clearance of vegetation for all infrastructure leaves the soils susceptible to erosion which in turn can result in the sedimentation of surface water resources, wetlands and the deterioration of aquatic habitats. These impacts will be mitigated through the development of temporary ditches during construction to collect any sediment runoff and will be sized to withhold a 1:50 year extreme rainfall event.

The presence and operation of the RTSF will result in the formation and migration of a contamination plume, with the contaminants of concern being sulfates and manganese. The contamination plume will be restricted due to the implementation of a blast curtain and the contaminated water will be abstracted and treated at the AWTF. The dewatering of the blast curtain will result in a cone of depression which may impact on the Leeuspruit. The potential impact on the Leeuspruit will be mitigated in part by the discharge of treated water from the AWTF into the Leeuspruit.

The presence of the RTSF may also impact on the surrounding environment due to the potential mobilisation of tailings material through runoff and windblown erosion. This will be mitigated through the implementation of wind breaks, concurrent rehabilitation of the RTSF and the installation of silt traps.

A summary of the most significant impacts prior to and post implementation of mitigation measures is provided in the table below.

Table IV: Significant Impacts Associated with the WRTRP

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
Construction Phase				
RTSF Complex	Loss of land capability	Soils and land capability	High (negative)	High (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	High (negative)
	Visual intrusion on the landscape	Visual	High (negative)	Medium-high (negative)
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	High (negative)	Medium-low (negative)
CPP	Loss of topsoil as a resource	Soils	Medium-high (negative)	Low (negative)
	Loss of land capability	Soils and land capability	High (negative)	High (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	Medium-high (negative)
	Visual intrusion on the landscape	Visual	Medium-high (negative)	Medium-low (negative)
Pipelines and Roads	Loss of topsoil as a resource	Soils	Medium-high (negative)	Medium-low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	High (negative)	Medium-low (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Minor (positive)	Moderate (positive)
	Direct investment and multiplier effect.	Socio-economic	Minor (positive)	Moderate (positive)
	Population influx and associated impacts	Socio-economic	Medium high (negative)	Medium low (negative)
	Physical and economic displacement	Socio-economic	High (negative)	Medium high (negative)
Operational Phase				
Water Abstraction from K10 Shaft	Desiccation of wetlands along the Wonderfonteinspruit	Wetlands	Medium-high (negative)	Medium-high (negative)
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Medium-high (negative)	Low (negative)
	Contamination of groundwater from RTSF seepage	Groundwater	Medium-high (negative)	Medium-low (negative)
	Contamination of groundwater from RWD seepage	Groundwater	Medium-high (negative)	Medium-low (negative)
	Contamination and deterioration of soils	Soils	Medium-high (negative)	Medium-low (negative)
	Improvement of water quality in the Leeuspruit due to discharge of treated water.	Surface water	Moderate (positive)	Moderate (positive)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Medium-high (negative)	Medium-low (negative)

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
	Modification of instream habitat	Aquatic ecology	Medium-high (negative)	Negligible (positive)
	Contamination and sedimentation of wetlands	Wetlands	Medium-high (negative)	Low (negative)
	Loss of water quantity	Wetlands	Medium-high (negative)	Medium-high (negative)
	Wetland sedimentation and increased saturation due to water discharge	Wetlands	Medium-high (negative)	Medium-low (negative)
	Visual intrusion on the landscape	Visual	High (negative)	High (negative)
CPP	Reduction in air quality due to stack emissions	Air quality	Medium-high (negative)	Low (negative)
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Minor (positive)	Moderate (positive)
	Contribution to country's economy	Socio-economic	Moderate (positive)	Moderate (positive)
Decommissioning Phase				
RTSF Complex	Visual intrusion on the landscape	Visual	High (negative)	High (negative)
CPP	Loss of topsoil as a resource due to compaction and erosion	Soils	Medium-high (negative)	Low (negative)
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Medium-high (negative)	Medium-low (negative)
Post-Closure				
RTSF Complex	Contamination of groundwater from RTSF seepage	Groundwater	Medium-high (negative)	Medium-low (negative)

Conclusions and Recommendations

The WRTRP will bring significant socio-economic contributions to the West Rand; the West Rand economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year, with the Westonaria LM unemployment recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%. The capital investment and contributions to the GDP associated with the WRTRP, along with the potential multiplier effects, are significant over the life of the operation (50 years), which will provide a sustained contribution to the local and national economy. In addition, the reclamation of historical TSFs, which are located on sensitive dolomitic aquifers, will result in positive impacts as permanent pollution sources are removed from the environment. Furthermore, mine affected water being discharged into the environment will be reduced and this water will eventually be treated to potable standards and discharged, having a positive impact on the environment and downstream users.

The WRTRP will also result in negative impacts on the environment, most notably the construction of the proposed RTSF. The development and presence of the RTSF will result in a contamination plume that will impact on groundwater quality. The RTSF will be approximately 1 390 ha in size and, should no mitigation be implemented, the resultant contamination plume will impact an area of approximately 3 600 ha 100 years after closure. The installation of a liner beneath the RTSF will prevent a contamination plume for sulfate and manganese after 50 years of operation, with the contamination plume 100 years after closure being restricted to the RTSF footprint.

However, the implementation of liner pollution control is likely to result in the WRTRP being financially unfeasible and all of the positive impacts associated with the project will not be realised. SGL proposes to implement a blast curtain which will restrict the contamination plume to an area of approximately 1 670 ha which is 280 ha greater than the RTSF footprint. Although the liner is preferred from a groundwater perspective, the implementation of a blast curtain will ensure the project is feasible and the larger positive impacts associated with the WRTRP are realised.

Based on the potential positive impacts associated with the project, the implementation of a blast curtain is considered to be an acceptable mitigation measure should the requirement of a liner result in the project becoming financially unfeasible; the implementation of a blast curtain is more suitable than the project not being undertaken at all. In addition, any potential impacts on the Leeuspruit due to dewatering activities will be mitigated in part due to the discharge of treated water into the Leeuspruit from the AWTF.

It must be noted that the Kloof Mining Right activities in isolation require authorisation in conjunction with the activities associated with the remaining Mining Right areas to incorporate the Ultimate WRTRP. Should one application or activity not be authorised, the entire WRTRP will not proceed and the significant positive impacts associated with the project will not be realised.

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ASTP	Average Score Per recorded Taxon
AWTF	Advanced Water Treatment Facility
BWSF	Bulk Water Storage Facility
C4S	Cooke 4 South
CPP	Central Processing Plant
CR	Critically Endangered
COP	Cooke Optimisation Project
CUP	Cooke Uranium Project
CV	Curriculum Vitae
CVB	Channelled valley bottom
DEA	Department of Environmental Affairs
DMR	Department of Mineral Resources
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMP	Environmental Management Programme
EN	Endangered
FTE	Full time equivalent
GAC	Granular activated carbon
GDARD	Gauteng Department of Agriculture and Rural Development
GDP-R	Gross Domestic Product per Region
I&APs	Interested and Affected Parties
IDP	Integrated Development Plan
IHAS	Integrated Habitat Assessment System
IHIA	Intermediate Habitat Integrity Assessment
IUCN	International Union for the Conservation of Nature
KDC	Kloof Driefontein Complex
LC	Least Concern
LM	Local Municipality

MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MIRAI	Macroinvertebrate Response Assessment Index
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
NDCR	National Dust Control Regulations, 2013
NEMA	National Environmental Management Act, 1998 (Act No. 107 of 1998)
NEM:AQA	National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004)
NEM:BA	National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Areas
NGO	Non-government Organisation
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NNR	National Nuclear Regulator
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
PES	Present Ecological Status
PFS	Pre-feasibility study
PHRA-G	Gauteng Provincial Heritage Resources Authority
POSA	Plants of South Africa
PP	Public Participation
PPP	Public Participation Process
RO	Reverse Osmosis
RTSF	Regional Tailings Storage Facility
RWD	Return Water Dam
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Index
SANS	South African National Standards
SASS5	South African Scoring System version 5
SAWQG	South African Water Quality Guidelines
SGL	Sibanye Gold Limited
SSC	Species of Special Concern

TDS	Total Dissolved Solids
TSF	Tailings Storage Facility
TSP	Total Suspended Particles
VB	Valley bottom without a channel
VU	Vulnerable
WBT	West Block Thickener
WMA	Water Management Area
WRDM	West Rand District Municipality
WRTRP	West Rand Tailings Retreatment Project
WULA	Water Use Licence Application
WWP	West Wits Project

Part A: Scope of Assessment and Environmental Impact Assessment Report

1 Introduction

Digby Wells Environmental (Digby Wells) was appointed by Sibanye Gold Limited (SGL) to conduct the Environmental Impact Assessment (EIA) process, which includes the compilation of an EIA and Scoping Report, for the West Rand Tailing Retreatment Project (WRTRP) in the Gauteng Province, South Africa, as shown in Plan 1[4].

1.1 Company Background

GFI Mining South Africa (Pty) Limited, (Registration Number 2002/031431/07) was, prior to February 2013, a subsidiary within the Gold Fields Group. In early 2013 Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines in the Free State to create a separate entity in SGL and listed SGL (Registration Number 2002/031431/06), listed as a fully independent company on both the JSE and the NYSE Stock Exchanges.

Subsequently, in October 2013, SGL purchased the interest held by Gold One International Limited (Gold One) in Rand Uranium Limited (Rand Uranium) and Ezulwini Mining Company Limited (Ezulwini). These interests were held through a 74% shareholding in Newshelf 1114 (Pty) Limited (Newshelf), which owns 100% of Rand Uranium and Ezulwini. The purchase consideration was 150 million SGL shares, amounting to a shareholding of about 17% being held by Gold One. The transaction was subject to various conditions, including the approval of the Competition Commission and the approval of the Minister of Mineral Resources. These approvals have been granted and the merger is now unconditional. The Gold One assets which have become part of Sibanye included the Cooke Operations (underground mining and surface reclamation operations) for gold and uranium production, and after completion of the transaction, SGL consolidated all of its and Gold One's operations for the reclamation of tailings to produce gold, uranium and sulfur on the West Rand.

1.2 Project History

The treatment of historical tailings in the West Rand area has a long history with Gold Fields, Rand Uranium, Harmony Gold Mining Company Limited (Harmony), Gold One and SGL completing a number of parallel, independent studies relating to the treatment of these historical tailings.

In late 2009, Gold Fields and Rand Uranium met to evaluate the potential synergy of an integrated flow sheet for the Cooke Uranium Project (Rand Uranium) and the West Wits Tailings Treatment Project (Gold Fields), both of which were nearing feasibility completion. A significant amount of re-engineering and confirmatory test work would have been required to achieve this and, given the momentum of the respective projects, it was agreed that the investment would not be justified at that point in time. After the completion of the respective projects they were put on hold because of economic circumstances at the time.

[4] All plans are also provided in Appendix A.

From 2010 through to 2012, Rand Uranium completed the Cooke Uranium Project (CUP) and the Cooke Optimisation Project (COP) for which various applications were made to the authorities with authorisation on certain aspects being received and others remain pending.

In 2012, Gold One acquired Rand Uranium and in the same year acquired the Ezulwini Mining Company (Pty) Ltd (Ezulwini) in an agreement with First Uranium Corporation. The company, during the same year, completed an application and relevant studies for the Geluksdal TSF Project.

In early 2013 Gold Fields unbundled its Kloof Driefontein Complex (KDC) and Beatrix gold mines to create SGL.

1.3 Project Description

The broader West Rand area[5] contains an estimated 1.3 billion tonnes of surface gold and uranium tailings, with approximately 170 million pounds of recoverable uranium and 11 million ounces of recoverable gold. SGL, as the current majority owner of these resources, plans to exploit them to develop a strong, long life and high yield surface mining business. Key to the successful execution of this development strategy is the WRTRP. The concept of the WRTRP is well understood with an 8 year history of extensive metallurgical test work, feasibility studies and design by a number of major mining houses. A pre-feasibility study (PFS) completed during 2013 for the WRTRP has confirmed that there is a significant opportunity to extract value from the SGL surface resources in a cost effective sequence.

The ultimate WRTRP or “Ultimate Project” involves the construction of a large-scale Central Processing Plant (CPP) for the recovery of gold, uranium and sulfur from the available resources. The CPP, centrally located to the West Rand resources, will be developed in phases to eventually treat eventually up to 4 million tonnes per month (Mt/m) of tailings inclusive of current underground arisings. The resultant tailings will be deposited on a Tailings Storage Facility (TSF) with a modern engineering design called the Regional TSF (RTSF). The regional and local project settings are indicated on Plan 1 and Plan 2.

The Ultimate Project will be implemented in a number phases. Of these phases, phase 1 or the “Initial Implementation”, entails the reclamation of certain TSFs as well as the construction and operation of the first phase section of the RTSF, Gold Module 1 of the CPP and the first uranium roaster and acid plants. The Ultimate Project and Initial Implementation are explained in more detail below (Plan 3).

[5] The broader West Rand area includes Carletonville in the far west, Westonaria and Randfontein in the northeast.

Plan 1: Regional Setting

Plan 2: Ultimate WRTRP Infrastructure Layout

1.3.1 Ultimate Project

Simplistically, SGL's historical TSF holdings in the West Rand can be divided into four Mining Right areas: the Cooke, Ezulwini, Kloof and Driefontein Mining Right areas as shown in Plan 4a – Plan 4d. Each of these Mining Right areas (other than Ezulwini) contains a number of historical TSFs as detailed below:

- Kloof Mining Right area: Kloof 1 TSF, Kloof 2 TSF, Leeudoorn TSF, Libanon TSF, Venterspost North and Venterspost South TSFs. Venterspost North and South TSFs will be processed with the concurrent construction of Module 2 floatation and gold plants of the CPP. The remainder of the TSFs will be processed once Module 3 has been constructed;
- Driefontein Mining Right area: Driefontein 1, 2, 3, 4 and 5 TSF. Once the Driefontein 3 and 5 TSFs have been depleted the remainder of the Driefontein TSFs, namely Driefontein 1, 2 and 4 TSFs, will be processed through the CPP;
- Cooke Mining Right area: C4S TSF, Cooke TSF and the Millsite Complex (38, 39 and 40/41 and Valley) TSFs. Millsite Complex will be processed with the concurrent construction of Module 2 floatation and gold plants; and
- Ezulwini Mining Right area: No TSFs fall within the Ezulwini Mining Right. Uranium will be processed at the Ezulwini Plant and new pipelines will be constructed.

Each of the Mining Right areas will be reclaimed in a phased approach. The Driefontein 3 TSF, concurrently with the Cooke TSF, will be reclaimed first. Following reclamation of Driefontein 3 TSF, Driefontein 5 TSF and Cooke 4 Dam south (C4S) will be reclaimed.

Once commissioned the project will initially reclaim and treat the TSFs at a rate of 1.5 Mt/m: 1 Mt/m from Driefontein 3 TSF, followed sequentially by Driefontein 5 and C4S TSFs and 0.5 Mt/m from Cooke TSF. Reclamation and processing capacity will ultimately ramp up to 4 Mt/m over an anticipated period of 8 years. At the 4 Mt/m tailings retreatment capacity, each of the Mining Right area TSFs will be reclaimed and processed simultaneously as well as the underground arisings being accommodated.

The tailings material will be centrally treated in a CPP. In addition to gold and uranium extraction, sulfur will be extracted to produce sulfuric acid which in turn will be re-used in the uranium plant leach section.

To ensure the economic viability of the project the upfront capital required for the WRTRP will be minimised, only essential infrastructure will be developed during initial implementation. Use of existing and available infrastructure may be used to process gold and uranium until the volumetric increase in tonnage necessitates the need to expand the CPP.

The authorisation, construction and operation of a new deposition site for the residue from the CPP will be located in an area that has been extensively studied as part of the original Gold Fields' Est Wits Project (WWP) and the Rand Uranium's Cooke Uranium Project (CUP) and Geluksdal TSF. The "deposition area" on which the project is focussing, has been termed the RTSF and is anticipated to accommodate the entire tonnage from the district. The RTSF if proved viable will be one large facility as opposed to the two independent deposition facilities proposed by the WWP and CUP respectively.

SGL has various authorisations and approvals for elements of the WWP and CUP projects, with authorisations and approvals for certain aspects of the respective projects still outstanding. The WRTRP aims to combine the WWP and CUP projects, as per stakeholder concerns and suggestions based on the WWP and CUP projects. Should the WRTRP not proceed, SGL will continue with the CUP and WWP projects for activities that have been authorised, as well as proceeding with the application processes for the outstanding authorisations.

Plan 3: Initial Implementation

Plan 4a: Kloof Mining Right Area

Plan 4b: Driefontein Mining Right Area

Plan 4c: Cooke Mining Right Area

Plan 4d: Ezulwini Mining Right Area

1.3.1.1 Mining Rights Concerned

1.3.1.1.1 Cooke Mining Right Area

Rand Uranium holds 2 mining rights (GP 7 MR and GP 173 MR) and two prospecting rights (GP 241 PR and GP 238 PR). These rights relate to the Cooke operations (1, 2 & 3) and Old Randfontein. This, after the prospecting rights have been converted into mining rights, will be referred to as the Cooke Mining Right Area.

1.3.1.1.2 Ezulwini Mining Right Area

Ezulwini holds Cooke 4 under GP 38 MR and a prospecting right (GP 307 PR). These will be known as the Ezulwini Mining Right Area.

1.3.1.1.3 Kloof Mining Right Area

Kloof holds in its own right, GP 66 MR within which the CPP and K10 water supply forms part. Adjacent to the Kloof Mining Right area are the Venterspost TSFs (North and South), as well as the proposed RTSF and AWTF; the Mining Right area will be amended to incorporate these areas into the right as part of this application.

1.3.1.1.4 Driefontein Mining Right Area

Driefontein holds mining right GP 51 MR. Currently the Driefontein No 4 TSF lies outside of the MR area and needs to be incorporated through an amendment process in terms of Section 102 of the MPRDA. This is the Driefontein Mining right Area.

Table 1-1 provides a summary of the ultimate project and Figure 1-1 shows the geographical extent of the ultimate project.

Table 1-1: Scheduled Activities of the WRTRP – Ultimate Project

Proposed Construction Start Date*	**2016**	**2018**	**2020**
Operation Date	**2019**	**2021**	**2024**
Activities	▪ Treat Driefontein 3 and 5, C4S TSF (@1Mt/m) and Cooke TSFs at0.5Mt/m totalling 1.5 Mt/m through Gold Module 1, uranium, roaster and acid plants of the new Central Processing Plant (CPP) with deposition onto the Regional Tailings Storage Facility (RTSF). ▪ High grade uranium concentrate (50 kt/m) transported and treated at Ezulwini uranium plant.	▪ Kloof 1 and 2 TSFs and current arisings ▪ Reclaim Leeudoorn and associated Mine Dumps ▪ Potentially South Deep Mine Dumps (future) and current arisings tail will go through CPP (high Uranium) ▪ Reclaim Millsite TSF	▪ Continue to reclaim Millsite TSF (39, 40, 41 and Valley) ▪ Reclaim Venterspost North and South Mine Dumps
Existing infrastructure to be leveraged	▪ Ezulwini Uranium Plant (50 kt/m) to treat concentrate from the CPP		
New infrastructure required	▪ CPP Gold Module I (footprint of full capacity to be authorised now): • Gold Plant I • Sulfide and oxide Floatation Plant • Uranium Plant 1 • Acid Plant • Roaster 1 ▪ RTSF (footprint of full capacity to be authorised now) ▪ West Block Thickener (WBT) and bulk water storage ▪ Pipelines between D3, D5, C4S, Cooke TSF, WBT, CPP and RTSF	▪ CPP Gold Module II: • Gold Plant II • Pipelines, roads and pumps	▪ CPP Gold Module III: • Gold Plant III • Uranium Plant II • Pipelines, roads and pumps • Thickener

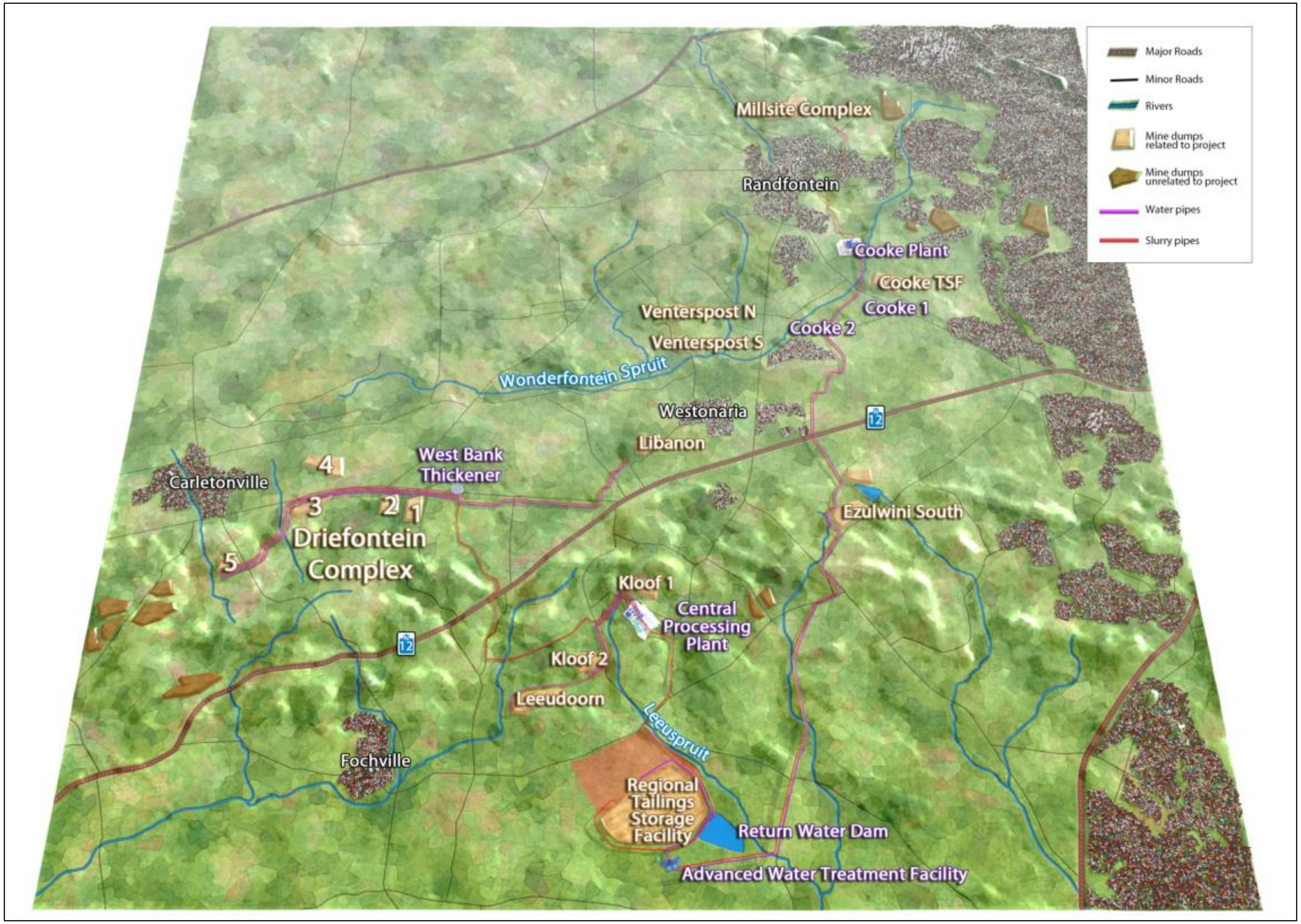

Figure 1-1: Geographical Extent of the WRTRP – Ultimate Project

1.3.1.2 Water Sources

A number of mine impacted water sources have been identified from which water can be supplied to the reclamation operations. SGL has recognised that water is a scarce and strategic commodity and hence currently impacted mine water will be used preferentially over Rand Water or other higher quality sources. Water will be supplied to the reclamation areas from the identified sources, such as mine affected water at the Kloof K10 shaft, Cooke 1 and 2 Shafts and Cooke 4 South Shaft, via pipelines and bulk water storage facilities (BWSF).

Once the impacted mine water, supplemented by recovered water from the various thickeners, has been used in the hydraulic reclamation process, it will find its way to the RTSF as carrier water for the retreated tailings. As process and rain water builds up on the RTSF it will be drained to the Return Water Dam (RWD) and treated through the Advanced Water Treatment Facility (AWTF).

1.3.1.3 Reclamation of Tailings

The tailings reclamation process is essentially a water hydraulic mining operation, where the TSFs will be hydraulically reclaimed to the natural ground level in nominal 12 to 15 m benches and the foot print rehabilitated to a suitable end land use.

Water will be supplied to the various reclamation sites, from existing impacted mine water sources, and then pressurised through a high pressure pumping system before reporting to the monitoring guns at the top of the historical TSFs. Monitoring guns will be used at the reclamation site mining face to reclaim the tailings material.

The reclaimed material, in the form of slurry, will flow through open channels over screens to remove oversized debris from the slurry before it enters a tank. A series of pumps will then pump the slurry from the tanks via thickeners to the CPP for gold, uranium and sulfur extraction. The historical TSFs proposed for reclamation cover a total of approximately 1 660 ha, as shown in Table 1-2. The RTSF footprint will be approximately 1 350 ha, liberating a nett 310 ha of currently sterilised land. The Venterspost North and South TSFs will be reclaimed as art of the Ultimate Project, although the inclusion of these TSFs into the Kloof Mining Right area is subject to this application.

Table 1-2: Total Area Covered by the TSFs that will be reclaimed over the Life of the Ultimate Project

Mining Right Area	Name	Area (ha)	Mining Right Area	Name	Area (ha)
Kloof Mining Right Area	Kloof 1 TSF	86.99	Driefontein Mining Right Area	Driefontein 1 TSF	87.15
	Kloof 2 TSF	72.76		Driefontein 2 TSF	85.26
	Venterspost S TSF	30.51		Driefontein 3 TSF	72.76
	Venterspost N TSF	60.68		Driefontein 4 TSF	165.66

Mining Right Area	Name	Area (ha)	Mining Right Area	Name	Area (ha)
	Leeudoorn TSF	186.27		Driefontein 5 TSF	67.72
	Total	**437.21**		Libanon TSF	93.64
Cooke Mining Right Area	Millsite Complex	315.47		**Total**	**572.19**
	Cooke TSF	178.99	Ezulwini Mining Right Area	Ezulwini South	157.99
	Total	**494.46**	Potential future TSFs[6]	South shaft and Twin shaft TSFs	107.66

1.3.1.4 Pipelines

The overland slurry and water piping required for the project will ultimately consist of approximately 120 km of pipeline (many of which will be parallel and in the same servitude). Existing mine servitudes will be utilised as far as possible for the overland piping. The following pipelines will be required:

- Water supply pipelines (from K10 shaft to the west BWSF, Cooke 1 and 2 water to the Cooke BWSF Cooke 4 shaft to the south BWSF and from the respective BWSFs to the historical TSFs);
- Slurry pipelines (from the historical TSFs to the West Block Thickener (WBT), North Block Thickener (NBT) and Cooke Thickener);
- Thickened slurry pipeline (from the WBT, NBT and Cooke Thickener to the CPP.);
- Uranium and sulfide rich slurry pipeline (from the CPP to Ezulwini);
- Tailings pipeline (from the CPP to the RTSF); and
- Treated water pipeline (from the AWTF to a discharge point on the Leeuspruit).

1.3.1.5 Thickeners

A WBT, NBT and Cooke Thickener will be constructed for the respective Mining Right areas. The thickeners will be used to thicken reclaimed tailings from the TSFs before it is pumped to the CPP for processing. The thickeners provide slurry of consistent density to the CPP and are critical in the optimisation of the operating of the plant. The thickeners also aid in minimising pumping costs by optimising the amount of water pumped around the circuit.

[6] The South Shaft and Twin Shaft TSFs will be part of a future application.

1.3.1.6 Central Processing Plant

The anticipated location for the CPP is mid-way between Kloof Main and Kloof 4 shaft central to all the resources, water and power supply, as well as existing and planned infrastructure (Plan 5). The Plant will be developed in phases to treat eventually up to 4 Mt/month of historical tailings and current underground arisings. The CPP will eventually comprise (Plan 6):

- Gold Plant Modules (3);
- Floatation plants and associated infrastructure (one associated with the uranium plants);
- Roasters and associated infrastructure;
- Acid plants and associated infrastructure;
- Uranium processing plants (2);
- Bulk sulfuric acid storage facility;
- Loading facilities for uranium concentrate, bulk sulfuric acid and reagents;
- Bulk Water storage facilities; and
- Pollution control dams.

1.3.1.7 Regional Tailings Storage Facility

This RTSF has been positioned and sized as a facility that can cater for both the tailings generated by the WRTRP as well as other tailings located in the region approximating 1.3 billion tonnes.

During the pre-feasibility study (PFS) the Gold Fields CTSF authorised by DEA/GDARD/NEMA and the Gold One Geluksdal TSF were considered for the WRTRP. Following an optimisation exercise requiring an ultimate deposition rate of 4 Mt/m, it was recognised that the CTSF and Geluksdal sites alone and collectively were insufficient to accommodate the desired tonnage profile for the project, both in deposition rates and in tonnage capacity for the proposed RTSF. The optimal location of the RTSF has been positioned between these two facilities, an area that has been extensively studied by the WWP and CUP but requires further investigation (Plan 7). It is likely that the construction of the RTSF will be phased to suit the envisaged tonnage build up. The RTSF will be sized, assessed and permitted on the basis of accommodating the long term requirements of the region. The RTSF will consolidate and mitigate the potential impacts of the historical TSFs currently scattered throughout the West Rand.

1.3.1.8 Return Water Dam

The design and management of the RTSF RWD will need to be undertaken in line with the requirements of the GN 704 regulations. The RWD has therefore been sized to ensure that it is unlikely to spill into any clean water system more than once in 50 years, given a certain return water and/or water treatment rate.

The ultimate RWD arrangement, which will consist of a series of compartments due to the phased development of the RTSF, will require a total storage capacity of at least 3.5 million m^3. To limit seepage of process water, the RWD will be lined with a geocomposite liner consisting of a geomembrane underlain by a 300 mm thick layer of clayey material won from site. A seepage collection system will also be provided to intercept and identify any leakage.

1.3.1.9 Advanced Water Treatment Facility

The design by Watercare Mining (WCM) consists of a multiple stage softening and membrane separation process. The method of softening uses a Crystalactor® process for softening which reduces the incoming water hardness by the precipitation of calcium pellets. Through pH control and a feed crystal source of fine quartz sand, precipitation is controlled and creates fine pellets which are highly stable and easy to handle. This effectively combines the softening and clarifying stage in one process. This is followed by GAC (granular activated carbon) and Nano-filtration to remove all solids as well as organic compounds to protect the Reverse osmosis (RO) membranes from damage and fouling. The filtrate from the first stage membranes is below the prescribed quality and the brine is sent to a secondary Crystalactor® for softening again and follows the same processes as described by Stage 1. Three stages are used to create an overall water recovery of 93% with the solid waste discharged as stable pellets at an approximate water content of only 5%. Each stage of RO membrane recovery ranges from 65% to 50%, with each consecutive stage being lower recovery due to the saturation limit as well as the operating pressure being kept as low as possible to conserve energy.

The options for disposal of the pellets is either by creating a slurry that is pumped to the RTSF, or it needs to be collected on a drying bank and collected with a tipper and driven to the RTSF for disposal. The footprint of the proposed plant is approximate area of 0.36 ha and will cater for the scope of the Ultimate Project.

Plan 5: CPP Location

Plan 6: CPP Layout

Plan 7: RTSF Location

1.3.2 Initial Implementation

Due to commercial imperatives in developing a project of this magnitude, it needs to be implemented over time. The initial investment and development will be focused on those assets that will put the project in a position to partially fund the remaining development.

This entails the design and construction of the initial components of the CPP (gold module, floatation plant, uranium plant, acid plant and a roaster), to retreat up to 1.5 Mt/m concurrently from the Driefontein 3 and 5 TSFs, C4S TSF (1Mt/m) and the Cooke TSF (0.5Mt/m). Driefontein 3, 5 and C4S TSFs will be mined sequentially over 11 years, whilst the Cooke TSF will be mined concurrent to these for a period of 16 years. The resultant tailings will be deposited onto the first stage of the new RTSF.

A high grade uranium concentrate, produced at the CPP, will be transported to Ezulwini (50 k tonnes per month) for the extraction of uranium. The tailings from this process will be deposited on the existing operational Ezulwini North TSF.

Figure 1-2 provides a high-level overview of the process to be undertaken as part of the Initial Implementation of the WRTRP, whilst Plan 3 provides a visual overview of the project to be implemented in the various phased.

Figure 1-2: Initial Implementation Process Summary

The CPP and RTSF are likely to be the two components of the project with the most significant potential environmental impacts and will be developed as the project progresses. The CPP will be developed in 3 phases over a period of approximately eight years, however this application is for the entire CPP site i.e. Modules I, II and III, uranium plants, roasters and acid plant. Similarly the RTSF will be developed in two phases over the life of the project, but this application is for the entire RTSF footprint and will be assessed as such. The decision to take this approach, as opposed to authorising these components in stages as they are developed, is to provide the regulators and the public with an impact assessment that takes the whole project into consideration. This approach allows the authorities to make a decision based on a complete impact assessment as opposed to incremental applications for each new phase.

The primary activities to take place during the Initial Implementation of the WRTRP are listed in Table 1-3, with the pipeline routes outlined in Table 1-4.

Table 1-3: Primary Activities of the WRTRP Initial Implementation

Category	Activity
Kloof Mining Right area	
Infrastructure	Pipeline Routes (residual tailings).
	Central processing Plant (CPP) incorporating Module 1 floatation and gold plants and uranium, roaster and acid plants.
	The Regional Tailings Storage Facility (RTSF), RTSF Return Water Dam (RWD) and the Advanced Water Treatment Facility (AWTF). Collectively known as the RTSF complex.
Processes	Abstraction of water from K10 shaft
	Disposal of the residue from the AWTF.
	Gold, uranium and sulfur extraction at the CPP (tailings to RTSF)
	Water distribution at the AWTF for discharge.
Pumping	Pumping of up to 1.5 Mt/m of tailings to the RTSF.
	Pumping water from the RTSF return water dams to the AWTF.
	Discharging treated water to the Leeuspruit.
Electricity supply	Power supply from Kloof 1 substation to the CPP.
	Power supply from Kloof 4 substation to the RTSF and AWTF.
Driefontein Mining Right area	
Infrastructure	Pipeline Routes (water, slurry and thickened tailings).
	West block Thickener (WBT) and Bulk Water Storage Facility (BWSF) complex.
	Collection sumps and pump stations at the Driefontein 3 and 5 TSFs

Category	Activity
Processes	Hydraulic reclamation of the Driefontein 3 and 5 TSFs.
Pumping	Pumping water from K10 to the BWSF located next to the WBT.
	Pumping water from the BWSF to the Driefontein TSFs that will be reclaimed.(Dri3 & 5 TSFs)
	Pumping slurry from the TSF sump to the WBT (for Driefontein 3 and 5 TSFs).
	Pumping the thickened slurry from the WBT to the CPP.
Electricity supply	Power supply from West Driefontein 6 substation to Driefontein 3 TSF.
	Power supply from West Driefontein Gold substation to Driefontein 5 TSF.
	Power supply from East Driefontein Shaft substation to WBT and BWSF.
Cooke Mining Right area	
Infrastructure	Pipeline routes (water, slurry and thickened tailings).
	Cooke thickener and BWSF.
	Collection sumps and pump stations at Cooke TSF and Cooke 4 South TSF.
Processes	Abstraction of water from Cooke 1 shaft.
	Hydraulic reclamation of the Cooke and C4S TSFs (which include temporary storage of the slurry in a sump).
Pumping	Pumping 500 kt/m of tailings from the Cooke TSF to the Cooke thickener.
	Pumping from the Cooke thickener to the CPP via Ezulwini.
Electricity supply	Power supply from the Cooke substation to the Cooke thickener.
	Power supply from the Cooke Plant to the Cooke TSF
Ezulwini Mining Right area	
Infrastructure	Pipeline routes (water, slurry and thickened tailings).
Processes	Uranium extraction at Ezulwini (tailings to Ezulwini North Dump).
	Abstraction of water from Cooke shaft.
Pumping	Pumping water from Cooke 4 Shaft to the C4S TSF for reclamation.
	Pumping slurry from the TSF sump to the CPP.
Electricity supply	Power supply from Ezulwini plant to the C4S TSF

Table 1-4: Pipeline Route Lengths

Name	Length (m)	Type
Driefontein 3 TSF to WBT	7 665	Slurry Pipeline -dilute
Driefontein 5 TSF to Driefontein 3 TSF	6 646	Slurry Pipeline -dilute
WBT to CPP	17 029	Slurry Pipeline -thickened
Cooke TSF to Cooke Thickener	2 245	Slurry Pipeline-dilute
Cooke Thickener to CPP	33 129	Slurry Pipeline-thickened-existing approved route GDARD,NNR
Ezulwini South TSF to CPP	18 915	Slurry Pipeline-thickened
CPP to RTSF	17 908	Tailings Pipeline – thickened (alternate routes)
CPP to Ezulwini	18 502	Tailings Pipeline (Uranium Rich) - dilute
BWSF to DRI3	7 699	Water Pipeline
BWSF to DRI5	14 168	Water Pipeline
K10 to west BWSF	10 477	Water Pipeline
Cooke shafts to Cooke TSF	1 218	Water Pipeline – existing approved route GDARD , NNR
Cooke 4 shaft to C4S TSF	1 218	Water Pipeline
RWD to AWTF	1 960	Water Pipeline
WBT to CPP (Alternative Route)	13 284	Slurry Pipeline (Alternative Route)

Amendments to various MWPs and EMPs will be applied for in due course pending the inclusion of additional TSFs as the WRTRP expands to process 4 Mt/m. The RTSF and CPP will be assessed for the complete footprint to ensure suitability for all future deposition requirements and envisaged process plant requirements in the CPP area. This application, however, deals with the amendment of the Kloof Mining Right to include the Initial Implementation activities occurring within or associated with this right.

1.3.3 Amendment to the Kloof Mining Right

This application and EIA relates to the required environmental authorisations for initial implementation relevant to the Kloof Mining Right Area which entails:

- The inclusion of Venterspost North and South TSFs into the Kloof Mining Right Area;
- Abstraction of makeup water from the K10 shaft; and

- The construction and operation of:
  - The CPP;
  - The RTSF;
  - The RWD;
  - The AWTF; and
  - Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The activities associated with the Kloof application are listed in Table 1-5.

Table 1-5: Kloof Activities

Category	Activity
Kloof Mining Right area	
Infrastructure	Pipeline Routes (residual tailings).
	Central processing Plant (CPP) incorporating Module 1 floatation and gold plants and uranium, roaster and acid plants.
	The Regional Tailings Storage Facility (RTSF), RTSF Return Water Dam (RWD) and the Advanced Water Treatment Facility (AWTF). Collectively known as the RTSF complex.
Processes	Abstraction of water from K10 shaft
	Disposal of the residue from the AWTF.
	Gold, uranium and sulfur extraction at the CPP (tailings to RTSF)
	Water distribution at the AWTF for discharge.
Pumping	Pumping of up to 1.5 Mt/m of tailings to the RTSF.
	Pumping water from the RTSF return water dams to the AWTF.
	Discharging treated water to the Leeuspruit.
Electricity supply	Power supply from Kloof 1 substation to the CPP.
	Power supply from Kloof 4 substation to the RTSF and AWTF.

2 Item 3: Project applicant

SGL has appointed Digby Wells as the independent Environmental Assessment Practitioner (EAP) to conduct the EIA and associated specialist studies for the WRTRP, as well as the required Public Participation Process (PPP).

2.1 Item 3(a)(i): Details of the EAP

Table 2-1 below provides the details of the Environmental Assessment Practitioner (EAP) working on the proposed Project.

Table 2-1: Contact details of the EAP

Name of Practitioner:	Mr Marcelle Radyn
Telephone:	+27 11 789 9495
Fax:	+27 11 789 9498
Email:	marcelle.radyn@digbywells.com

2.2 Item 3(a)(ii): Expertise of the EAP

2.2.1 The qualifications of the EAP

Marcelle completed his BSc at the University of the Witwatersrand. He then completed a BSc (Hons) through the University of South Africa. Refer to Appendix B for proof of these qualifications.

2.2.2 Summary of the EAP's past experience

Marcelle is a Senior Environmental Consultant at Digby Wells within the Environmental Management Services Department. Marcelle has been with Digby Wells since 2012 and has managed many projects within South Africa. During his employment at Digby Wells, Marcelle has been extensively involved in the management of the Environmental Impact Assessment (EIA) process as well as with the compilation of Environmental Management Programmes (EMPr). This includes the completion of the EIA/EMPs for mining related projects in accordance with the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA). The projects involved managing the Public Participation Process (PPP), Project Meetings and resource allocation and management. He has also compiled numerous Prospecting Right Applications and Water Use License Applications (WULA). In addition he possesses experience in conducting due diligence investigations and EMP compliance auditing.

Refer to Appendix B for Marcelle's Curriculum Vitae (CV).

3 Item 3(b): Description of the property

In terms of the Kloof Mining Right area (which includes Leeudoorn, Venterspost and Libanon), SGL holds a converted mining right GP 66 MR (registered in the MPTRO under 44/2007 MR) in respect of properties listed in Table 3-1, with the properties applied for inclusion into the Kloof Mining Right area listed in Table 3-2.

Table 3-1: Farms Associated with the existing Kloof Mining Right Area

Affected Farms			
Kraalkop 147 IQ	Middelvlei 255 IQ	Uitval 280 IQ	Venterspost 284 IQ
Foch 150 IQ	Nelshoogte 246 IQ	Gemspost 288 IQ	Rietfontein 519 IQ
Luipaardsvlei 243 IQ	Panvlakte 291 IQ	Bekkersdal 294 IQ	Elandsfontein 346 IQ
Doornpoort 347 IQ	Doornkloof 348 IQ	Doornkloof 350 IQ	Rietfontein 349 IQ
Leewdoorn 351 IQ	Leeuwpoort 356 IQ	Weltevreden 357 IQ	Wildebeestkuil 360 IQ
Davonia 363 IQ		Gemsbokfontein 290 IQ	

Table 3-2: Farms Associated with the Extension of the Kloof Mining Right Area

Affected Farms			
Farm Name	**Portions**	**Farm Name**	**Portions**
Gemspost 288 IQ	Portion 11 and Portion of the Remaining Extent	Cardoville 358 IQ	Portions 1, 3, 4, 6, 7, 8, 11 and 13 and a Portion of the Remaining Extent.
Wildebeestkruil 360 IQ	Portions 2, 4, 5, 6, 7, 8 and 18.	Carol 362 IQ	Portion 1, 2, 3, 4 and a Portion of the Remaining Extent.
Rietfontein 519 IQ	Remaining Extent of Portion 3 and Portions 1 and 21.	Droogheuvel 521 IQ	Portion 1 and 2 and a Portion of the Remaining Extent

This Mining Right includes the mines previously known as Kloof, Libanon, Leeudoorn and Venterspost.

The amendment of the Kloof Mining Right to include new activities and infrastructure will entail development on a number of properties (Plan 8). The aspects of the Initial Implementation of the WRTRP relevant to the Kloof Mining Right area and the properties these will take place on are detailed in Table 3-3 to Table 3-10.

Table 3-3: AWTF Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 13 of the farm Cardoville 364 IQ	T0IQ00000000036400013
Application Area (Ha):	0.36 ha	
Magisterial District:	Vanderbijlpark Magisterial District	
Distance and direction from nearest town:	30 km SW of Carletonville	

Table 3-4: CPP Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Remaining Extent of the farm Doornkloof 348 IQ	T0IQ00000000034800000
	Portion 5 of the farm Rietfontein 349 IQ	T0IQ00000000034900005
	Portion 11 of the farm Rietfontein 349 IQ	T0IQ00000000034900011
	Portion 35 of the farm Rietfontein 349 IQ	T0IQ00000000034900035
	Portion 36 of the farm Rietfontein 349 IQ	T0IQ00000000034900036
Application Area (Ha):	65 ha	
Magisterial District:	Westonaria Magisterial District	
Distance and direction from nearest town:	22.46 km SW of Carletonville	

Table 3-5: RTSF and Return Water Dam (RWD) Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Remaining Extent of the farm Cardoville 358 IQ	T0IQ00000000035800000
	Portion 1 of the farm Cardoville 364 IQ	T0IQ00000000036400001
	Portion 3 of the farm Cardoville 358 IQ	T0IQ00000000035800003
	Portion 4 of the farm Cardoville 358 IQ	T0IQ00000000035800004
	Portion 7 of the farm Cardoville 364 IQ	T0IQ00000000036400007
	Portion 8 of the farm Cardoville 364 IQ	T0IQ00000000036400008
	Portion 11 of the farm Cardoville 364 IQ	T0IQ00000000036400011
	Portion 13 of the farm Cardoville 364 IQ	T0IQ00000000036400013
	Portion 2 of the farm Droogheuvel 521 IQ	T0IQ00000000052100002
	Portion 2 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000002
	Portion 7 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000007
	Portion 18 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000018
Application Area (Ha):	1 380 ha	
Magisterial District:	Vanderbijlpark Magisterial District (Cardoville) Potchefstroom Magisterial District (Droogheuvel and Wildebeestkuil)	
Distance and direction from nearest town:	35 km SW of Carletonville	

Table 3-6: K10 Shaft

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 31 of the farm Venterspost 284 IQ	T0IQ00000000028400031
Application Area (Ha):	0.005 ha	
Magisterial District:	Oberholzer Magisterial District	
Distance to town:	22 km SE of Carletonville	

Table 3-7: Venterspost North and South Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Remaining extent of the farm Gemspost 288 IQ	T0IQ00000000028800000
	Portion 13 of the farm Gemsbokfontein 290 IQ	T0IQ00000000029000013
Application Area (Ha):	60.68 ha (North), 30.5 ha (South)	
Magisterial District:	Oberholzer Magisterial District	
Distance and direction from nearest town:	22 km SE of Carletonville	

Table 3-8: Transmission Lines Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 6 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600006
	Portion 7 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600007
	Portion 8 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600008
	Portion 24 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600024
	Portion 3 of the farm Cardoville 358 IQ	T0IQ00000000035800003
	Portion 1 of the farm Cardoville 364 IQ	T0IQ00000000036400001
	Portion 3 of the farm Cardoville 364 IQ	T0IQ00000000036400003
	Portion 4 of the farm Cardoville 364 IQ	T0IQ00000000036400004
	Portion 8 of the farm Cardoville 364 IQ	T0IQ00000000036400008
	Portion 13 of the farm Cardoville 364 IQ	T0IQ00000000036400013
	Portion 1 of the farm Cardoville 365 IQ	T0IQ00000000036400001
	Portion 20 of the farm Doornkloof 350 IQ	T0IQ00000000035000020
	Portion 73 of the farm Doornpoort 347 IQ	T0IQ00000000034700073
	Portion 1 of the farm Driefontein 113 IQ	T0IQ00000000011300001
	Portion 2 of the farm Driefontein 113 IQ	T0IQ00000000011300002
	Portion 2 of the farm Driefontein 355 IQ	T0IQ00000000035500002
	Portion 8 of the farm Driefontein 355 IQ	T0IQ00000000035500008
	Portion 10 of the farm Driefontein 355 IQ	T0IQ00000000035500010
	Portion 11 of the farm Driefontein 355 IQ	T0IQ00000000035500011
	Portion 15 of the farm Driefontein 355 IQ	T0IQ00000000035500015
	Portion 7 of the farm Rietfontein 349 IQ	T0IQ00000000034900007
	Portion 12 of the farm Rietfontein 349 IQ	T0IQ00000000034900012
	Portion 20 of the farm Rietfontein 349 IQ	T0IQ00000000034900020
	Portion 25 of the farm Rietfontein 349 IQ	T0IQ00000000034900025
	Portion 32 of the farm Rietfontein 349 IQ	T0IQ00000000034900032

	Description	General Surveyor's Cadastral code
	Portion 35 of the farm Rietfontein 349 IQ	T0IQ00000000034900035
	Portion 1 of the farm Springbok Kraal 359 IQ	T0IQ00000000035900001
	Portion 1 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000001
	Portion 2 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000002
	Portion 5 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000005
	Portion 7 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000007
	Portion 18 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000018
Application Area (Ha):	325 ha	
Magisterial District:	Oberholzer Magisterial District (Blyvooruitzicht and Driefontein) Vanderbijlpark Magisterial District (Cardoville) Westonaria Magisterial District (Doornkloof, Doornpoort and Rietfontein) Potchefstroom Magisterial District (Springbok Kraal and Wildebeestkuil)	
Distance and direction from nearest town:	4 to 25 km SE from Carletonville	

Table 3-9: Pipeline Routes Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 1 of the farm Cardoville 364 IQ	T0IQ00000000036400001
	Portion 2 of the farm Cardoville 364 IQ	T0IQ00000000036400002
	Portion 3 of the farm Cardoville 364 IQ	T0IQ00000000036400003
	Portion 4 of the farm Cardoville 364 IQ	T0IQ00000000036400004
	Portion 7 of the farm Cardoville 364 IQ	T0IQ00000000036400007
	Portion 11 of the farm Cardoville 364 IQ	T0IQ00000000036400011
	Portion 13 of the farm Cardoville 364 IQ	T0IQ00000000036400013
	Portion 0 of the farm Doornkloof 348 IQ	T0IQ00000000034800000
	Portion 5 of the farm Doornpoort 347 IQ	T0IQ00000000034700005
	Portion 11 of the farm Doornpoort 347 IQ	T0IQ00000000034700011
	Portion 18 of the farm Doornpoort 347 IQ	T0IQ00000000034700018
	Portion 19 of the farm Doornpoort 347 IQ	T0IQ00000000034700019
	Portion 20 of the farm Doornpoort 347 IQ	T0IQ00000000034700020
	Portion 21 of the farm Doornpoort 347 IQ	T0IQ00000000034700021

	Description	General Surveyor's Cadastral code
	Portion 37 of the farm Doornpoort 347 IQ	T0IQ00000000034700037
	Portion 35 of the farm Rietfontein 349 IQ	T0IQ00000000034900035
	Portion 28 of the farm Rietfontein 349 IQ	T0IQ00000000034900028
	Portion 36 of the farm Rietfontein 349 IQ	T0IQ00000000034900036
	Portion 73 of the farm Rietfontein 349 IQ	T0IQ00000000034900073
	Portion 1 of the farm Springbok Kraal 359 IQ	T0IQ00000000035900001
	Portion 1 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000001
	Portion 2 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000002
	Remaining Extent of portion 5 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000005
	Portion 7 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000007
	Portion 18 of the farm Wildebeestkuil 360 IQ	T0IQ00000000036000018
Application Area:	8 500 m^2	
Magisterial District:	Oberholzer Magisterial District (Driefontein and Blyvooruitzicht) Potchefstroom Magisterial District (Wildebeestkuil) Vanderbijlpark Magisterial District(Cardoville and Doornpoort) Westonaria Magisterial District (Doornkloof, Leeudoorn, Libanon, Modderfontein, Uitval and Waterpan)	
Distance and direction from nearest town:	15 km SE of Westonaria	

Table 3-10: Pump Stations Property Descriptions

	Description	General Surveyor's Cadastral code
Farm Name(s) and 21 digit Surveyor General Code(s) for each farm portion:	Portion 8 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600008
	Portion 24 of the farm Blyvooruitzicht 116 IQ	T0IQ00000000011600024
	Portion 1 of the farm Driefontein 113 IQ	T0IQ00000000011300001
	Portion 10 of the farm Driefontein 355 IQ	T0IQ00000000035500010
	Portion 11 of the farm Driefontein 355 IQ	T0IQ00000000035500011

	Description	General Surveyor's Cadastral code
Application Area (Ha):	0.05 ha	
Magisterial District:	Oberholzer Magisterial District	
Distance and direction from nearest town:	4.5 km E of Carletonville	

Plan 8: Land Tenure

4 Item 3(c) of Appendix 3: Locality map

The WRTRP ultimate scope is located across the West Rand District Municipality (WRDM) in Gauteng Province. The WRDM includes four local municipalities (LMs): Mogale City, Westonaria, Randfontein and Merafong City. Towns and larger settlements located in the broader project area include Randfontein, Toekomsrus, Fochville, Carletonville, Westonaria, Venterspost, Modderfontein, Rietvallei, Bekkersdal and Mohlakeng.

Although sections of the RTSF traverse the Merafong City Local Municipality (LM), the Kloof Mining Right area falls predominantly within the Westonaria City Local Municipality. Land uses in the Westonaria LM can be categorised in three main divisions, i.e. agriculture, mining, and residential. Agriculture is the dominant land use in the LM, followed by mining and residential land uses, with the latter accounting for approximately 8% of the total land area of the LM. The municipality's human settlements are relatively scattered due to the mining activities taking place. The LM's residential development is generally dispersed with the dominant townships including:

- Westonaria;
- Bekkersdal;
- Hillshaven;
- Glenharvie;
- Venterspost;
- Simunye; and
- Mining towns such as Libanon and Waterpan.

The most significant land uses within the project area are mining, agriculture, residential and businesses. Of these, agriculture covers the largest portion of the area, followed by mining and residential uses. The area includes a large number of both historical and existing mining activities.

As indicated in Plan 1, the Kloof Mining Right area is situated West of the R28 regional road and north of the R54, in Westonaria.

5 Item 3(d) of Appendix 3: Description of the scope of the proposed overall activity

While the Ultimate Project activity is described in section 1.3.1 above, the required environmental authorisations for initial implementation relevant to envisaged activities pertaining to the Kloof Mining Right area include:

- The inclusion of Venterspost North and South into the Kloof Mining Right Area;
- Abstraction of makeup water from the K10 shaft; and

- The construction and operation of:
  - The CPP;
  - The RTSF;
  - The RWD;
  - The AWTF; and
  - Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.

The activities listed above are described in more detail in Section 5.1.

5.1 Listed and Specified Activities

5.1.1 Environmental Authorisation

The primary authorisation to consider will be an Environmental Authorisation to be granted in accordance with the Environmental Impact Assessment Regulations, 2014 (the EIA 2014 Regulations) promulgated in terms of the provisions of the National Environmental Management Act, 1998, as amended (NEMA). NEMA identifies two classes of activities requiring authorisation, those of a less significant nature requiring evaluation by what is described as a Basic Assessment process (BA), and those with substantial impact which require a more detailed scoping and environmental impact assessment (S&EIA) process. In addition to the EIA 2014 Regulations, the Minister of Environmental Affairs (DEA) has published two notices identifying activities that require a BA process (Listing Notice 1) and a full Environmental Impact Assessment process (Listing Notice 2). The proposed activities should be assessed against the activities listed in the two listing notices to determine which of the Listed Activities will be triggered. As this project triggers activities under both Listing Notice 1 and 2, a full EIA process will be undertaken.

The listed and specified activities are set out in Table 5-1 below.

Part 3 of Chapter 4 of the EIA 2014 Regulations sets out the timeframe for applying for and obtaining an Environmental Authorisation (EA). In brief, this requires:

- Compilation of a Scoping Report: within 44 days from date of submission of the application for the EA, a Scoping Report must be submitted to the competent authority;
- Consideration of the Scoping Report by the competent authority: the competent authority must reach a decision on the Scoping Report within 43 days and either accepts it and directs the applicant to proceed with the EIA, or refuse it under defined circumstances. The Scoping Report was submitted to the DMR on 13 November 2015;
- Preparation of the EIA: the applicant must prepare a detailed EIA and an Environmental Management Programme (EMPr) in accordance with the Scoping

Report and submit it to the competent authority within 106 days after being directed to do so; and

- Decision on the application: the competent authority must reach a decision on the EIA and the EMPr and either grant authorisation or refuse it.

5.1.2 Waste Management

The Regulations regarding the Planning and Management of Residue Stockpiles and Residue Deposits, 2015 were published on Friday 24 July 2015 in GN R632 in GG 39020. These Regulations provide the framework for the management of TSFs in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA), in place of the Regulations previously in place in terms of the MPRDA. Although the DMR will remain the competent authority, residue stockpiles and residue deposits will now be governed by the new NEM:WA Regulations.

The implications in brief are as follows:

- The identification and assessment of environmental impacts arising from residue stockpiles and residue deposits must be done as part of the environmental impact assessment;
- The management of residue stockpiles and residue deposits must be in accordance with any conditions and management measures in the EMP and waste management licence;
- A risk analysis based on the identified characteristics and the classification must be used to determine the appropriate mitigation and management measures;
- Residue stockpile and residue deposit must be characterised to identify any potential risk to health, safety and environmental impacts that may be associated with the residue when stockpiled or deposited, in terms of its physical characteristics, chemical characteristics and mineral content; and
- The required pollution control barrier system shall be defined by the National Norms and Standards for the Assessment of Waste for Landfill Disposal and the National Norms and Standards for Disposal of Waste to Landfill.

As far as the design of TSFs is concerned, the Regulations provide that the design must be undertaken by a professional civil or mining engineer, an assessment of the typical soil profile on the site is required for all residue stockpile and residue deposit must be made and the design of a residue stockpile and residue deposit must take into account all phases of the life cycle of the residue stockpile and residue deposit, from construction through to post closure

The List of waste management activities that have, or are likely to have, a detrimental effect on the environment published in GN 921 in GG 37083 of 29 November 2013 have been amended in terms of GN R633 in GG 39020 of 24 July 2015 to include residue deposits and residue stockpiles.

Further details pertinent to the policy and legislative context of this project are set out in Section 6 of this report.

Table 5-1: Project Activities

<table>
<tr><th colspan="2">Listed Activity</th><th>Description of Activity</th><th>Aerial extent of the activity</th></tr>
<tr><th colspan="4">Listing notice GNR 983 (Basic Assessment) (NEMA)</th></tr>
<tr><td>Activity 9</td><td>The development of infrastructure exceeding 1 000 m in length for the bulk
transportation of water or storm water-
▪ with an internal diameter of 0.36 metres or more; or
▪ with a peak throughput of 120 litres per second or more.</td><td>Transportation of water from K10 Shaft to the Bulk Water Storage Facility (BWSF). The pipeline will have a diameter of at least 0.36 m with a daily throughput of approximately 230 l/s.</td><td rowspan="2">The total aerial extent of envisaged pipelines will cover approximately 8 500 m^2.</td></tr>
<tr><td>Activity 10</td><td>The development and related operation of infrastructure exceeding 1 000 metres in length for the bulk transportation of sewage, effluent, process water, waste water, return water, industrial discharge or slimes-
▪ with an internal diameter of 0,36 metres or more; or
▪ with a peak throughput of 120 litres per second or more.</td><td>Pipelines will be installed to convey slurry and process water between the RWD and RTSF.</td></tr>
<tr><td>Activity 11</td><td>The development of facilities or infrastructure for the transmission and distribution of electricity-
▪ outside urban areas or industrial complexes with a capacity of more than 33 but less than 275 kilovolts.</td><td>The development of facilities or infrastructure for the transmission and distribution of electricity. The electrical switch gear will be 132 kV (transmission will be either 6.6 kV or 11 kV).</td><td>The total aerial extent of envisaged power lines will cover approximately 325 ha.</td></tr>
</table>

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 12	The development of- ▪ infrastructure or structures with a physical footprint of 100 square metres or more where such development occurs- ▪ within a watercourse; ▪ in front of a development setback; or ▪ if no development setback exists, within 32 metres of a watercourse, measured from the edge of a watercourse.	Where the pipeline routes traverse watercourses. There are approximately 25 watercourse crossings.	250 m^2
Activity 14	The development of facilities or infrastructure, for the storage, or for the storage and handling, of a dangerous good, where such storage occurs in containers with a combined capacity of 80 cubic metres or more but not exceeding 500 cubic metres.	Diesel and reagents storage for the CPP. Diesel storage on site will be at least 80 m^3 and in horizontal tanks. Total cyanide storage will be approximately 150 m^3; caustic storage 80 m^3 and acid storage 40 m^3.	65 ha
Activity 16	The development and related operation of facilities for the desalination of water with a design capacity to produce more than 100 cubic metres of treated water per day.	Desalination works at AWTF.	3 600 m^2
Activity 19	The infilling or depositing of any material of more than 5 cubic metres into, or the dredging, excavation, removal or moving of soil, sand, shells, shell grit, pebbles or rock of more than 5 cubic metres from- ▪ a watercourse.	Wherever pipelines route cross over watercourses.	250 m^2

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 24	The development of a road with a reserve wider than 13.5 m, or where no reserve exists, the road is wider than 8 m.	Additional roads to be constructed to allow for access to new infrastructure such as the RTSF and CPP.	Approximately 19 km of roads.
Activity 45	The expansion of infrastructure for the bulk transportation of water or storm water where the existing infrastructure- ▪ has an internal diameter of 0.36 metres or more; or ▪ has a peak throughput of 120 litres per second or more; and ▪ where the facility or infrastructure is expanded by more than 1 000 metres in length; or where the throughput capacity of the facility or infrastructure will be increased by 10% or more.	Upgrade of pipelines at K10 Shaft.	The total aerial extent of envisaged pipelines will cover approximately 8 500 m^2.
Activity 67	Phased activities for all activities ▪ listed in this Notice, which commenced on or after the effective date of this Notice; or ▪ similarly listed in any of the previous NEMA notices, which commenced on or after the effective date of such previous NEMA Notices	Construction of the CPP and RTSF. The CPP will be constructed in phases over an eight year period. The RTSF will be constructed as required over the life of the project.	1 380 ha
Listing notice GNR 984 (Full Scoping and EIA) (NEMA)			
Activity 6	The development of facilities or infrastructure for any process or activity which requires a permit or licence in terms of national or provincial legislation governing the generation or release of emissions, pollution or effluent.	Applications for authorisation will need to be submitted in terms of the NNRA, NWA and NEM: AQA.	N/A

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 15	The clearance of an area more than 20 hectares of indigenous vegetation.	Clearing of land for the construction of the CPP, RTSF and AWTF.	More than 20 hectares of indigenous vegetation will be cleared.
Activity 16	The development of a dam where the highest part of the dam wall, as measured from the outside toe of the wall to the highest part of the wall, is 5 metres or higher or where the high water mark of the dam covers an area of 10 hectares or more.	Construction of the RTSF and the RWD. The RTSF will have a final height of 100 m and cover an area of 1 350 ha. The RTSF's RWD will have a wall height of 5 m to 10 m, and with a total storage volume of at least 3.5 Million m^3.	1 380 ha
Activity 17	Any activity including the operation of that activity which requires a mining right as contemplated in section 22 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002), including associated infrastructure, structures and earthworks, directly related to the extraction of a mineral resource, including activities for which an exemption has been issued in terms of section 106 of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).	A Section 102 Amendment will be applied for to include the additional mining operations into the existing Kloof mining right.	N/A
Activity 21	Any activity including the operation of that activity associated with the primary processing of a mineral resource including winning, reduction, extraction, classifying, concentrating, crushing, screening and washing but excluding the smelting, beneficiation, refining, calcining or gasification of the mineral resource in which case activity 6 in this Notice applies.	Reprocessing of gold and uranium tailings at the CPP.	65 ha

Listed Activity		Description of Activity	Aerial extent of the activity
Activity 25	The development and related operation of facilities or infrastructure for the treatment of effluent, wastewater or sewage with a daily throughput capacity of 15 000 cubic metres or more.	Operation of the AWTF.	3 600 m^2
Activity 28	Commencing of an activity, which requires an atmospheric emission license in terms of section 21 of the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004).	Applications for authorisation will need to be submitted in terms of the NNRA, NWA and NEM: AQA.	N/A
Listing notice GNR 921 (Full Scoping and EIA, Category B) (NEM: WA)			
Activity 1	The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage.	Construction and operation of the RTSF and the sewage treatment plant.	1 380 ha
Activity 7	The disposal of any quantity of hazardous waste.	Operation of RTSF.	1 380 ha
Activity 11	The establishment or reclamation of a residue stockpile or residue deposit.	Establishment of the RSTF	1 380 ha

5.2 Item 3(d)(ii): Description of the activities to be undertaken

This section describes in detail the envisaged activities to be undertaken and includes (Plan 9):

- Abstracting water from K10 shaft;
- Construction of pipelines;
- Construction of transmission lines;
- Construction and operation of
  - Pump stations;
  - The CPP;
  - The AWTF;
  - The RTSF; and
  - The RWD.

Existing infrastructure of which use will be made includes:

- Kloof 1 and Kloof 4 electrical substations;
- The K10 shaft (as makeup water source); and
- Pollution control and return water dams at the existing Kloof operation.

During the construction phase of the project the environmental aspects of land transformation, job creation and spending may need to be investigated further. Land transformation was seen to have an influence on the heritage landscape, land use and biophysical (wetlands and fauna & flora) of the project areas. This applies to all the areas of surface disturbance such as pipelines, RTSF, CPP and support infrastructure.

The creation of jobs was seen to link to the characterisation of the social environment of the study area and this would need to be studied to identify possible impacts; positive and negative. The capital expenditure and the operational costs for the project are linked to the economic analysis of the project.

The activities associated with the construction phase are summarised in Figure 5-1.

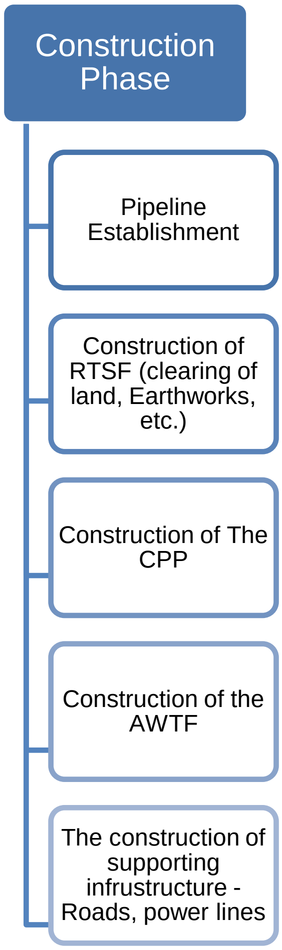

Figure 5-1: Summary of construction activities - Kloof

It is during the operational phase that a number of activities, with associated environmental aspects and impacts, will take place. These can be linked to the 6 main project activities as summarised in Figure 5-2.

Note: The processing of the uranium concentrate at Ezulwini has been authorised as part of the Ezulwini Mining Right and EMP. This project is concerned with the proposed pipeline to Ezulwini which has not been authorised and as such forms part of this application.

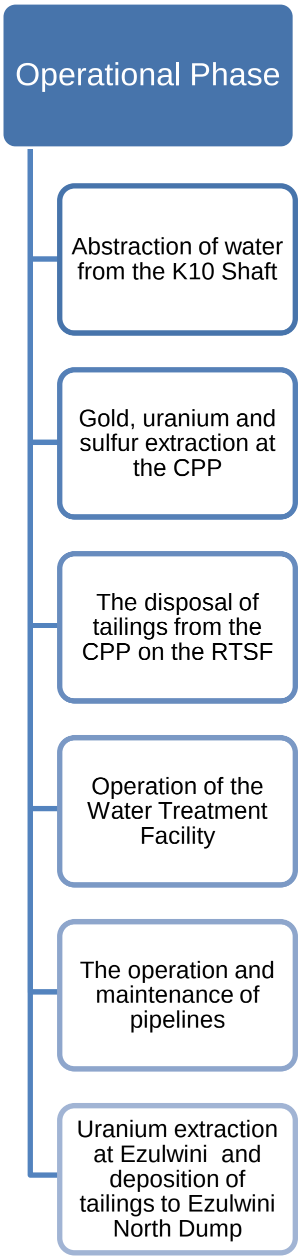

Figure 5-2: Main activities associated with the operational phase of the project – Kloof

The project spans several mining right areas with pipelines often required to traverse areas where no mining right is held. To ensure the liability of project infrastructure is attributed to SGL's mining right areas, the following principles were adopted:

- The Mining Right area within which infrastructure is situated will be liable for said infrastructure;
- Where pipelines traverse non-mining areas, the mining right area whose activities necessitate the pipeline, will accept liability; and
- The Kloof Mining Right area will be extended to include the RTSF complex footprint.

Plan 2 shows the infrastructure and the Mining Right area liable for it.

5.2.1 Water from K10 Shaft

A number of water sources have been identified, from which water can be supplied to the surface reclamation operations, one such source being the K10 Shaft, located just west of Westonaria. The WRTRP has recognised that water is a scarce and strategic commodity and hence mine impacted water will be used preferentially over Rand Water or other higher quality sources. Water will be supplied to the reclamation areas from the identified sources via water storage facilities.

Currently, approximately 30 000 m^3 of mine affected water is discharged into the Wonderfonteinspruit from K10 Shaft. It is proposed that 20 000 m^3 of the mine affected water from K10 Shaft be used for the reclamation activities associated with the WRTRP.

Once the impacted mine water has been used in the hydraulic reclamation process, it will find its way to the RTSF. As water builds up in the RTSF it will be drained to the RWD and treated at the AWTF. The water can then be treated to potable standards (SANS 241:2011), depending on the final use.

5.2.2 Central Processing Plant

The anticipated location for the CPP is mid-way between Kloof main and Kloof 4 shaft central to all the resources, water and power supply as well as existing and planned infrastructure (Plan 5). The Plant will be developed in phases to eventually treat up to 4 Mt/month of historical tailings and current arisings. The CPP will eventually comprise (Plan 6):

- Gold Plant Modules;
- Floatation plants and associated infrastructure (one associated with the uranium plants);
- Roasters and associated infrastructure;
- Acid plants and associated infrastructure;
- Uranium processing plants;
- Bulk sulfuric acid storage facility;
- Loading facilities for uranium concentrate, bulk sulfuric acid and reagents;
- Bulk Water storage facilities; and
- Pollution control dams.

The individual infrastructure components of the CPP are listed and laid out in Plan 6. The process flow of the CPP is as follows:

- Screened and thickened slurry will be delivered to the CPP by overland pipeline from the WBT at a high slurry density (RD 1.6) at a rate of 1 Mt/m. Upon arrival, the slurry will be diluted to an RD of 1.3 or 35% solids, using recirculated process water, and will then be subjected to a flotation process using a combination of sulfide and oxide flotation reagents. The first 5% concentrate mass pull (50 000 t/month), containing the naturally floatable gold, as well as most of the gold associated with sulfide minerals and uranium, will be subjected to ultra-fine grinding to liberate locked up gold, following which it will be thickened and pumped to the Ezulwini Plant for uranium extraction;
- A further 15% flotation concentrate mass pull (150 000 t/month), containing the balance of the sulfide-associated gold as well as the oxide-associated gold, will be thickened and pumped to a new Carbon In Leach (CIL) gold plant to be constructed within Module 1 of the CPP (refer to Plan 6);
- In the CIL Gold Plant, slaked lime will be added to the feed slurry to maintain a pH of 10.5. The slurry will then be leached with cyanide to enable the gold to be adsorbed onto activated carbon in the 7-stage CIL plant. The loaded carbon will be acid treated and eluted in a Zadra elution plant;
- Gold will be recovered from the eluate in an electro winning plant located inside the Gold Room (smelt house). Regenerated carbon will be recycled to the CIL plant;
- CIL tailings will be subjected to a Weak Acid Dissociable (WAD) cyanide destruction process before being mixed with flotation tailings. These tailings will then be thickened and pumped to the RTSF; and
- A common reagent offloading, storage and mixing facility will be provided at a designated area at the plant boundary.

A summary of the reagents to be used at the CPP are included in Table 5-2.

Table 5-2: Reagents to be used at the CPP

Process	Reagent	Purpose
Flotation	Betacol 381 BA	Flotation collector
	Aero 407	
	Oleoflot 5010	
	Sasfroth 10	Flotation frother
	Copper sulfate ($CuSO_4$)	Flotation activator
Gold Recovery	Lime (CaO)	pH modification and neutralisation
	Sodium cyanide (NaCN 33%)	Gold dissolution and elution

Process	Reagent	Purpose
	Activated carbon granules	Carbon-In-Pulp gold recovery process
	Hydrochloric acid (HCl 33%)	Acid treatment of activated carbon
	Caustic Soda (NaOH 45%)	Gold elution
	Sulfamic acid (H_3NSO_3)	Descaling of heat exchangers
	Silica (SiO_2)	Smelting flux
	Sodium nitrate ($NaNO_3$)	
	Sodium borate ($Na_2B_40_7$)	
Uranium Recovery	Sulfuric acid (H_2SO_4 98.5%)	Uranium ore leaching
	Pyrolusite (MnO_2)	Oxidising agent required in uranium leaching process
	Coal	Steam (heat) generation for uranium leaching process
	Limestone	pH modification and neutralisation
	Lime (CaO)	
	Resin beads	Recovery of uranium from ore
	Alamine	Extractant in uranium solvent extraction process
	Isodecanol	Modifier in uranium solvent extraction process
	Kerosene	Reagent diluent in solvent extraction process
	Caustic soda (NaOH 45%)	pH modifier in uranium solvent extraction process
	Sodium carbonate	
	Anhydrous ammonia gas	Uranium final product precipitation
Tailings Cyanide Destruction	Sodium metabisulfite (SMBS) ($Na_2S_2O_5$)	Tailings cyanide destruction
	Copper sulfate ($CuSO_4$)	Catalyst for cyanide destruction process
	Lime (CaO)	pH modifier

5.2.3 Regional Tailings Storage Facility

The RTSF will be located on a site originally known as B2/B3 as part of the WWP (site 33/34 from the CUP Geluksdal project), which was the alternate site for the West Wits CTSF, shown in Plan 7. The RTSF is situated south west of the current Doornpoort TSF which is operated by Gold Fields.

This new Tailings Facility is seen to be a facility that will cater for both the tailings generated by the WRTRP as well as possibly for other tailings produced in the region. It is likely that the construction of the RTSF will be phased (initial 1.5 Mt/m progressing to up to 4 Mt/m) to suit the envisaged tonnage build up. This RTSF has been positioned and sized as a facility that can cater for both the tailings generated by the WRTRP as well as other tailings located in the region approximating 1.3 billion tonnes.

Auxiliary infrastructure to be constructed as part of the RTSF complex includes:

- A penstock tower;
- Penstock outlet pipeline;
- Silt traps;
- Cascade ponds; and
- The RWD.

It is likely that the construction of the RTSF will be phased to suit the envisaged tonnage build up from the initial 1.5 to 4 Mt/m. The RTSF will be sized, assessed and permitted on the basis of accommodating the long term requirements for the region both in tonnage capacity and a deposition rate of 4 Mt/m.

There are various aspects pertaining to the operation and maintenance of the RTSF and these include:

- Method of deposition;
- Wall raising procedure;
- On-dam pipework;
- Decant management;
- Operation of on-site pump stations;
- General maintenance;
- Concurrent Rehabilitation;
- Installation of Infrastructure during Step-in Phase;
- Annual drainage enhancement installations; and
- Monitoring.

The outer 'shell' of the RTSF will consist of over-consolidated tailings material which will be deposited using the spigot deposition method; this allows for relatively thin layers of tailings to be placed in successive cycles, allowing for and reducing sun drying times. The overall side slope of the RTSF will be 1:4.5, which is relatively flat in comparison to conventional TSFs in the Highveld region (SLR Consulting, 2013). The side slope ratio results in higher factors of safety against slope failure, as well as being capable to support sustained vegetation cover. The rate of rise of the Ultimate Project RTSF will be 3 m per year above the starter wall level and will have a density of 1.6 tonnes per m^3; the rate of rise for the Initial Implementation of the WRTRP will be below 2 m per year.

5.2.4 Return Water Dam

The design and management of the RTSF RWD will need to be undertaken in line with the requirements of the GN 704 regulations. The RWD has therefore been sized to ensure that it is unlikely to spill into any clean water system more than once in 50 years, given a certain return water and/or water treatment rate.

The ultimate RWD arrangement, which will consist of a series of compartments due to the phased development of the RTSF, will require a total storage capacity of at least 3.5 million m^3. To limit seepage of process water, the RWD will be lined with a geocomposite liner consisting of a geomembrane underlain by a 300 mm thick layer of clayey material won from site. A seepage collection system will also be provided to intercept and identify any leakage.

5.2.5 Advanced Water Treatment Facility

The AWTF will treat the return water generated from the RTSF and will essentially replace the normal return water systems conventionally adopted with a view to optimising capital and aligning the WRTRP with SGL's overall water management strategy.

Following the production of a comprehensive water and salt balance, various parameters which would influence the selection of water treatment technologies were identified and are discussed under Section 9 of this document.

As for the preferred option, a design by Watercare Mining will be pursued (Figure 5-3). The design consists of a multiple stage softening and membrane separation process. The method of softening uses a Crystalactor® process which reduces the incoming water hardness by the precipitation of calcium pellets. Through pH control and a feed crystal source of fine quartz sand, precipitation is controlled and creates fine pellets which are highly stable and easy to handle. This effectively combines the softening and clarifying stage in one process. This is followed by GAC (Granular Activated Carbon) and Nano-filtration to remove all solids as well as organic compounds to protect the Reverse Osmosis (RO) membranes from damage and fouling. The filtrate from the first stage membranes is below the prescribed quality and the brine is sent to a secondary Crystalactor® for softening again and follows the same processes as described by Stage 1. Three stages are used to create an overall water recovery of 93% with the solid waste discharged as stable pellets at an approximate water content of only 5%. Each stage of RO membrane recovery ranges from

65% to 50%, with each consecutive stage being lower recovery due to the saturation limit as well as the operating pressure being kept as low as possible to conserve energy.

The options for disposal of the pellets is either by creating a slurry that is pumped to the RTSF, or it needs to be placed on a drying bank, collected with a tipper and driven to the RTSF for disposal. The footprint of the proposed plant is approximately 3 600 m^2 and will have a design capacity of, on average, 15 Mℓ per day. The chemicals to be utilised at the AWTF are described in Table 5-3.

Table 5-3: Chemicals to be used at the AWTF

Process	Reagent
Clean in Place Procedures	Carbonate based MC1800
	Citric Acid
	Sodium Hydroxide (NaOH)
Antiscalants	Phosphonate based CT9190
	Potassium hydroxide base CS50
Neutralisers	Calcium hydroxide ($Ca(OH)_2$)
	Sodium carbonate (Na_2CO_3)
	Sodium hydroxide (NaOH)
Oxygen Scavengers	Sodium metabisulfite ($Na_2S_2O_5$)
Oxidisers	Calcium hypochlorite (CaOCl)
	Sodium hypochlorite (NaOCl)

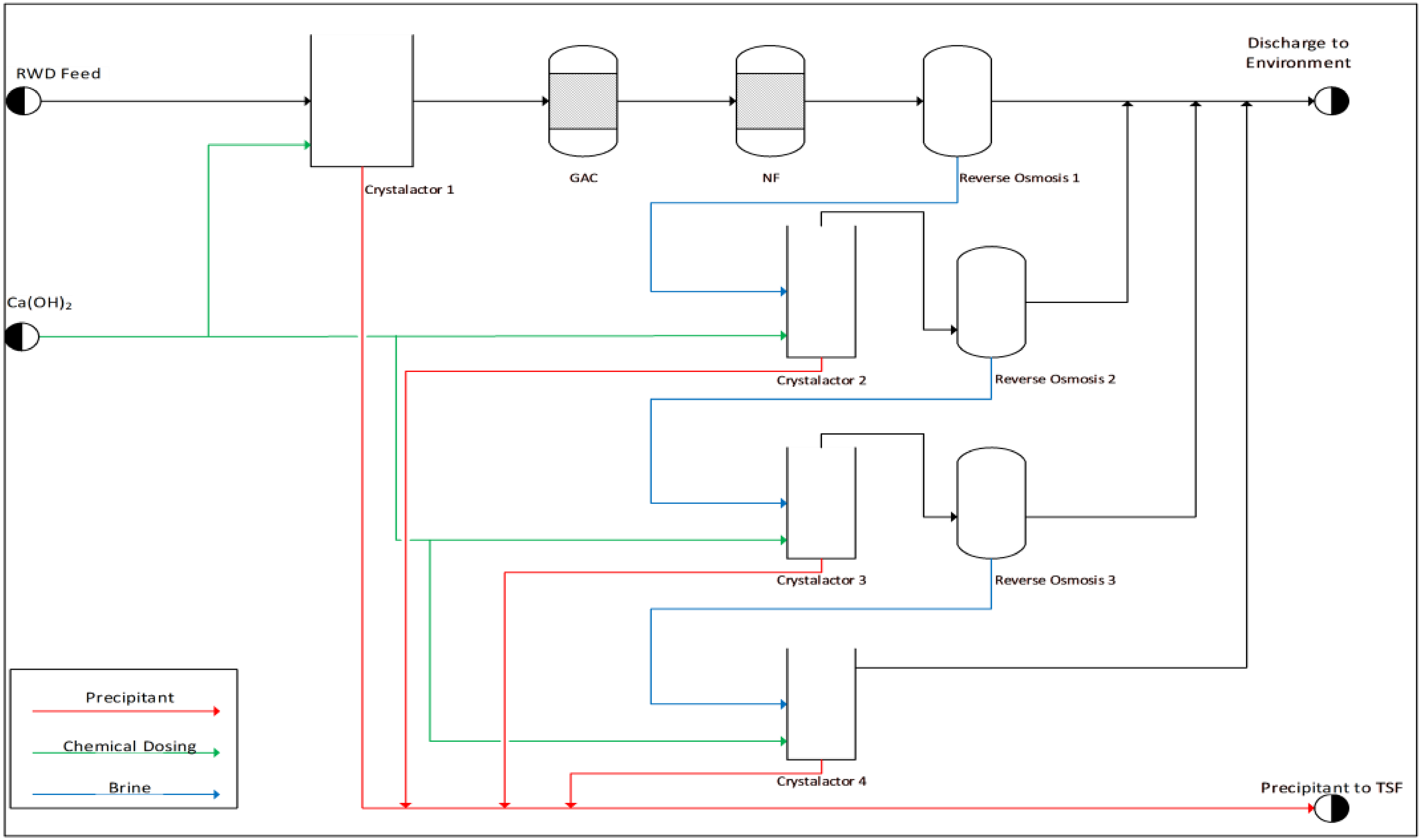

Figure 5-3: Process Flow Diagram of Watercare Mining Treatment Process

5.2.6 Preferred Pipeline Routes (Kloof Mining Right area only)

Existing mine servitudes will be utilised as far as possible for the overland piping. The following pipeline routes are relevant to this application (refer to Plan 9 and Table 5-4 for routes and lengths):

- Slurry pipeline from the CPP to the RTSF;
- Water pipeline from the RWD to the AWTF; and
- Water pipeline from the AWTF to the discharge point on the Leeuspruit.

The total pipeline route length for Kloof is 19 868 m. The pipeline routes have been developed to take cognisance of the existing servitudes, the location of the TSFs and the locations of the proposed infrastructure, such as the CPP, RTSF and thickeners. In addition, sensitive environments have been taking into consideration, as well as mine owned land and already disturbed areas. The overall pipeline route alternatives that were considered are provided in Plan 10.

The pipelines have been designed according to the appropriate pipe stress ranges and hydraulic grade lines. All pipelines within 100 m of the delineated wetlands will be supported on reclaimed railway sleepers placed at 9 m intervals and the pipeline will not contain any flanges for the full length of the wetland crossing. A continuous HDPE internal liner will be included. The pipelines will be supported on *in situ* cast concrete support with foundations 50 m before and after river crossings. In addition, the pipelines will be fitted with inspection points which consist of a welded port with plug on the pipe wall which penetrates the pipeline wall but not the HDPE internal line; should the internal liner be damaged, the inspection point will let through liquid to indicate a the liner has been damaged.

Table 5-4: Pipeline Route Lengths

Name	Length (m)	Type
CPP to RTSF	17 908	Slurry Pipeline
RWD to AWTF	1 960	Water Pipeline
AWTF to discharge	1 000	Water Pipeline

5.2.7 Transmission Lines

Transmission lines will be constructed to convey electricity from the existing Kloof 1 substation to the CPP (3 405 m) and from Kloof 4 substation to the RTSF / AWTF (12 893 m). The design specifications of these lines are still underway but currently the switch gear will be 132 kV and the transmission lines either 6.6 or 11 kV to the CPP.

5.2.8 Pump Stations

Pump stations or booster pump stations will be constructed to convey water and slurry as required.

Plan 9: Kloof Mining Right Area Pipelines

Plan 10: WRTRP Pipeline Routes Alternatives

6 Item 3(e): Policy and Legislative Context

This section (Table 6-1 and Table 6-2), although also applicable to the Ultimate WRTRP, relates specifically to the Kloof Mining Right in the context of this EIA Report. It aims to provide a description of the policy and legislative context within which the project is being proposed. This section has been divided into national, provincial and local legislation and policies, plans, guidelines and development planning frameworks and tools.

Table 6-1: Relevant National Legislation

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>The Constitution of the Republic of South Africa, 1996 (Act No. 108 of 1996)</u> Under Section 24 of the Constitution of the Republic of South Africa, it is clearly stated that: *Everyone has the right to (a) an environment that is not harmful to their health or well-being; and (b) to have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that -* *(i) Prevent pollution and ecological degradation;* *(ii) Promote conservation; and* *(iii) Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development.*	An EIA process is being undertaken to determine the impacts associated with the project. As part of the EIA process, mitigation measures and monitoring plans have been recommended to ensure that any potential impacts are managed to acceptable levels to support the rights as enshrined in the Constitution.
<u>National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA) and EIA Regulations (December 2014)</u> The National Environmental Management Act, 1998 (Act No 107 of 1998) (NEMA), as amended was set in place in accordance with Section 24 of the Constitution of the Republic of South Africa. Certain environmental principles under NEMA have to be adhered to, to inform decision making for issues affecting the environment. Section 24 (1)(a) and (b) of NEMA state that: *The potential impact on the environment and socio-economic conditions of activities that require authorisation or permission by law and which may significantly affect the environment, must be considered, investigated and assessed prior to their implementation and reported to the organ of state charged by law with authorizing, permitting, or otherwise allowing the implementation of an activity.* The Environmental Impact Assessment (EIA)	The EIA process has been undertaken in accordance with the principles of Section 2 of NEMA as well as with the EIA 2014 Regulations, promulgated in terms of NEMA. These Listed Notices have been reviewed against the project activities to determine the likely triggers. The listed activities which are potentially triggered under the Listing Notices are provided in Table 5-1. Based on the activities listed, it has been identified that a full EIA process is required for the project. An application for the listed activities has been submitted to the DMR who is the relevant Competent Authority in terms of this application for Environmental Authorisation.

Applicable legislation and guidelines used to compile the report	Reference where applied
Regulations, Government Notice Regulation (GN) R982 were published on 04 December 2014 and promulgated on 08 December 2014 (the EIA 2014 Regulations). Together with the EIA 2014 Regulations, the Minister also published GN R 983 (Listing Notice No. 1), GN 984 (Listing Notice No. 2) and GN R 985 (Listing Notice No. 3) in terms of Sections 24(2) and 24D of the NEMA, as amended.	
<u>GN R. 982 National Environmental Management Act, 1998 (Act No. 107 of 1998): Environmental Impact Assessment Regulations, 2014</u> These three listing notices set out a list of identified activities which may not commence without an Environmental Authorisation from the relevant Competent Authority through one of the following processes: ▪ Regulation GN R. 983 - Listing Notice 1: This listing notice provides a list of various activities which require environmental authorisation and which must follow a basic assessment process. ▪ Regulation GN R. 984 – Listing Notice 2: This listing notice provides a list of various activities which require environmental authorisation and which must follow an environmental impact assessment process. ▪ Regulation GN R. 985 – Listing Notice 3: This notice provides a list of various environmental activities which have been identified by provincial governmental bodies which if undertaken within the stipulated provincial boundaries will require environmental authorisation. The basic assessment process will need to be followed.	Refer to Table 5-1 above for the listed activities which could potentially be triggered by the proposed project.
<u>National Water Act, 1998 (Act No. 36 of 1998) (NWA)</u> The National Water Act, 1998 (Act No. 36 of 1998) (NWA) provides for the sustainable and equitable use and protection of water resources. It is founded on the principle that the National Government has overall responsibility for and authority over water resource management, including the equitable allocation and beneficial use of water in the public interest, and that a person can only be entitled to use water if the use is permissible under the NWA.	An Integrated Water Use Licence Application (IWULA) and Integrated Water and Waste Management Plan (IWWMP) has been compiled and submitted to the Department of Water and Sanitation (DWS) as the decision making authority. The water uses triggered under Section 21 of the NWA in relation to the proposed project are listed below: ▪ S21(c) – Impeding or diverting

Applicable legislation and guidelines used to compile the report	Reference where applied
GN R704 National Water Act, 1998 (Act No. 36 of 1998) Regulations 4 and 5 of the regulation on use of water for mining and related activities aimed at the protection of water resources, Government Notice Regulation 704 (GN R No. 704) published in June 1999, states the following: ▪ Regulation 4: No residue deposit, reservoir or dam may be located within the 1:100 year flood line, or less than a horizontal distance of 100 m from the nearest watercourse. Furthermore, person(s) may not dispose of any substance that may cause water pollution. ▪ Regulation 5: No person(s) may use substances for the construction of a dam or impoundment if that substance will cause water pollution. ▪ Regulation 6 is concerned with the capacity requirements of clean and dirty water systems, while Regulation 7 details the requirements necessary for the protection of water resources.	the flow of water in a watercourse; ▪ S21 (g) – Disposing of waste in a manner which may detrimentally impact on a water resource; ▪ S21 (i) – Altering the bed, banks, course or characteristics of a watercourse; ▪ S21 (j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.
Mineral and Petroleum Resource Development Act. 2002 (Act No. 28 of 2002) (MPRDA) A Mining Right Application (MRA) submitted to the Department of Mineral Resources (DMR) in terms of the Mineral and Petroleum Resources Act, 2002 (Act No.28 of 2002) (MPRDA) must be succeeded by various documents including a Scoping Report, EIA Report and an EMP. The MPRDA requires that mining companies assess the socio-economic impacts of their activities from start to closure and beyond. Companies must develop and implement a comprehensive Social and Labour Plan (SLP) to promote socio-economic development in their host communities and to prevent or lessen negative social impacts.	This EIA Report, which relates specifically to the Kloof Mining Right (although it is generally applicable to the WRTRP as a whole) has been compiled in accordance with the MPRDA read with the EIA 2014 Regulations.
National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) The National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) (NEM:BA) regulates the management and conservation of the biodiversity of South Africa within the framework provided under NEMA. This Act also regulates the protection of species and ecosystems that require national protection and also	As part of this project, a flora, fauna, wetlands and aquatic assessment has been undertaken to determine the current status of the environment and to determine any potential ecological sensitivities to be avoided and/or mitigated. There are currently no applications

Applicable legislation and guidelines used to compile the report	Reference where applied
takes into account the management of alien and invasive species. This Act works in accordance to the framework set under NEMA. The following regulations which have been promulgated in terms of the NEM:BA are also of relevance: ▪ Alien and Invasive Species Lists, 2014 published (GN R599 in GG 37886 of 1 August 2014) ; ▪ National Environmental Management: Biodiversity Act, 2004: Threatened and Protected Species Regulations; ▪ National list of Ecosystems Threatened and in need of Protection under Section 52(1) (a) of the Biodiversity Act (GG 34809, GN 1002, 9 December 2011).	submitted in terms of NEM:BA for the project.
<u>National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM:AQA)</u> According to the National Environmental Management: Air Quality Act, 2004 (Act No. 39 of 2004) (NEM: AQA) the Department of Environmental Affairs (DEA), the provincial environmental departments and local authorities (district and local municipalities) are separately and jointly responsible for the implementation and enforcement of various aspects of NEM: AQA. A fundamental aspect of the new approach to the air quality regulation, as reflected in the NEM: AQA is the establishment of National Ambient Air Quality Standards (NAAQS) (GN R 1210 of 2009). These standards provide the goals for air quality management plans and also provide the benchmark by which the effectiveness of these management plans is measured.	An Air Quality Assessment has been undertaken to determine the baseline conditions of the air prior to the implementation of the proposed activities at the CPP and RTSF and respective TSFs. The project activities will be set out to abide by the NEM: AQA and standards set out in the National Ambient Air Quality Standards. The required measures have been included in the EMPr. An Atmospheric Emissions Licence has been applied for in terms of Section 21 of the NEM:AQA. The following activities have been applied for: ▪ Category 4, sub-category 4.16: Production of acid; ▪ Category 4, subcategory 4.17: Gold processing; and ▪ Category 7, sub-category 7.2: Production of acids.

Applicable legislation and guidelines used to compile the report	Reference where applied
<u>National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)</u> The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) is the overarching legislation that protects and regulates the management of heritage resources in South Africa. The Act requires that Heritage Resources Agency's in this case the South African Heritage Resources Agency (SAHRA) and Gauteng Provincial Heritage Resources Authority (PHRA-G), be notified as early as possible of any developments that may exceed certain minimum thresholds. This act is enforced through the National Heritage Regulations GN R 548 (2000).	A Notice of Intent to Develop (NID) has been submitted, as part of this report, to the PHRA-G and the South African Heritage Resources. Furthermore, a Heritage Impact Assessment (HIA) has also been undertaken.
<u>The Provincial Heritage Resources Authority Gauteng (PHRA-G)</u> The Provincial Heritage Resources Authority Gauteng (PHRA-G) is responsible for the identification, conservation and management of heritage resources throughout the province. The Agency was established in terms of the NHRA.	An HIA has been undertaken in respect of these regulations to determine whether a permit will be required as a result of the proposed activities.
<u>Environmental Conservation Act, 1989 (ECA), (Act No. 73 of 1989) - National Noise Control Regulations, GN R.154 (10 January 1992)</u> These regulations make provision for guidelines pertaining to noise control and measurements. The regulations make reference to the use of the South African National Standards 10103:2008 (SANS) guidelines for the Measurement and Rating of Environmental Noise with Respect to Land Use, Health, and Annoyance and to Speech Communication. The National Environmental Management: Air Quality Act, 2004 (Act No 39 of 2004) also provides for noise control.	A Noise Impact Assessment has been undertaken as part of the EIA process to understand the potential impacts as a result of the proposed activities to be undertaken.

Table 6-2: Local By-Laws

Applicable legislation and guidelines used to compile the report	Reference where applied
Spatial Planning and Land Use Management Act, 2013 (Act No 16 of 2013) (SPLUMA) SPLUMA is a framework act for all spatial planning and land use management legislation in South Africa and came into force on 1 July 2015. Municipalities will as a result of the new legislation be solely responsible for processing and dealing with land use applications and the appeals relating thereto. Municipalities will have 5 years from commencement of the Act to adopt and approve a single land use scheme for all of its municipal area. The land use scheme must include appropriate categories of land use zoning and regulations for the entire municipal area, including areas not previously subject to a land use scheme. Rezoning will be required for land that was previously excluded from town planning schemes and zoned as "undetermined".	This Act will be relevant in terms of the required re-zoning applications related to this project. Mining companies will have to rezone mine property to comply with any new land use scheme of the Municipality, which would have an implication on rates and taxes after rezoning. Notwithstanding that land was previously zoned as mining land (such as Kloof), it may fall within a new land use scheme once this is developed by the municipality.

7 Item 3(f): Need and Desirability of the Proposed Activities

The objectives of the WRTRP is to reprocess historical TSFs to economically recover gold, uranium and sulfur, while implementing concurrent rehabilitation of their footprints for long term sustainability. By removing the existing historical TSF liabilities located on ecologically sensitive dolomitic structures, sulfur and uranium constituents will reduce significantly and will consequently reduce any future pollution potential and acid mine drainage, as well as eliminate residual cyanide trapped in the historical TSFs. In addition, the reclamation of up to 13 historical and current TSFs throughout the project area and the deposition of the residual tailings on the RTSF will reduce the footprint of mining on the landscape, freeing in excess of 300 ha of land. The following benefits are envisioned as a result of the implementation of the WRTRP:

- During construction, capital investment into the WRTRP will generate a total of R26.48 billion of new business sales that will translate into R9.89 billion in GDP-R, at 2015 prices, as well as creating a total of 54 049 full time equivalent (FTE) man-years. Of these, approximately three quarters will be created through production and consumption induced impacts. Households will earn R4.25 billion (2015 prices) in income over the Initial Implementation construction period (Appendix C);
- The operational phase will span the period between 2018 and 2034, during which the historical TSFs will be reclaimed. This will generate sales to the value in excess of R40 billion at 2015 prices. Through the direct and multiplier effects, the mine will stimulate the creation of new business sales to the value of approximately R72 billion that will translate into R36.8 billion of value added in 2015 prices. On average, R6.5

billion of production output, and associated R4.6 billion of GDP-R will be created on an annual basis (Appendix C). This will in turn create and sustain 53 820 employment opportunities throughout the country, of which 7 683 jobs will be sustained at the mine itself (Appendix C). The total income earned by all households benefiting from the WRTRP operation, directly or through multiplier effects, will be approximately R7 billion in 2015 prices. In addition, operations of the mine will increase export earnings for South Africa and boost government revenue to the value of R5 billion (2015 prices) (Appendix C);

- Protection of sensitive dolomitic aquifers and water resources through:
  - The removal of the historical TSFs, currently located on the dolomites.
  - The deposition of the reclaimed and reprocessed tailings onto the RTSF, which is to be constructed on impermeable bedrock, away from sensitive dolomitic areas.
- Removal of impacts associated with existing historical gold tailings facilities by reducing sulfur and uranium concentrations. The reduction in sulfur concentrations will in turn lower the risk of Acid Mine Drainage (AMD);
- Reduction of health risk to surrounding communities by addressing persistent dust fallout from TSF's spread over a vast area, into a single well-managed best practice designed RTSF;
- Release of valuable land under the historical TSFs for residential, commercial, and agricultural needs. The final land uses of the TSF footprints will be determined based on a Closure Plan for the respective Mining Right areas;
- Treatment of currently impacted water with the proposed AWTF, which could potentially provide potable water for domestic and agricultural users, mitigating existing shortages.

The baseline environment for the project area indicates impacted and modified environments due to the land uses within the landscape, namely mining, agriculture and residential. These land uses have impacted and will continue to impact on the surrounding environment. The respective specialist studies have assessed the continued impacts of the existing land uses on the baseline environment, or the no-go option. The continued impacts on the aquatic habitats and wetlands due to the current land uses are considered to be medium-high to high. Although construction and operational impacts are likely to occur as a result of the WRTRP, there will be long term positive impacts as pollution sources will be removed, impacted wetlands from the CPP and RTSF will be offset, and treated water will be discharged into the Leeuspruit, diluting the poor water quality. The discharge of 15 Mℓ/day of treated water into the Leeuspruit have positive impacts for downstream water uses in terms of both water quality and water quantity.

7.1 Kloof Specific Components

The activities and infrastructure associated with the Kloof Mining Right area, as well as the activities associated with the remaining Mining Right areas, are critical for the success of the WRTRP. The WRTRP requires the implementation of all of the proposed activities associated with each Mining Right area; should one aspect of the proposed WRTRP not be approved, the WRTRP would not go ahead. To realise the need and desirability of the WRTRP, the activities associated with the Kloof Mining Right area are required as discussed below.

7.1.1 RTSF

The existing TSFs to be reclaimed currently reside on sensitive dolomitic areas which may be potentially impacted by seepage and runoff from these TSFs. Furthermore, the remnant radioactive materials contained within the TSFs may pose a health risk to surrounding communities.

The RTSF, on the contrary, will be constructed on bedrock with low permeability and away from the dolomitic areas which, in turn, will decrease potential impacts on the underground water resources in the area.

In addition, due to the incorporation of the CPP, reclaimed tailings destined to report to the RTSF will have reduced sulfur and uranium concentrations, resulting in the reduction of AMD potential, as well as a decrease in the risk of radioactive exposure to the surrounding communities and environment alike. The WRDM IDP (2015/2016) has expressed concern over the threats from mining on land uses, water quality and air quality which leads to impacts on human health. The reclamation of up to 13 historical and current TSFs and the deposition onto the RTSF, with reduced sulfur and uranium concentrations, will aid in reducing the significance and extent of such impacts on the environment, aligning with the IDP for the district.

7.1.2 CPP

In conjunction with the gold extraction process, the CPP will remove substantial amounts of sulfur and uranium from the reclaimed slurry before being pumped onto the RTSF. The CPP will also ensure that the cyanide used during the gold extraction process is minimised before the slurry reports to the RTSF. The CPP is critical for the extraction of gold and uranium and, thus, the feasibility of the project, as well as reducing the cyanide and sulfur content in the residual tailings which will reduce the significance of the impacts on the surrounding environment.

7.1.3 AWTF

The AWTF will treat process water from the RTSF to SANS 241:2011 drinking water standards and the treated water will be discharged into the Leeuspruit. This will potentially improve the current ecological status of the Leeuspruit and associated catchment due to an increase of water quantity that is of an acceptable water quality. In addition, the treatment of the process water to potable standards (SANS 241:2011) enables the water to be utilised by surrounding communities. The WRDM Environmental Management Framework (EMF) (2010) and IDP (2015/2016) outlines that the District is experiencing immense pressure in terms of water availability and quality for the region, as well as the impacts on water quality that may impact on human health.

The development and operation of the AWTF will significantly reduce impacts on water resources in the region; mine affected water will be used during the reclamation of the TSFs and transport of the slurry resulting in reduced volumes of mine affected water reporting to the catchment. This mine affected water will be treated to potable standards (SANS 241:2011), improving the water quality and increasing the quantity of water available that is an adequate standard, as well as being discharged into the Leeuspruit, potentially improving the water quality of the Leeuspruit. Approximately 15 Mℓ/day of treated water will be discharged into the Leeuspruit, increasing the water quantity and volume of water available for downstream, users. The AWTF is likely to ease the existing pressure on the WRDM regarding water quality and quantity.

8 Item 3(g): Motivation for the Preferred Development Footprint within the approved Site including a full Description of the Process followed to reach the Proposed Development Footprint within the approved site

8.1 Item 3(g)(i): Details of the Development Footprint Alternatives Considered

With reference to the site plan provided as Plan 4 and the location of the individual activities on site, alternatives were considered for the infrastructure relevant to the Kloof Mining Right area. The criteria used to assess the alternatives include:

- the property on which or location where it is proposed to undertake the activity;
- the type of activity to be undertaken;
- the design or layout of the activity;
- the technology to be used in the activity;
- the operational aspects of the activity; and
- the option of not implementing the activity.

Alternatives in terms of the site location of key infrastructure were limited as SGL prioritised placing infrastructure not only on properties that it owns and/or fell within its current Mining Right areas, but also on properties and servitudes that made economic, environmental and social sense. Furthermore, it was crucial that infrastructure be placed within reasonable distances of the resources (historical TSFs) and the ultimate deposition site at the RTSF.

In addition to the above, a site selection process was undertaken in terms of the placement of the CPP as well as the RTSF. The site selection process considered not only environmental and social aspects, but also sensible economics as mentioned.

8.1.1 RTSF

Two independent, parallel TSF site selection processes were completed by Golder Associates (Golder, 2010) for Rand Uranium’s CUP (Geluksdal TSF Project) and Metago (Metago, 2009) for Gold Fields’ WWP. These processes entailed the selection of a suitable site for a TSF required for the respective proposed projects.

Both processes used environmental, economic and social screening criteria to aid in the selection process. These criteria included:

- Presence of dolomites;
- Urban development;
- Protected areas such as ridges, rivers, wetlands and conservation areas. The Gauteng C-plan data from the GDACE (now GDARD) was used;
- Factors impacting on the economic viability including capex, opex for the reclamation, processing, pumping and deposition of the feed material; and
- Open areas suitable for the required footprint size based on the life of mine tonnage and deposition rates.

Based on the above criteria a shortlist of sites was defined after which environmental and social screening exercises took place. The findings of the screening assessment were used to rank the sites and provide an overall score for each of the sites.

The site selection undertaken by Golder Associates for Rand Uranium, identified the proposed Geluksdal TSF (site 35), for which authorisation was applied and approved by GDARD. As an alternative site, Golder proposed that site 45 North and 45 South be considered. However, the ranking process indicated that sites 33 and 34 would be the most suitable sites, but had already been earmarked by Gold Fields as a potential alternative TSF site in their process and were therefore unavailable to Rand Uranium.

In a parallel site selection process undertaken by Metago for Gold Fields, the social, environmental and economic screening and subsequent ranking determined that sites B2/B3 as well as the Doornpoort TSF contiguous A sites (ultimately selected for the WWP and approved by DEA) were the most economically viable and the preferred sites from an environmental and social perspective. Site B2/B3 was considered as the alternative.

Importantly and fortuitously, the two TSF preferred areas identified by Metago, as B2/B3, overlie areas identified by the Golder Associates site selection process, which they called area 33 and 34. In relation to the WRTRP and the proposed RTSF, these areas represent the proposed area identified for the RTSF.

In summary the two independent processes resulted in the identification of a common area for the construction of a new TSF that could have accommodated the residue from their proposed projects. This site was then considered in respect of the combined larger requirements for the WRTRP for the combination of the two individual projects (Rand Uranium and Gold Fields) and found to be suitable in size and potential and is the preferred site for the proposed RTSF. It should be noted that neither of the original two sites for the CUP and Geluksdal TSF and WWP have the attributes to accommodate the tonnage and deposition rate required by the ultimate WRTRP to cater for all of the historical TSFs within the West Rand. Refer to Plan 7 for the preferred RTSF site, with the alternative sites and site selection process for the WWP and CUP and Geluksdal TSF illustrated in Plan 11.

8.1.2 CPP

A site selection process (premised on its location being central to the resources base of the historical TSFs and being closest to the proposed RTSF) was undertaken by Golder Associates (Golder, 2013) for the CPP (previously referred to as the CTP in the study). A total of 100 candidate site areas were identified, of which 25 candidate sites were in compliance with the site selection criteria and taken forward for further analysis.

After screening the 25 top listed candidate sites, 15 candidate sites remained and were taken forward for assessment by the specialists through a high-level desktop analysis to investigate the social, environmental, regulatory, economic and engineering viability of the sites. The inputs from the specialists collectively resulted in 9 of the 15 candidate sites being fatally flawed. After assessing each site collaboratively including a risk assessment, 4 sites remained as the options for final assessment. The Top Two sites were then identified as the preferred and alternative site respectively. The sites were called Site T2 (Preferred Option) and Site T9 (Alternative). The preferred option Site T2 has been assessed as part of this environmental impact assessment as indicated on Plan 4 and will be taken into the impact assessment phase.

8.1.3 Pipeline Routes

The pipeline routes and supporting infrastructure need to be located where the feed sources, current infrastructure, services and proposed infrastructure including the CPP and RTSF are located. Alternative pipeline routes between the CPP and the RTSF have been identified. The pipeline routes alternatives investigated are included in Plan 10.

Premised on the primary requirement of the pipe routes being selected being the shortest distance between the CPP and the RTSF, alternative routes were considered which capitalised on the following:

- Following existing routes where possible;
- Avoiding identified environmental sensitive areas, predominantly wetland areas;
- Crossing existing impacted land;
- Maximising mine owned land; and
- Assessing the operating costs pertaining to topographical considerations on pumping costs.

The preferred pipeline route was determined using the above criteria and overlaying sensitive areas, such as wetlands, over the proposed routes. The preferred pipeline route has been selected based on the location of current servitudes, the bypassing of Kloof Main Shaft due to the high costs involved with pumping and crossing national roads and the locations and frequency of wetlands.

8.1.4 AWTF

In terms of the AWTF, a desktop trade-off study was conducted by Paterson & Cooke to compare the capital costs, operational costs and total cost of ownership of two options namely:

- Re-using the return water for re-mining; and
- Treating the return water to discharge compliance, using the location at the RWD.

The outcome of the trade-off showed that AWTF option will have a lower life cycle cost in comparison with the return water pumping system for a range of flow rates.

Technology alternatives were considered purely from a “best fit” and cost effective perspective. In terms of the AWTF, there is a wide range of technologies available for the treatment of high salt and heavy metal load mine affected water. For the specific return water dam product by the RTSF, various options regarding the appropriate technology and the business case were considered.

The list below shows a summary of the applicable technologies available for treatment of this water:

- Biological Reduction of heavy metals and sulfates;
- Electrodialysis Reversal Technology;
- Ion Exchange Technology;
- Reverse Osmosis Membrane Technology;
- Electrocoagulation; and
- Freeze Desalination.

Each of the mentioned technologies has their own niche applications, and the respective advantages and disadvantages have been taken into account when the appropriate technology was chosen. The preferred technology is an advanced combination of Crystilactor and Reverse Osmosis.

8.1.5 The Option of Not Implementing the Activity

In terms of the “No-go” option, the primary land uses for the region are mining, agriculture, and in some areas, residential. The proposed location of the RTSF is currently used for agriculture. If not used for mining (the no-go option), possible alternative land uses for the proposed RTSF and associated infrastructure site include commercial agriculture, grazing, or low-cost housing.

Existing/ historical TSFs will remain *in situ* and will continue to impact on the environmental and social landscapes, as per the status quo. In particular are the impacts relating to the surface water quality and PES of the wetlands and aquatic habitats. None of the envisioned benefits (described in Section 7) will come to fruition, such as environmental clean-up, job opportunities, investment into the local and regional economy, treatment of currently impacted water and a reduction in the health impacts posed by the historical TSFs. The existing impacts include:

- Leaching contaminants e.g. uranium and sulfur, into the sensitive dolomitic aquifers;
- Risk to community health and an increased potential for AMD in the Western Basin;
- Further weakening of the West Rand’s economy as mining declines; and
- The AWTF will not be funded which will result in mine affected water not being treated potable standards (SANS 241:2011). This results in water quality resources continuing to be impacted upon by contaminated water, impacting on the receiving environment and downstream water users.

The Kloof Mining Right area houses the primary infrastructure required for the implementation of the WRTRP. If any component of it is not approved the entire project would not proceed.

Plan 11: RTSF Alternatives and Site Selection Process

8.2 Item 3(g)(ii): Details of the Public Participation Process followed

The Public Participation Process (PPP) was developed to ensure compliance with environmental regulatory requirements and to provide Interested and Affected Parties (I&APs) with an opportunity to evaluate the proposed project. During this process stakeholders are able to provide inputs and to receive feedback from the environmental specialists and/or proponent. This section provides an overview of the PPP undertaken and full details thereof are included in the Public Participation (PP) Report under Appendix D.

8.2.1 Stakeholder Identification

To ensure a proper representation of all stakeholders, the following identification methods were utilised to develop a comprehensive stakeholder database:

- Conduct Windeed searches for farm portions in and around the project site to verify land ownership and obtain contact details;
- Use of existing stakeholder databases available from SGL, Digby Wells and Gold Fields;
- Desktop and online research; and
- Stakeholder networking and discussions to source additional stakeholder details.

Stakeholders identified who are effected by or interested in the proposed project were grouped into the following broad categories:

- **Government:** National, Provincial, District and Local Authorities;
- **Parastatals:** Various semi-Government entities;
- **Landowners:** Directly or indirectly affected and adjacent;
- **Land occupiers:** Directly or indirectly affected and adjacent;
- **Communities:** Directly affected and adjacent communities;
- **Agriculture and Water:** Farmers associations and entities responsible for water management and/or regulation;
- **Non-Governmental Organisations (NGOs):** Environmental organisations, community-based organisations; and
- **Business and industry:** small to medium enterprises, mines, industrial and large business organisations.

A detailed description of the various stakeholder categories are provided in further detail in the Public Participation Report and a full list of stakeholders is categorised and included in the stakeholder database.

8.2.1.1 Directly Affected Landowners

The following directly affected landowners have been identified, as per Table 8-1, and included into the stakeholder database.

Table 8-1: Landowners and Properties Directly Affected

Farm	Portion	Registered Landowner
UITVAL 280-IQ	RE	Far West Rand Dolomitic Water Association
UITVAL 280-IQ	8	Far West Rand Dolomitic Water Association
UITVAL 280-IQ	9	Far West Rand Dolomitic Water Association
DOORNKLOOF 350-IQ	5	Far West Rand Dolomitic Water Association
LEEUWPOORT 356-IQ	71	Far West Rand Dolomitic Water Association
LEEUWPOORT 356-IQ	70	Far West Rand Dolomitic Water Association
DOORNKLOOF 350-IQ	RE/6	Mamellong General Trading
DOORNKLOOF 350-IQ	21	Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	RE/1	Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	22	Bergdeel CC
LIBANON OR WITKLEIGAT 283-IQ	RE	Kloof Gold Mining Company Limited (Sibanye)
DRIEFONTEIN 355-IQ	22	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	4	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	10	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	11	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	20	Murray and Roberts Cementation Pty Ltd
DRIEFONTEIN 113-IQ	2	Driefontein Consolidated (Pty) Ltd (Sibanye)

Farm	Portion	Registered Landowner
DRIEFONTEIN 355-IQ	15	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	21	Golden Dries Developments CC
DRIEFONTEIN 355-IQ	5	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	8	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 113-IQ	RE\1	Driefontein Consolidated (Pty) Ltd (Sibanye)
DRIEFONTEIN 355-IQ	R	Driefontein Consolidated (Pty) Ltd (Sibanye)
BLYVOORUITZICHT 116-IQ	6	Driefontein Consolidated (Pty) Ltd (Sibanye)
BLYVOORUITZICHT 116-IQ	7	Driefontein Consolidated (Pty) Ltd (Sibanye)
BLYVOORUITZICHT 116-IQ	24	Blywonder Trust Pty Ltd
BLYVOORUITZICHT 116-IQ	8	Nortjie Elizabeth Margaritha
DOORNKLOOF 350-IQ	4	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	35	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	73	Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	R	Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	13	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	36	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	5	Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	12	Kloof Gold Mining Company Limited (Sibanye)
LEEUDOORN 351-IQ		Kloof Gold Mining Company Limited (Sibanye)
DOORNKLOOF 350-IQ	33	Kloof Gold Mining Company Limited (Sibanye)

Farm	Portion	Registered Landowner
RIETFONTEIN 349-IQ	35	Kloof Gold Mining Company Limited (Sibanye)
LIBANON OR WITKLEIGAT 283-IQ	R	Sibanye Gold Ltd
RIETFONTEIN 349-IQ	41	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	35	Kloof Gold Mining Company Limited (Sibanye)
RIETFONTEIN 349-IQ	73	Kloof Gold Mining Company Limited (Sibanye)
DOORNPOORT 347-IQ	29	Birks Hyram
DOORNPOORT 347-IQ	28	Kloof Gold Mining Company Limited (Sibanye)
DOORNPOORT 347-IQ	11	South Deep (Goldfields)
DOORNPOORT 347-IQ	37	Johannes Leonard Momberg
DOORNPOORT 347-IQ	5	South Deep (Goldfields)
DAVONIA 363-IQ	R	Sibanye Gold Ltd
WILDEBEESTKUIL 360-IQ	1	South Deep (Goldfields)
DOORNPOORT 347-IQ	1	South Deep (Goldfields)
DOORNPOORT 347-IQ	19	South Deep (Goldfields)
DOORNPOORT 347-IQ	18	South Deep (Goldfields)
KALBASFONTEIN 365-IQ	RE/1	South Deep (Goldfields)
CARDOVILLE 364-IQ	11	South Deep (Goldfields)
CARDOVILLE 364-IQ	RE/3	South Deep (Goldfields)
CARDOVILLE 364-IQ	8	South Deep (Goldfields)
KALBASFONTEIN 365-IQ	51	South Deep (Goldfields)

Farm	Portion	Registered Landowner
CARDOVILLE 364-IQ	RE/6	South Deep (Goldfields)
KALBASFONTEIN 365-IQ	50	South Deep (Goldfields)
CARDOVILLE 364-IQ	13	South Deep (Goldfields)
CARDOVILLE 364-IQ	RE/5	South Deep (Goldfields)
SPRINGBOK KRAAL-IQ	1	South Deep (Goldfields)
RIETFONTEIN 349-IQ	12	Sibanye Gold
RIETFONTEIN 349-IQ	31	Unknown
DOORNKLOOF 350-IQ	20	Sibanye Gold
RIETFONTEIN 350-IQ	13	Sibanye Gold
RIETFONTEIN 350-IQ	32	Sibanye Gold

8.2.1.2 Adjacent Landowners

The various adjacent landowners for the project are reflected in Table 8-2 below.

Table 8-2: Adjacent Property Details

Farm	Portion	Registered Landowner
UITVAL 280-IQ	6	Far West Rand Dolomitic Water Association
UITVAL 280-IQ	5	Far West Rand Dolomitic Water Association
UITVAL 280-IQ	4	Far West Rand Dolomitic Water Association
DRIEFONTEIN 355-IQ	23	Corobrik Pty Ltd
BLYVOORUITZICHT 116-IQ	9	Blywonder Trust Pty Ltd
DRIEFONTEIN 355-IQ	28	Eskom Holdings Ltd

Farm	Portion	Registered Landowner
RIETFONTEIN 349-IQ	0	
RIETFONTEIN 349-IQ	7	Sibanye Gold
RIETFONTEIN 349-IQ	14	Sibanye Gold
RIETFONTEIN 349-IQ	21	Sibanye Gold
RIETFONTEIN 349-IQ	25	Sibanye Gold
RIETFONTEIN 349-IQ	47	Sibanye Gold
DOORNKLOOF 350-IQ	74	Sibanye Gold
DOORNPOORT	4	Sibanye Gold
DOORNKLOOF 350-IQ	73	Unknown
DOORNKLOOF 347-IQ	2	Sibanye Gold
RIETFONTEIN 349-IQ	19	Sibanye Gold
RIETFONTEIN 349-IQ	19	Sibanye Gold
RIETFONTEIN 349-IQ	20	Sibanye Gold
RIETFONTEIN 349-IQ	35	Sibanye Gold

8.2.1.3 Authorities

As indicated in Table 8-3, various authorities are listed who have been engaged during the pre-application phase.

Table 8-3: Authorities Engaged

Authority	Representative
Department of Water Affairs and Sanitation (DWS)	Ms Petunia Ramunenyiwa Acting Provincial Head
	Bashan Govender Water Quality Manager
Department of Mineral Resources (DMR)	Dimakatso Ledwaba Acting Regional Manager
	Jimmy Sekgale Assistant Director
	Rudzani Mabogo Assistant Director
	Moleseng Tlaila Assistant Director
Gauteng Department of Agriculture and Rural Development (GDARD)	Jacob Legadima Director - Air Quality Management
	Dan Motaung Deputy Director: EIA
National Department of Environmental Affairs (DEA)	Lucas Mahlangu Deputy Director: Licensing Systems Management
National Nuclear Regulator (NNR)	Patle Mohajane Manager: Naturally Occurring Radioactive Material (NORM)
West Rand District Municipality	Musa Zwane Environment and Green Manager
	Suzan Stoffberg Environmental Specialist

8.2.2 Land Claimants

A request to identify lands over affected farm portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Based on feedback from the Commission, there are land claims on the following properties associated with the Kloof Mining Right area:

- Portion 19 of Gemspost 288 (within the Kloof Mining Right Area south of Venterspost South TSF);

- Portion 15 of Doornfontein 522 (farm portion adjacent to Kloof Mining Right area); and
- Portion 4 of Kalbasfontein 365 (farm portion adjacent to Kloof Mining Right area).

8.2.3 Pre-Consultation with Interested and Affected Parties

A summary of consultation activities is provided in Table 8-4 and provides an overview of the various consultation methods already undertaken as part of the pre-application phase. Consultation with stakeholders was focussed toward one-on-one meetings and focus group meetings with authorities, landowners and NGOs.

Consultation prior to the application submission was aimed at providing stakeholders with an overview of the WRTRP. This was driven by SGL, with support from Digby Wells. One-on-one and focus group meetings were held along with telephonic discussions with invited stakeholders that could not attend. Engagement with the authorities also aimed to obtain an understanding of the regulatory requirements in lieu of the changes promulgated in December 2014. Table 8-4 details activities that formed part of the pre-application phase.

Stakeholders were provided with project information as part of the engagement process which were distributed via email, post and hand delivery or presented at stakeholder meetings. An overview of each are detailed below.

- Positioning document;
- Various notification letters;
- Information pack comprising of a project description document and Invitation letter with registration and comment form and agenda;
- Illustrative Maps;
- Animation showing the reclamation process; and
- Various PowerPoint presentations.

Table 8-4: Summary of PP Activities during the Pre-Application Phase

Activity	Details	Reference in PP Report
Pre-Application Phase		
Identification of stakeholders	Stakeholders, with associated details, were identified by means of Windeed searches, available existing information, stakeholder networking, site visits, and research for the compilation of a database.	**Appendix D** Stakeholder database.
Identification of land claims	A request to identify potential land claims over affected land portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Feedback indicated there are land claims on the following properties associated with the Kloof Mining Right area: Gemspost 288 Ptn 19, Doornfontein 522 Ptn 15 and Kalbasfontein 365 Ptn 4. A response on some of the properties is still outstanding.	**Appendix D** Land claims letters.
Development of information materials	Various material pieces were developed to be used as part of stakeholder meetings and for ad-hoc requests to provide project details.	**Appendix D** Pre-application information materials.

Activity	Details	Reference in PP Report

Stakeholder meetings	Meetings with stakeholders were arranged as one-on-one meetings and focus group meetings. These are listed below:
	▪ One-on-one Authorities Meetings:
	  ▪ Department of Water and Sanitation – 2 and 11 December 2014;
	  ▪ National Nuclear Regulator – 2 December 2014;
	  ▪ Department of Environmental Affairs – 2 December 2014;
	  ▪ Gauteng Department of Agriculture and Rural Development – 3 and 11 December 2014 ;
	  ▪ West Rand District Municipality – 3 December 2014;
	  ▪ Department of Mineral Resources – 10 December 2014; and
	  ▪ Section 80 Committee, West Rand District Municipality (Environmental Portfolio) – 3 February 2015 & 15 April 2015
	▪ Focus Group Meeting with Authorities – 16 April 2015;
	▪ Focus Group Meeting with Landowners – 16 April 2015; and
	▪ Focus Group Meeting with Environmental NGOs – 21 April 2015 .
	A high level overview of the full project was mainly discussed and stakeholder inputs captured. All stakeholder comments have been responded to in the CRR.
		Appendix D
		Comment and Response Report.

8.2.4 Consultation during the Scoping Phase

The aim of consultation during the Scoping Phase was centred on the formal EIA process, proposed specialist impact studies and addressing stakeholder comments already submitted. The Scoping Report was made available for review for a period of 30 days and a combination of Focus Group and Open House meetings were prominent methods to facilitate stakeholder dialogue between the project team and landowners, authorities, NGOs and communities.

The updated Scoping Reports were made available to stakeholders on the Digby Wells website and in public places for a 21 day comment period and notification was distributed to inform stakeholders of its availability. Stakeholders had the opportunity to verify that their comments were captured and also to review responses provided by the project team.

The various PP materials used during the Scoping phase have been included as appendices.

- Background Information Document;
- Newspaper advertisements;
- Site notices;
- Letter with Registration and Comment Form; and
- PowerPoint presentation and poster set.

Table 8-5 details PP activities that will be undertaken as part of the Scoping Phase have been detailed.

Table 8-5: Summary of PP Activities during the Scoping Phase

Activity	Details	Reference in PP Report
Scoping Phase		
Update of stakeholder information	The stakeholder database has been updated with new I&APs who formally register, attend stakeholder meetings or submit comments.	**Appendix D** Stakeholder database.
Distribution announcement materials	A BID, announcement letter with registration and comment form was email and posted to stakeholders on *Tuesday, 1 September 2015*. *An SMS to announce the project was sent to the full database on Tuesday, 1 September 2015.* The Background Information Document was also available on (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/) *Tuesday, 1 September 2015.* The announcement letter also included information of the stakeholder meetings that will be held, where the Scoping Reports will be available for comment and the allowed public comment period.	**Appendix D** BID, letter with registration and comment form.
Placing of advertisements	Advertisements were placed in the following newspapers: ▪ Randfontein Herald (Local Newspaper), Friday 11 September 2015; ▪ Carletonville Herald (Local Newspaper), Thursday, 3 September 2015; and ▪ Roodepoort Record (Local Newspaper), Friday, 4 September 2015.	**Appendix D** Advertisement.
Placing of site notices	Site notices were put up at various places within proposed project site, local libraries and publically accessible venues within close proximity of the project area on *Tuesday, 1 September 2015 – Thursday, 3 September 2015.* These places are:	**Appendix D** Site notice map and placement report.

Activity	Details	Reference in PP Report
Scoping Phase		
	▪ City of Johannesburg Metropolitan Library; ▪ Randfontein Public Library; ▪ Westonaria Public Library; ▪ Toekomsrus Public Library; ▪ Fochville Public Library; ▪ Carletonville Public Library; and ▪ Bekkersdal Public Library. A site notice placement report and map has been developed, indicating the exact locations where site notices were placed, with photos and GPS coordinates.	
Identification of land claims	A request to identify potential land claims over affected land portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Feedback indicated there are land claims on the following properties associated with the Kloof Mining Right area: Gemspost 288 Ptn 19, Doornfontein 522 Ptn 15 and Kalbasfontein 365 Ptn 4. A response on some of the properties is still outstanding.	**Appendix D** Land claims letters.
Announcement of the Scoping Reports	The announcement letter was emailed and posted to the full database on *1 September 2015* to: ▪ Announce availability of the Scoping Reports; ▪ Share information of the Open House meetings; ▪ Where the Scoping Reports will be available for comment; and ▪ Public comment period. The public comment was extended and announcement was done by means of a letter emailed and posted to stakeholders on 15 October 2015.	**Appendix D** Letter to announce availability of Scoping Report

<table>
<tr><th>Activity</th><th>Details</th><th>Reference in PP Report</th></tr>
<tr><th colspan="3">Scoping Phase</th></tr>
<tr><td></td><td>SMSs to notify stakeholders that the Scoping Reports are available for comment and about the public comment period extension was sent to the full database.
The Scoping Reports was available on the Digby Wells website: (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/).
(Public comment period: 15 September to 15 October 2015, extended to 6 November 2015)</td><td></td></tr>
<tr><td>Placement of Scoping Reports</td><td>The Scoping Reports have been made available to stakeholders at the following public places:
▪ City of Johannesburg Metropolitan Library
▪ Randfontein Public Library
▪ Westonaria Public Library
▪ Toekomsrus Public Library
▪ Fochville Public Library
▪ Carletonville Public Library
▪ Bekkersdal Public Library
The Scoping Reports were available on the Digby Wells website (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/) and was available at the various stakeholder meetings.
(Public comment period: 15 September to 15 October 2015, extended to 6 November 2015)</td><td>Appendix D
Placement map.</td></tr>
<tr><td>Focus Group Meetings</td><td>The following Focus Group meetings were held during October and November 2015:</td><td>Appendix D
Comment and Response Report.</td></tr>
</table>

Activity	Details	Reference in PP Report
Scoping Phase		
	▪ Authorities' site visit to key areas of the project was held on Tuesday, 6 October 2015 from 09:00 – 11:00. All the officials met at Lido Sand Works Conference venue and were accompanied from there by SGL and Digby Wells. A route and infrastructure map was also provided. The following authorities attended: DMR, DWS, NNR, WRDM and WLM); ▪ The site visit was followed by the formal Focus Group Meeting from 12:00 – 14:00 at the same venue; ▪ A Focus Group Meeting was held with landowners (occupiers and private) on Tuesday, 6 October from 16:00 – 19:00 at Lido Sand Works Conference venue; ▪ A Focus Group Meeting was held with NGOs and some very technical stakeholders on Tuesday, 13 October 2015 from 10:00 – 12:00 at Oaklands Inn, Randburg; and ▪ A smaller Focus Group with specific landowners (as per their request) close to the Doornpoort farm on 4 November 2015. This meeting was accompanied by SGL, Digby Wells and SLR (consulting engineers).	**Appendix D** PowerPoint Presentation.
Open House Meetings	Two Open House meetings were held with communities and all stakeholders scheduled between 15:00 – 19:00 on the following dates and venues: ▪ Wednesday, 7 October 2015: Westonaria Banquet Hall; and ▪ Thursday, 8 October 2015: Carletonville Community Hall.	**Appendix D** Comment and Response Report.
Announcement of the updated Scoping Reports	Announcement letter of availability of the updated Scoping Reports was emailed and posted to the full database on Tuesday 17 November 2015. *An SMS to notify stakeholders that the updated Scoping Reports are available for comment was sent to the full database on Tuesday, 17 November 2015.*	**Appendix D** Announcement Letter.

Activity	Details	Reference in PP Report
	Scoping Phase	
	These reports were available on (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment-project/). ***(Public comment period: 17 November to 15 December 2015)***	
Placement of updated Scoping Reports	The updated Scoping Reports include the amended CRR, which contains new stakeholder comments and responses, and the inclusion of new PP activities undertaken as part of the Scoping phase. The updated Scoping Reports were available on the Digby Wells website (www.digbywells.com/en/public-documents/sibanye-gold-west-rand-tailings-retreatment -project).	N/A
Focus Group Meetings	It is anticipated that various Focus Group Meetings will be held. Stakeholders will be informed of the various meetings via email and telephonic discussions. Additional methods of informing stakeholders of the meetings will be considered and implemented.	**Appendix D** Comment and Response Report
Open House Meetings	Two Open House Meetings will be held with all stakeholders, and specifically so communities, scheduled between 15:00 – 18:00 as follow: ▪ Wednesday, 17 February 2016: Westonaria Banquet Hall; and ▪ Thursday, 18 February 2016: Carletonville Community Hall.	**Appendix D** Comment and Response Report
Obtaining comments from stakeholders	Comments, issues and suggestions received from stakeholders will be captured into the Comment and Response Report.	**Appendix D** Comment and Response Report

8.2.5 Consultation during the Impact Assessment Phase

It is anticipated that the PP process to be implemented for the Impact Assessment phase will be similar to the process commenced for the Scoping phase. The premise of activities is to ensure that the various legislative requirements for PP are met and that a single, integrated process is followed. This will limit stakeholder fatigue and ensure that stakeholders are presented with a single view of the full project and EIA information.

8.3 Item 3(g)(iii): Summary of Issues Raised by I&APs

This section provides a summary of the I&AP comments that have arisen from the PPP thus far. The CRR summary is provided in Table 8-6 to Table 8-8.

Table 8-6: Interested and Affected Parties

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
Landowners, Lawful occupier/s of the land, Landowners or lawful occupiers on adjacent properties					
Nicci Simpson *Landowner*	Yes	25 March 2015, 17 April 2015	It is requested that more effort be made to inform landowners for the attendance of stakeholder meetings, specifically previously disadvantaged farmers. The Public Participation process must also be managed in a more transparent manner.	A fair amount of landowners have already been identified either interested in or affected by the proposed project, and since the formal EIA process is only aimed to start in September 2015, we are continuing our efforts to identify more landowners by means of various channels. Also, adverts will be placed as part of the formal EIA process. Please feel free to provide details of specific landowners you would want us to include as part of the process.	Not yet finalised and under investigation
Peet Bornman, Jaco Taute *Landowners*	Yes	16 April 2015	When the west wind blows the whole area is white with dust and trucks do not always water for dust suppression. Breathing in the dust causes health issues.	With dedicated mitigation measure in place, dust emission will be reduced drastically, hence lowering exposure to repairable fractions that result in health problems-this material is likely sourced from the historical dams which are planned to be removed. The newly planned RTSF will be concurrently rehabilitated.	Not yet finalised and under investigation
Piet Rheeder, Armand de Villiers *Landowners*	Yes	16 April 2015	Pollution of groundwater and surface sources, specifically the Leeuspruit, is a concern. This will also disturb the water balance of our water.	Any water discharged into the Leeuspruit, will be treated to SANS 241 drinking standards and will enhance the quality therein. These guidelines are very stringent, so therefore, any water discharged will be of a benefit as it will serve to promote dilution, of the current water quality of the Leeuspruit.	Not yet finalised and under investigation
Peet Bornman, Piet Rheeder *Landowners*	Yes	16 April 2015	The Regional Tailings Storage Facility (RTSF) will have a negative impact on surrounding area, specifically from a visual point of view.	A Visual Impact Assessment was undertaken and assesses the significance of the visual impacts to the surrounding landscape. Mitigation measures have been provided in the EMP to mitigate such visual impacts. Please refer to the photomontages in Section 9.4 of the Topography and Visual Impact Assessment Report for an illustration of the potential future views of the RTSF and other project infrastructure.	Not yet finalised and under investigation
Dre Schalekamp, Nicci Simpson *Landowners*	Yes	16 April 2015	Why pollute new agricultural land? Other Tailings Storage Facilities (TSFs) can be used. Sibanye need to do what is good for the community.	This project is attempting to combine the proposed Geluksdal and West Wits project TSFs into a single deposition site based on request made by the community and the DMR. The historic dumps are not designed to today's best practice standards. Their size	Not yet finalised and under investigation

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
				limits the deposition rates and tonnage storage required to retreat these dumps economically. They do not have adequate pollution prevention measures in place and are a source of pollution to the groundwater aquifers of the dolomites.	
Armand de Villiers *Landowner*	Yes	16 April 2015	Will mined areas be rehabilitated and if so, what are the timelines?	The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years. The final end-land use of these re-mined areas will be dependent on several factors and engagement with all stakeholders is imperative to assist in determining the end-land use and also site specific conditions. The timeframe associated with the rehabilitation of these areas is dependent on several factors, such as the rate of reclamation and current market demands.	Not yet finalised and under investigation
Coetsee Badenhorst, Alf Rudman *Landowners*	Yes	16 April 2015	How will compensation be managed for the project, since no agreements have been put in place yet?	The specialist studies are not directly involved in decisions around the actual buy-out of farms which have to be considered at the appropriate timelines as the project unfolds and meets social, commercial and environmental imperatives.	Not yet finalised and under investigation
Barry van Wyk, Peet Bornman *Landowners*	Yes	16 April 2015	Cattle's meat will be contaminated as a result of the project and people have been very ill as a result of drinking contaminated water.	The impact assessment phase has evaluated the current groundwater quality at various farm boreholes. Representative boreholes were collected for water quality evaluation and the laboratory result is available for anyone interested. The potential impact during and after the mine operation have also been predicted. Please refer to the groundwater EIA report for details.	Not yet finalised and under investigation
Sarel Cilliers, Barry van Wyk *Landowners*	Yes	16 April 2015	We are not in support of the proposed project and object to it strongly. Promises are being made and nothing is delivered. Our environment and lives are destroyed because of the mines.	Thank you for the comment. The legislative process will allow all stakeholders to raise their grievances.	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Hermann Heunis *Landowner*	Yes	4 September 2015	The National Water Act stipulates that water pollution should be avoided by all possible reasonable humane methods. Assessments done in the past show that this principle cannot be guaranteed.	All developments impact water to some degree however the EIA regulations read with the National Water Act provide for the assessment of those impacts and necessary mitigations and then the regulator can make a balanced and informed decision about the project.	
Dre Schalekamp *Landowner* Thabang Frans Ramogodi *Senwes LTD*	Yes	15 October 2015, 6 November 2015	The affected land is being used to produce maize and this land will be next to the TSF.	The SIA and Economic Impact Assessment (EIA) addresses the impact on land uses from the perspective of (a) increased access to land following the retreatment of tailings, and (b) alternative end-land uses post mine closure (see also Section 11.6 and Section 11.10 of the SIA, as well as the EIA specialist study	
Jacobus van Wyk *Landowner* Mr & Mrs Rudman *Landowners*	Yes	6 October 2015, 12 October 2015	My farm's water will be contaminated. There will also be air pollution due to the dust and we will inhale the dust. There will also be an visual impact and our property prices will drop.	The Groundwater Impact Assessment has modelled the potential contamination plume and draw down impacts associated with the RTSF and blast curtain. In addition, an Air Quality Impact Assessment modelled potential dust fallout, PM2.5 and PM10 emissions. Please refer to Sections 8.3 and 9.2 of the Topography and Visual Impact Assessment Report. The viewshed areas of the CPP and RTSF were split into categories expected to experience different levels of visual exposure. These categories are as follows. CPP: 0 - 1.5 km Potential High Visual Exposure, 1.5 - 3 km Potential Moderate Visual Exposure and 3 - 4 km Potential Low Visual Exposure. RTSF: 0 -5 km Potentially High Visual Exposure, 5 - 9 km Potentially Moderate Visual Exposure and 9 - 12 km Potentially Low Visual Exposure. Plans 13, 15 and 16 of the Topography and Visual Impact Assessment Report indicate the practical viewshed models of the CPP, RTSF and Kloof MRA. The above impacts have also been detailed in the EIA report, with the mitigation measures provided.	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Kriszanne Lehman *Landowner* F.R.J de Bruyn *Landowner* Jean Coetzer & Maria Coetzer *Landowner*	Yes	28 September 2015, November 2015	The pollution will affect my and my family's health negatively.	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Alida Potgieter *Landowner* Sarel Cilliers *Landowner* Andre Burger *Landowner* Dorothy de Bruyn *Landowner*	Yes	6 October 2015, 1 & 6 November 2015	As land value is impacted by surrounding mine dams, land should be bought out entirely at a competitive rate to ensure owner can replace farm somewhere else without financial loss.	The purchasing of properties is dependent on various aspects, one of which is SGL receiving a licence to operate. Should the project proceed, the acquisition of properties will take place on case-by-case basis if applicable.	
Paul da Cruz *Landowner*	Yes	13 October 2015	The proposed pipeline will also negatively affect the current and future value of my property thereby having a financial impact on the investment I have made in the property and improving it.	The impact of the infrastructure proposed on individual land value will have to be assessed once the necessary environmental and company approvals for the project are obtained.	
Dr J.A Olivier *Landowner*	Yes	4 November 2015	There needs to be a balance between the economics and impact an environment for this project; there needs to be a compromise between the stakeholders involved.	SGL concurs.	
Nicci Simpson *Landowner* Dr J.A Olivier *Landowner* Alf Rudman *Landowner*	Yes	6 October 2015, 4 November 2015	Why can't the RTSF be built more north of the Doornpoort TSF?	The West Wits project EIA provided a site selection process and Gold Fields also submitted an application for another TSF. DMR said what a single TSF must be developed for the area. The proposed TSF will need to accommodate 4 million tonnes of tailings per month. The proposed Gold Fields TSF could only accommodate 2,75 million tonnes of tailings per month and West Wits 0,75 million tonnes of tailings per month - this was established through the 2 EIA studies undertaken. If was identified that the preferred area for the RTSF falls between the West Wits area and Gold	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	Consulted				
				Fields area, but unfortunately 2 separate sites can't be used for the RTSF.	
H.N Thorold, Adriaan and Lanet and Susan and Jaco Taute, Victor Siqongana, Pulane Malebo, Shanique Marais, Patricia August *Landowners / Occupiers*	Yes	5 November 2015	Do not build the dump and the plant.	Under the constitution a developer has the right to put forward any project proposal for regulatory approval and which meet legislative requirements.	
H.N Thorold, Adriaan and Lanet and Susan and Jaco Taute, Victor Siqongana, Pulane Malebo, Shanique Marais, Patricia August *Landowners / Occupiers*	Yes	5 November 2015	The impacts can be managed by keeping existing plant at Waterpan or Westonaria.	This is the most suitable area for the RTSF in terms of greatest final capacity and the rate of deposition required. Two independent site selection processes looked at a 50 km radius of the district and both homed into this area.	
Kimberly Gietzmann *Landowner*	Yes	6 November 2015	Increase of theft because mines do not control access to their properties and do not give advanced notice.	Your comment is noted. Safety and security concerns are endemic to the region and the country, and needs a collective and collaborative approach to root out.	
Pierre Ludick on behalf of Dr J.A Olivier *Landowner*	Yes	15 December 2015	My communication refers: As I am in contention to the proposed dump of Sibanye to be placed in Kalbasfontein, I am therefore insisting on the services of an independent specialist to be despatched to assist the community, and where I am instructing that the services of this specialist environmentalist to be paid for by Sibanye, as it is Sibanye who is wanting to place the dump in our area that we do not want. It is unacceptable to me that the community should be expected to be paying for such services and where it is insisted upon that all studies be reinitiated, with nothing being carried over from the Geluksdal project, but to begin afresh. Your immediate and urgent response is required.	With regard to your request that we consider the appointment an independent consultant at our own expense, we point out that if payment is made to such a consultant, he could not be regarded as any more independent than our existing consultants who are currently lending us advice. Regrettably, therefore, we are unable to accede to your request.	
Municipal councillor					

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
Clr Vincent Mfazi *West Rand District Municipality, Section 80 Committee*	Yes	3 February 2015	The reclamation process uses water, but Acid Mine Drainage (AMD) is a concern and will be used as part of the process.	Government funds with regard to AMD are largely targeted at legacy or abandoned areas. The WRTRP will use impacted water from current operations No inter connected mine activities exist between the western and far western basins.	Not yet finalised and under investigation
Clr Roy Harris *West Rand District Municipality, Section 80 Committee*	Yes	3 February 2015	Is this similar to what is done by Mintails? Radioactivity is a concern because it remains well after reclamation and rehabilitation took place. The rehabilitated land might not be suitable for agriculture because it remains radioactive.	Similar to what is done at DRD Gold. Final rehabilitation of the reclaimed TSF footprint has to achieve standards set by the NNR for end land use Working with specialists to cut into surface and take out radioactive material to understand feasibility at this stage.	
Clr Vincent Mfazi *West Rand District Municipality, Section 80 Committee*	Yes	3 December 2014, 15 April 2015	The clay structure will collapse during the reclamation process and new chemical structures will be formed which can be harmful to people and the environment. How will the particulates be prevented from floating into the air once the clay structure is destroyed?	The reclamation is a waterborne process. The slurry will be processed through a number of chemical processes before going to the RTSF. The resultant tailings will undergo a very specific geochemical analysis as part of the specialist impact studies to ensure that the chemical components of the process is understood in detail once the elements in the tailings are exposed to the various processes. The specialists addressing the geochemical analysis and doing the design of the RTSF are highly specialized. Collection of samples from a composite and individual sample of the TSFs to be treated and analysis thereof after metallurgical test work has been done over the last six months in order to understand all the elements including the clay structures. Air quality modelling will be used and integrated with the geochemical findings in order to prescribe mitigation measures to be included in the EMP.	Not yet finalised and under investigation
Municipality					
Susan Stoffberg *West Rand District Municipality,*	Yes	3 December 2014	What are the potential land uses that can be considered? This will assist the West Rand District Municipality for future development and associated planning.	The post closure land uses of the TSFs that will be mined will be based on inputs from various sectors of local society - ongoing interaction with the relevant Section 80 committees will assist in integrating planning.	Not yet finalised and under investigation
Olivia Calderia	Yes	15 April 2015	There are a lot of health issues because of the amount	Dust and PM_{10} monitoring is in place already to assess	Not yet finalised and

<table>
<tr><th colspan="2">Interested and Affected Parties</th><th rowspan="2">Date of comments received</th><th rowspan="2">Issues raised</th><th rowspan="2">EAPs response to issues as mandated by the applicant</th><th rowspan="2">Consultation Status (consensus dispute, not finalised, etc.)</th></tr>
<tr><th>Name of Individual</th><th>Consulted</th></tr>
<tr><td>West Rand District Municipality, Section 80 Committee</td><td></td><td></td><td>of dust and this is an issue/concern. A lot of watering will need to be done.</td><td>current scenario and future impacts associated with those pollutants. A dispersion model will be run during the EIA phase, after which mitigation measures will be recommended to curtail potential impacts. Mitigation measures will be put in place to curtail dust i.e. concurrent covering and vegetation of tailings slopes, application of dust suppressants on mine dirt road – water, dust-a-side etc. Suitable quality water will be available.</td><td>under investigation</td></tr>
<tr><td>Tokky Mosolo
Westonaria Local Municipality</td><td>Yes</td><td>16 April 2015</td><td>Ad hoc projects for community development originating from other mining houses in the area are underway and a consolidated Social and Labour Plan (SLP) for the area and the project should be developed (incorporating other mining houses in the area).</td><td>The SLPs must be tied to a mining right issued by the DMR.SGL is attempting to consolidate these as the legislation requires them to be separate.</td><td>Not yet finalised and under investigation</td></tr>
<tr><td>Joyce Kethwa
Westonaria Municipality</td><td>Yes</td><td>2 October 2015</td><td>There will be a lot of dust and people will contract diseases like cholera and TB. Also we will have a lot of earth tremors where maybe houses will be affected e.g. cracks and broken windows.</td><td>One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.</td><td></td></tr>
<tr><td>Charles Stevens
West Rand District Municipality</td><td>Yes</td><td>6 October 2015</td><td>What are the closure objectives and what will be the land use be used for? This must be determined at the planning phase. Also, what is the future use of the RTSF considering post-closure?</td><td>The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years.</td><td></td></tr>
<tr><td colspan="6">Organisations of state (Responsible for Infrastructure that may be affected Roads Department, Eskom, Telkom, DWA etc.)</td></tr>
<tr><td>Will be consulted during the Scoping and EIA phases.</td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Communities</td></tr>
<tr><td>Lucas Misapitso
Interested Community Member</td><td>Yes</td><td>21 April 2015</td><td>Some of the communities are irresponsible and uses AMD water to irrigate crops and are also using sludge to manufacture bricks. It is a huge problem and a</td><td>The DMR Regional Strategy was considered during the compilation of the rehabilitation report and the plan compiled is aligned with these objectives. This will</td><td>Not yet finalised and under investigation</td></tr>
</table>

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
			health risk. Communities need to be educated and mitigation measures put in place.	ensure that all the proposed mitigation measures are implemented accurately to minimize any residual impacts. The reclamation process will ensure controlled exposure of the material to air and water and contained within the existing foot print of the TSF.	
Lucas Misapitso *Interested Community Member*	Yes	21 April 2015	Which mitigation strategies will Sibanye use to reduce the radiation levels? The Westrand already has high level of radiation.	The remaining footprint after reclamation is the biggest challenge, but the needed closure and rehabilitation plans will be developed in collaboration with the relevant competent authorities. This will also include end land use which will be considered as part of the social studies to be undertaken. One of the reasons the project is being undertaken is to remove the latent radiation found in these tailings facilities. This will reduce the risk and exposure for communities. NNR approvals for the project require assessments to be done for workers and public in and around the TSFs to be reclaimed.	Not yet finalised and under investigation
Ezekiel Khunou *Bekkersdal Care for the Aged* Tefo Hlasa *Batho Pele Community Development Centre* Sylvia Maguma *Sizabantu HBC*	Yes	25 September 2015, 7 October 2015	The project might impact me in terms of health. The dust can have negative impact to the community especially our elderly whom their immune system is vulnerable to many for opportunistic diseases.	Thank you for your comment. One of the key objectives of the ultimate project is to re-mine and thus physically remove the tailings dams as sources of potential dust pollution. Any potential impacts resulting from the hydraulic re-mining and construction processes, will be investigated during the EIA process, and if needed, appropriate mitigation measures will be put in place to mitigate these impacts.	
Bongani Jonas *MACU*	Yes	28 September 2015	During such reclamation processes at dams near informal dwellers, they are automatically affected or infected from the acid mining drainage e.g. cattle drink water from a polluted dam.	Surface and groundwater specialist studies have been undertaken to determine environmental impacts and the results thereof, together with mitigation measures, are available to the public and stakeholders.	
Siphiwe Radebe *SANCO*	Yes	7 October 2015	When demolishing the old TSFs, dust will be a concern for nearby communities, because there will be chemicals used. Are any mitigation measure put in place for that?	The reclamation of TSFs uses only water and dust doesn't get created as part of the process. No chemicals are included.	
Moatlhodi Molefe *Wira Coordinator*	Yes	7 October 2015	There is exclusion and not sufficient communication which leads to the community not being informed properly.	The Public Participation process provides opportunity to communities to partake in the process in order to gain a better understanding of the project and EIA	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				process. No stakeholders are excluded from the process and can partake freely.	
Thabsile Vilakazi *Batho Pele Community Development Centre* Sibusiso Khumalo *SANCO* Makhotso Lekopa *Ward Committee secretary ward 18*	Yes	7 & 8 October 2015	What is the benefit for the community?	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	
Ebrahim Dithagiso *Hillshaven Homeowners Association* Sibongile Doreen Kati *Twelve Star Co-operative* Siphiwe Radebe *SANCO*	Yes	27 September 2015, 6 & 7 October-2015	First it will affect us because the project will change the nature of this place the dust will affect the community which will cause people to be ill and easily affected by TB.	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Tebogo Makolwane *SANCO* Londi Tembe *Poortjie Community*	Yes	7 & 8 October 2015	It will impact me positive if I would be a beneficiary from the project, even though it might also leave after effects in terms on health and environmental due to air pollution, which might affect my community.	Thank you for your comment. The SIA makes recommendations to maximise project benefits for affected communities. The SLP will also commit to implement community projects based on the priorities of the municipality. See also Section 11.5 and 11.8 of the SIA.	
Norman Ngqaqu *Merafong Disability Forum* Clement Mokoma *Ward 18 Ward Committee BEE*	Yes	8 October 2015	Why are the Councilors not here?	The various Councilors were invited, but it is understood that they are on recess and not able to attend.	
Clement Mokoma *Ward 18 Ward Committee BEE*	Yes	8 October 2015	How/what will the communities benefit out of this proposed project in terms of jobs?	Approximately 2000 jobs opportunities will be available during the construction phase and approximately 500	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Annah Tshoagong *Aganang Centre* Tebogo Makolwane *SANCO*				permanent positions thereafter.	
Mosimanegape Mathiba *Matre-Faith Trading and Projects*	Yes	18 November 2015	The polluted air and water affects people, animals, farmers and plants.	Model predictions show that impacts are minimal and within compliance. Please refer to the relevant specialist' studies and sections in the draft EIA Report.	
Busisiwa Ronose *Westonaria Concerned Residents*	Yes	14 December 2015	The tailings dam must concentrate accordingly in order to avoid the contaminants that have been disposed in the tailings dam from affecting the environment.	Mitigation measures have been provided in the EIA report for the operation of the RTSF to mitigate and prevent potential impacts to the surrounding environment. Water runoff, seepage and contamination plumes and erosion of tailings material through wind have all been identified as potential to result in environmental impacts. The mitigation measures are provided in the EIA report.	
Traditional Leaders					
No traditional leaders are involved in the project.					
Department of Land Affairs					
Nomvuzo Mjadu *Department of Agriculture, Forestry and Fisheries*	Yes	15 December 2015	The pipeline routes traverse watercourses and there will be 25 watercourses crossing:- • Are there no any other routes away from the 25 rivers, to mitigate the chances of spillage or pipeline bursts and leakages into the watercourses?		
Department of Environmental Affairs					
Lucas Mahlangu *Department of Environmental Affairs*	Yes	2 December 2014	For listed activities it needs to be ensured that the correct department or level is consulted.	Noted - however we understand that at the present these interactions will be channelled through the DMR.	Not yet finalised and under investigation
Majalele Pholudi *Department of Environmental Affairs*	Yes	16 April 2015	Environmental liability is important; who will be held responsible?	A closure costing estimate was undertaken as part of the EIA process and will be approved by the DMR and it will be Sibanye Gold's responsibility to provide sufficient funds to undertake rehabilitation prior to approval of the project.	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
Other Competent Authorities Affected					
Victor Nkuna, Portia Chawane, Bashan Govender *Department of Water and Sanitation*	Yes	2, 11 December 2014, 4 June 2015	How will water use be managed or treated and where will water be sourced from used for reclamation?	The removal of historic dumps on dolomite as part of the tailings reclamation is expected to improve the water quality by removing the sources of contamination. The geochemistry of the proposed RTSF has been conducted and the seepage rate has been calculated. Appropriate monitoring and management plans will be implemented at each site that is being reclaimed.	Not yet finalised and under investigation
Patle Mahonjane *National Nuclear Regulator*	Yes	2 December 2014	A radiation protection function needs to be integrated as part of the EIA and associated processes.	The EIA process as well as a public and worker assessment is required to be carried out for approval of the NNR which will require monitoring and reporting. Sibanye have a dedicated radiation protection team that will work on the WRTRP.	Not yet finalised and under investigation
Mwinsa Mpundu *National Nuclear Regulator* Rina Taviv, Christopher Rakuambo *Gauteng Department of Agriculture and Rural Development*	Yes	2, 3 December 2014	Are there other options for the project? For example decentralised plants, rather expanding the existing ones e.g. Geluksdal Central Tailings Storage Facility (CTSF)?	The technical viability of the processes to be employed for gold, uranium and sulphur are the result of extensive metallurgical test work, based on this outcome the position of all the components of the necessary infrastructure are then subjected to alternatives in terms of location and are presented for scrutiny as part of the EIA process.	Not yet finalised and under investigation
Moleseng Tlaka *Department of Mineral Resources*	Yes	10 December 2014	Will the RTSF be able to accommodate all the tailings facilities in the area and will it be jointly owned by Sibanye Gold and Gold Fields?	The RTSF will be able to accommodate SGL and other TSFs in the area to a total of 1.3 billion tonnes.	Not yet finalised and under investigation
Bashan Govender *Department of Water and Sanitation*	Yes	11 December 2014	The Department of Water and Sanitation look to address issues coming from underground/surface water AMD experienced currently.	The water management will be integrated with the technology and recovery will be the focus for the area. Water migrating to groundwater resources will be reduced and it is aimed to close shafts and mines where required. For the WRTRP the use of Rand Water will be replaced with treatment of existing water resources to be used as part of the reclamation process. It is also envisaged that municipality(s) will be assisted with the management of their water.	Not yet finalised and under investigation
Dan Motaung *Gauteng Department of*	Yes	11 December 2014, 4 June 2015	Concern is that the new area is in a rural setting used for farming and this will be removing agricultural land in	The historical TSF sites will be removed, making previously unusable land available. The potential	Not yet finalised and under investigation

Interested and Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Consultation Status (consensus dispute, not finalised, etc.)**
Name of Individual	**Consulted**				
Agriculture and Rural Development Marius Keet *Department of Water and Sanitation*			Gauteng.	impact of the RTSF on the surface and groundwater has been evaluated and mitigations methods have been proposed. With the implementation of the proposed mitigations techniques, the impact can be reduced to minimum. Please refer to the Surface and Groundwater reports for details.	
Bashan Govender *Department of Water and Sanitation* Rudzani Mabogo *Department of Mineral Resources*	Yes	11 December 2014, 16 April 2015	Close consideration must be given to the liner option or rather how to go about securing that water does not leak into the underground water resources e.g. High Density Polyethylene (HDPE) liner	It is likely that lining a facility of this size will make the project economically unfeasible however a number of options are being explored.	Not yet finalised and under investigation
Eric Mulibana, *Gauteng Department of Agriculture and Rural Development* Portia Chawane, Victor Nkuna *Department of Water and Sanitation*	Yes	2 December 2014,16 April 2015	Where will the water to be used for reclamation be sourced from? It is proposed that existing mine water for the reclamation process.	The water will be sourced from existing impacted water from underground operations at the Kloof, and Cooke shafts. Currently 35 Mℓ/day is discharged from the Kloof 10 shaft, into the Wonderfonteinspruit, and 20 Ml/d from Cooke under licence. The first phase (1.5Mt/m) of this project will take 30 Ml/d of that for hydraulic reclamation and once it has gone through the process, it will be treated through an advanced water treatment facility (AWTF) at the toe of the RTSF. The treated water will either be discharged to the Leeuwspruit or can be supplied to nearby communities. It is not likely that there will be a significant impact on downstream users where water is being discharged into the Wonderfonteinspruit.	Not yet finalised and under investigation
Wilcot Speelman *National Nuclear Regulator*	Yes	16 April 2015	Clarity on the full project needs to be provided, not just phase one. The WRTRP must be well thought through considering that it will be a 25 year project sot that potential negative impacts do not become a reality in the future and is irreparable.	The project will be presented as a whole to demonstrate long term viability with authorisation being sought for initial implementation.	Not yet finalised and under investigation
Dan Motaung *Gauteng Department of Agriculture and Rural Development*	Yes	16 April 2015	How will rehabilitation for the project and RTSF be managed?	Consideration of alternate are a requirement for all sites proposed in the WRTRP. The specific rehabilitation measures for the RTSF and historic facilities will be addressed within the rehabilitation plan that will compiled including appropriate re-vegetation	Not yet finalised and under investigation

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	**Consulted**				
				techniques and post rehabilitation monitoring.	
Marius Keet *Department of Water and Sanitation*	Yes	4 June 2015	Sibanye can potentially assist in supplying water to people in the broader region.	Sibanye is more than willing to engage with the Department on these matters.	Not yet finalised and under investigation
Rudzani Mabogo *Department of Mineral Resources*	Yes	6 October 2015	It is important to ensure that the RTSF will be accessible to all companies in the area, large or small, busy with reclamation to deposit tailings.	Other miming companies in the area will have access for deposition and the necessary arrangements will have to be negotiated and put into place.	
Bashan Govender *Department of Water and Sanitation*	Yes	6 October 2015	Will the RTSF be lined?	Various options are being investigated currently.	
Bashan Govender *Department of Water and Sanitation*	Yes	6 October 2015	Does SGL have the needed allocated and dedicated funds should a pipe burst? Also, are the required emergency processes in place for such an event?	Yes, SGL does have the required funds allocated and associated health & safety plans in place in order to address pipeline emergencies.	
Elmond Lekota *National Nuclear Regulator*	Yes	6 October 2015	The pipeline infrastructure results in a lot of stream and wetland crossings; you must have alternatives and it must be environmentally viable and cost effective.	Thank you for your comment, all the necessary pipe routes have been assessed in relation to viable alternatives and thus minimising potential risks to the wetlands -these will be assessed during the EIA phase and appropriate mitigation measures recommended.	
Amukezani Shibambo *Department of Water and Sanitation*	Yes	6 October 2015	Has SGL done an analysis, and associated costs, of treatment and discharge of water into the Leeuspruit? It needs to be determined if the treated water can be used for human consumption and not just to discharge into the river.	Yes part of the proposal is to install a AWTF (advanced water treatment facility) to treat the water to the SANS 241 potable water standard, prior to discharge.	
Rudzani Mabogo *Department of Mineral Resources*	Yes	7 October 2015	What other social development benefits will this project be brining to the area?	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as	

Interested and Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Consultation Status (consensus dispute, not finalised, etc.)
Name of Individual	Consulted				
				part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	

Table 8-7: Other Affected Parties

Other Affected Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	Consulted				
Xolani Hlanganyana *Empowering Emotionally Abused Women and Children*	Yes	28 September 2015	Safety precautions need be followed and the community should be alerted in terms of safety.	Risk assessments are conducted for all sections of the proposed plant and suitable mitigations provided especially for safety issues.	
William Mathe *Letsema Agriculture Development Unit*	Yes	28 September 2015	The heritage site is only Donaldson Dam, the stream that supply Donaldson Dam is used by churches to baptise people of various religions.	Please refer to the Water Quality Assessment for further details on the risks associated with continued use of the Donaldson Dam. From a heritage perspective, the loss of ritualistic use of the dam will manifest in the degradation of the intrinsic intangible heritage value. Where continued use is maintained, no impact to the intangible heritage value of the resource is envisaged.	
Thabang Wesi *Great Westonaria Concerned Residents Association P.R.O*	Yes	7 October 2015	Regulators are always backing up the mines. Diseases will occur and people's lives could be in danger if the DMR do not consider who they issue licences to.	All mines need to comply with regulations, which sets out requirements pertaining to health impacts. Should this project proceed, SGL will adhere to these legislative requirements.	
Philip Mofokeng *ANC Treasure Ward 15* Charles Marekwa *Remmogo* Johnson Mdlolo *SANCO*	Yes	7 October 2015	There will be more revenue impact because of job creation and economic upliftment.	Thank you for the comment.	
Heinrich von Wielligh *Corobrik*	Yes	8 October 2015	Will all the required funds be available for rehabilitation?	The intention is to rehabilitate back to a suitable land use, as determined by the LED plans and from community consultation. Some concurrent rehabilitation	

Other Affected Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
				is envisaged with final rehabilitation being completed after removal of the final layer of tailings and will be completed within 2/3 years.	

Table 8-8: Interested Parties

Interested Parties		**Date of comments received**	**Issues raised**	**EAPs response to issues as mandated by the applicant**	**Section and paragraph reference in this report where the issues and/or responses were incorporated**
Name of Individual	**Consulted**				
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	What type of water treatment will be used and how many megalitres will be treated a day?	Chrystalactic/Reverse osmosis process is proposed for the water treatment. Between 10 and 15 megalitres will be treated per day and options for the use thereof is being investigated.	Not yet finalised and under investigation
Emily Taylor *Endangered Wildlife Trust (EWT)*	Yes	21 April 2015	The EWT would like to be involved and assist with information relating to the identification of species, where possible.	Thank you for your comment, the wet and dry season field work studies have been completed and the full species list (both fauna and flora) is in the F&F report heading no.7. EWT did not accompany the team during the dry season site visit due to short time frames. However the report will also be made available to EWT for review.	Not yet finalised and under investigation
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	The DMR's regional mine closure strategies needs to be closely considered and the required closure funds needs to be available. While the FSE is in support of the re-mining of historical tailings storage facilities and reclamation, a precautionary approach needs to be adopted and consideration should be given to risks when determining re-mining, rehabilitation, closure and financial provisions for rehabilitation and closure. The primary objective of regional TSFs and regional mine closure must be to prevent or minimize adverse	The DMR's closure guideline document and Dr Phil Tanner's Report and guideline will be considered in the compilation of rehabilitation plan report. This will ensure that all the proposed mitigation measures are implemented accurately to minimize any residual impacts. The reclamation process will ensure controlled exposure of the material to air and water and contained within the existing foot print of the TSF. The closure provision fund will be put in place and managed according to legal requirements which provides for assessing these aspects.	Not yet finalised and under investigation

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	Consulted				
			long term environmental and socio-economic impacts, and to leave the environment in a state where sustainable development can take place.		
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	21 April 2015	Radiometric surveys over previously reprocessed mine residue deposit footprints have, in some cases, shown elevated levels of residual radioactivity in soils.	This is a valuable comment and will definitely be taken into account. It is understood that the land use can only be determined once the historical TSFs are removed. The radioactive material and impact on the underlying soils will vary for each footprint; therefore the end land use potentials will be different.	Not yet finalised and under investigation
Mariette Liefferink *Federation for a Sustainable Environment* Judith Taylor *Earthlife Africa* Bashan Govender *Department of Water and Sanitation*	Yes	21 April 2015, 4 June 2015	Social and economic benefits are very important and communities need to benefit, and not just in terms of jobs, but benefits must be applicable to communities over the long term. They need to be involved to ensure short to long term benefits that are sustainable.	The Project will give preference to local employment for both temporary and permanent employment of suitably skilled people, as well as for local procurement. The SLP of the Project will provide details of required skills and associated local employment opportunities. These results will provide an indication to candidate employees opportunities in order to better equip themselves. The SLP makes provision for skills development and internships. The SIA recommends that project training programmes are extended to include members of the local communities. Local economic development projects will be implemented as part of the SLP. See also Section 11.1 to 11.4 and 11.13 of the SIA report.	Not yet finalised and under investigation
Elise Tempelhoff *Media24*	Yes	6 October 2015	How will SGL ensure that dust won't affect the area negatively?	One of the key objectives of the ultimate project is to re-mine and thus physically remove the historical sources of dust i.e. TSFs. Predicted impacts on ambient air quality resulting from the hydraulic re-mining and construction processes are minimal (see Section 8.1). It is worth mentioning that mitigation measures in place will further reduce anticipated impacts.	
Thabang Wesi *Great Westonaria Concerned Residents Association P.R.O*	Yes	7 October 2015	Have SGL worked with the communities in terms of grooming them for potential employment opportunities?	SGL is in the process to identify the various requirements for employment and will incorporate the SIA specialist study findings and recommendations.	
Mariette Liefferink *Federation for a Sustainable*	Yes	13 October 2015	The impact assessment ratings and associated definitions utilised for the EIA studies needs to be	Sibanye Gold trusts that Digby Wells, as the independent and competent EAP, will apply the latest	

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
Environment			reconsidered, since this will influence the mitigation measures to be developed and implemented.	definitions and ratings to the impact assessments.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	13 October 2015	As part of the Geluksdal project it was proposed that alternative sites need to be identified. One of the very strong suggestions was to deposit on Gold Fields' site which is land already mined. May I ask why that was not perused? My understanding is that Gold Fields are comfortable to investigate this option whereby liabilities and responsibilities can be co-owned.	The Gold Fields site has not been considered, due to the total deposition tonnages required.	
Judith Taylor *Earthlife Africa*	Yes	13 October 2015	Impacts from dust are significant and so does the effect thereof on people - they are getting very sick in areas such as Welkom and Riverlea.	The hydraulic mining is not a dust generating process. However, the proposed hydraulic reclamation of the historical TSFs will result in the permanent removal of these sources, resulting in an environment that is within compliance.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	22 October 2015	Demonstrate that the end or post-mining (sequential) land use with associated use of other resources connected with such sequential land use, for example water use, is viable and will result in a self-sustaining ecosystem and communities.	Sustainable closure plans with adequate funding are a requirement of the EIA process with final closure to be assessed and refined in conjunction with relevant stakeholders at the time of closure.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	22 October 2015	Plough some of the value from the reprocessing operations back into the rehabilitation of the entire mining area. It must be accepted that the reprocessing of some mining residues will never be economically viable and that these will need to be transported to the RTSF, if this is not too costly or rehabilitated in situ.	Adequate financial provision (which is reviewed annually by the competent authority) is made for the entire mining impacted area.	
Mariette Liefferink *Federation for a Sustainable Environment*	Yes	4 November 2015	The FSE recommends that the risks pertaining to radon, stay on or in close proximity to contaminated land and/or unauthorised entry to mine sites be investigated and mitigation measures proposed.	This is an important aspect to consider with respect to land use. Appropriate mitigation measures will be provided within the soils report and the rehabilitation plan, as the level of contamination will determine the potential land use and what remedial action is required.	
Jaco Taute and Carl van Heerden *Landowners, NFMD*	Yes	14 December 2015	We as the NFMD (No for Mega Dump) Forum representing the Community (farmers, business owners and residential area). Attached find signed petition forms (29 forms and 793 signatories_ and a letter from	Your petition is noted and will be submitted to the DMR along with the final EIA.	

Interested Parties		Date of comments received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and/or responses were incorporated
Name of Individual	**Consulted**				
			Tom McGhee our Consulting Geologist.		
Tom McGhee *Independent Consultant*	Yes	14 December 2015	With this project having a lifespan of over 30 years, it is apparent that both the area of the existing dumps and the area of the proposed RTSF as well as a large area on either side of the proposed pipelines will be under threat during this period with no benefits to existing communities. I seriously urge you to reconsider your proposal.	The project will be undertaken in stages and the benefits of removing the dumps from the landscape will materialise as soon as the reclamation starts. Please refer to our mitigation measures in the EIA and let us know if there are any gaps that you can identify.	

9 Item 3(g)(iv): The Environmental Attributes Associated with the Development Footprint Alternatives

This section describes the baseline environmental conditions prior to the proposed project commencing. Furthermore, this section also contains a description of the current land uses and specific environmental features relevant to the project area.

9.1 Baseline Environment

9.1.1 Air Quality

The Air Quality Impact Assessment report is attached as Appendix E.

9.1.1.1 Climate

Ambient air quality in this region of South Africa is strongly influenced by regional atmospheric movements, together with local climatic and meteorological conditions. The most important of these atmospheric movement routes are the direct transport towards the Indian Ocean and the recirculation over the sub-continents.

The country experiences distinct weather patterns in summer and winter that affect the dispersal of pollutants in the atmosphere. In summer, unstable atmospheric conditions result in mixing of the atmosphere and rapid dispersion of pollutants. Summer rainfall also aids in removing pollutants through wet deposition. In contrast, winter is characterised by atmospheric stability caused by a persistent high pressure system over South Africa. This dominant high pressure system results in subsidence, causing clear skies and a pronounced temperature inversion over the Highveld. This inversion layer traps the pollutants in the lower atmosphere, which results in reduced dispersion and a poorer ambient air quality. Preston-Whyte and Tyson (1988) describe the atmospheric conditions in the winter months as highly unfavourable for the dispersion of atmospheric pollutants.

Site specific MM5 modelled meteorological data set for full three calendar years (2012 – 2014) was obtained from the Lakes Environmental Consultants in Canada to determine local prevailing weather conditions. This dataset consists of surface data, as well as upper air meteorological data that is required to run the dispersion model.

Modelled meteorological data for the period January 2012 to December 2014 was obtained for a point in the proposed project area near Westonaria (26.317775°S, 27.650683° E).

9.1.1.2 Wind

Dispersion of atmospheric pollutants is a function of the prevailing wind characteristics at any site. The vertical dispersion of pollution is largely a function of the wind field. The wind speed determines both the distance of downward transport and the rate of dilution of pollutants. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness.

The amount of particulate matter generated by wind is highly dependent upon the wind speed. Below the wind speed threshold for a specific particle type, no particulate matter is liberated, while above the threshold, particulate matter liberation tends to increase with the wind speed. The amount of particulate matter generated by wind is also dependent on the material's surface properties. This includes whether the material is crusted, the amount of non-erodible particles and the particle size distribution of the material.

The spatial and annual variability in the wind field for the West Rand area calculated from the modelled data is clearly evident in Figure 9-1. The predominant winds are coming from north northeast and north with an average wind speed of 3.86 m/s. Wind class frequency distribution per sector (wind direction) is given in Figure 9-2 and Table 9-1.

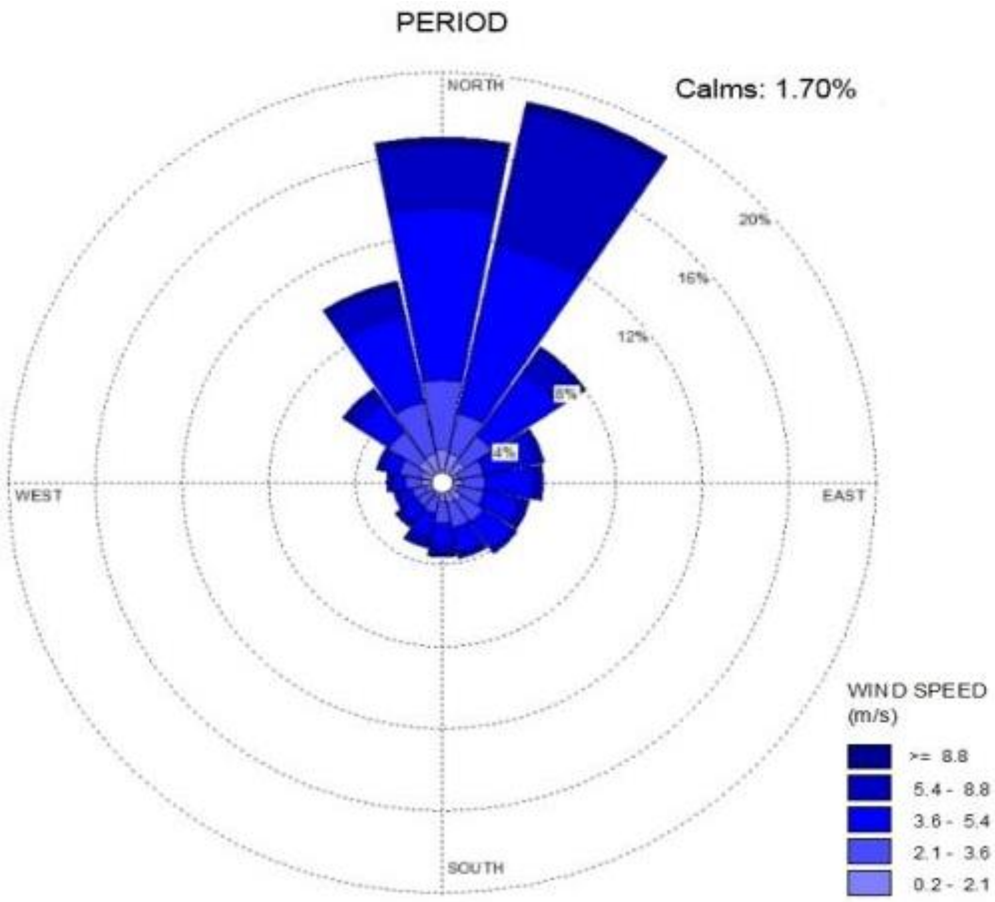

Figure 9-1: Surface Wind Rose for Sibanye Project Area

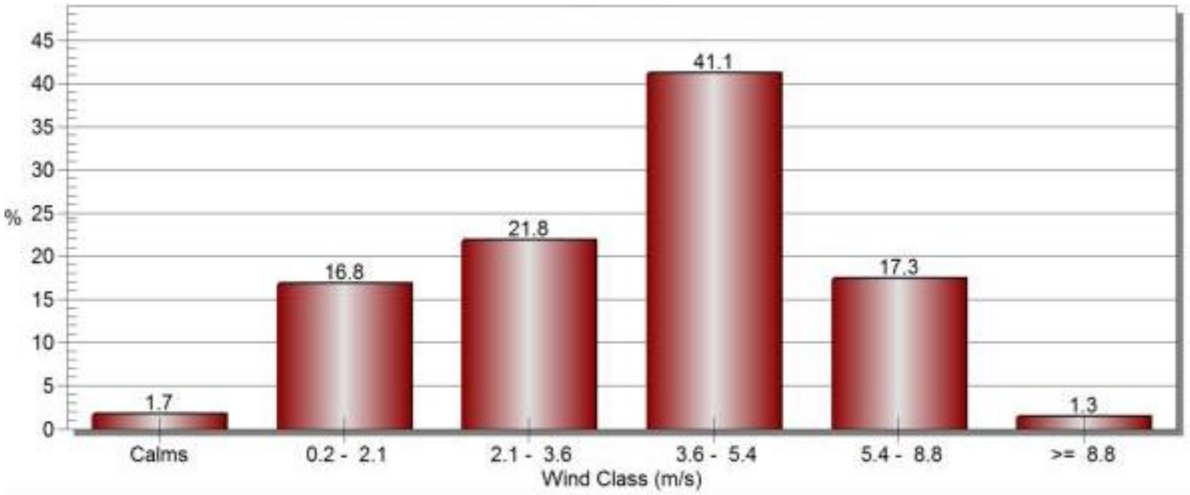

Figure 9-2: Wind Class Frequency Distribution

Table 9-1: Wind Class Frequency Distribution per Direction

No.	Directions	0.2 -2.1	2.1 -3.6	3.6 -5.4	5.4 -8.8	>= 8.8	Total (%)
1	N	1.6	3.4	8.4	3.1	0.4	16.8
2	NNE	1.5	2.0	8.4	6.6	0.4	18.9
3	NE	1.3	1.5	3.8	1.4	0.1	8.0
4	ENE	0.8	1.2	2.4	0.4	0.0	4.8
5	E	0.9	1.0	2.2	0.5	0.0	4.7
6	ESE	0.8	1.2	1.7	0.4	0.0	4.1
7	SE	1.1	1.2	1.6	0.3	0.0	4.2
8	SSE	1.0	1.2	1.2	0.3	0.0	3.8
9	S	0.9	1.0	1.1	0.5	0.1	3.6
10	SSW	0.7	0.8	1.2	0.5	0.0	3.2
11	SW	0.6	0.8	0.8	0.4	0.0	2.6
12	WSW	0.8	0.7	0.6	0.2	0.0	2.3
13	W	1.0	0.7	0.6	0.2	0.0	2.6
14	WNW	1.0	1.0	0.8	0.3	0.0	3.1
15	NW	1.3	1.6	1.8	0.7	0.1	5.6
16	NNW	1.5	2.5	4.4	1.5	0.2	10.0
Sub-Total		**16.8**	**21.8**	**41.1**	**17.3**	**1.3**	**98.3**
	Calms						1.7
	Missing/Incomplete						0
Total							**100**

9.1.1.3 Temperature

Air temperature is important, both for determining the effect of plume buoyancy (the larger the temperature difference between the plume and the ambient air, the higher the plume is able to rise), and determining the development of the mixing and inversion layers.

The monthly distribution of average daily maximum temperatures indicate that the average midday temperatures for Westonaria range from 16.6°C in June to 26.7°C in January. The region is the coldest during July with temperatures of 0.1°C on average during the night.

9.1.1.4 Relative Humidity

The data in Table 9-2 is representative of the relative humidity for the proposed WRTRP area. The annual maximum, minimum and average relative humidity is given as 66.4%, 61.6% and 63.8%, respectively. The daily maximum relative humidity remains above 60 % for most of the year, and range from 57.9 % in November to 74.2 % in March. The daily minimum relative humidity on the other hand is above 56 % for the whole year, with the highest minimum (67.2 %) observed in June and the lowest (55.6 %) occurring in November.

Table 9-2: Monthly Average Relative Humidity Values

Relative Humidity (%)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly Maximum	67.1	65.6	74.2	63.3	64.0	72.2	69.9	67.7	67.7	64.0	57.9	63.8	66.4
Monthly Minimum	62.1	60.9	60.6	62.5	61.5	67.2	63.0	63.6	61.8	60.8	55.6	59.1	61.6
Monthly Average	64.5	63.1	66.5	62.8	62.6	69.1	66.7	65.2	64.1	62.0	56.5	62.2	63.8

9.1.1.5 Precipitation

As shown in Table 9-3, for the three years data considered, the total monthly rainfall (max) and average total monthly rainfall are reported. The annual totals, maximum and average of 1 065 mm and 591 mm are reported.

Table 9-3: Total Monthly and Average Precipitation Values

Precipitation (mm)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Total Monthly Rainfall (Maximum)	204.2	115.1	70.9	46.2	6.9	4.1	0.5	8.6	53.1	178.3	148.6	228.1	1065
Average Total Monthly Rainfall	122.0	64.1	35.8	25.1	2.6	1.4	0.3	5.8	19.2	72.9	99.1	142.5	591

9.1.1.6 Evaporation

As shown in Table 9-4, the annual averages for maximum, minimum and mean monthly evaporation rates for Westonaria area are 263 mm, 113 mm and 178 mm, respectively. The highest monthly maximum evaporation (322 mm) occurred in October. The rate decreases to the lowest in 68 mm in April. The monthly minimum evaporation ranges between 68 mm (April) and 180 mm in October.

Table 9-4: Monthly Evaporation Rates for Westonaria

Evaporation (mm)	January	February	March	April	May	June	July	August	September	October	November	December	Annual
Monthly Max.	289	262	224	190	223	244	257	261	288	322	277	320	263
Monthly Min.	88	120	93	68	79	70	85	111	155	180	178	128	113
Monthly Mean	206	177	171	141	124	109	126	170	224	253	224	212	178

9.1.1.7 Emissions and Particulates

Dust deposition results confirm that the area experiences dust deposition rates that are generally within the recommended residential limit specified by the National Dust Control Regulations (NDCR, 2013). Some sites were observed to be in violation of the recommended frequency of exceedance. At some sites, three or more sequential months are in exceedance, which violates the two permissible and non-sequential months allowed in a year (NDCR, 2013).

Dust deposition rates measured between 2010 and 2013 were compliant at all sites, with the exception of August and September 2010 (two sequential months that exceeded the standard - 600 mg/m^2/day (NDCR, 2013). In 2014, all sites (Venterspost Primary, Manyano Shaft, Ikamva Shaft Thuthukane Shaft, Bekkersdal Community Clinic and Hills Haven) were in violation of the permissible frequency of exceedance (two within a year). These sites exceeded the recommended standard for four sequential months. A detailed dust deposition baseline for the project area is provided as part of the Air Quality Impact Assessment report attached as Appendix E.

9.1.2 Geology

9.1.2.1 Regional Geology

The Karoo Supergroup is underlain by the Transvaal Supergroup, which is preserved in three structural basins. Of these basins, the Transvaal Basin is of consequence here and dates from 2 650 – 290 million years ago (*The Vaalian Erathem*). The Transvaal Supergroup comprises of the Pretoria and Chuniespoort Group formations.

The regional geology based on the 1:250 000 Geological Map 2626 West Rand series suggests that the lithographies are associated with the Pretoria Group. The Pretoria Group comprises of several formations including Rooihoogte, Timeball Hill, Boshoek, Hekpoort, Strubenkop, Daspoort and Silverton. The upper Pretoria Group is approximately 6 – 7 km thick and comprises of predominant mudrock alternating with quartzitic sandstone, significant interbedded basaltic-andesitic lavas and subordinate conglomerate, diamictite and carbonate rocks, all of which have been subject to low-grade metamorphism (Eriksson, Altermann & Hartzer, 2006). This group forms a prominent east-west trending ridges in the vicinity of the WRTRP. Extensive diabase sill intrusions, as characterised by its highly positive magnetic signature in the aeromagnetic survey, is evident as intrusions in the Silverton shale and Timeball Hill siltstone-shale sequences.

The Malmani Subgroup dolomite of the Chuniespoort Group has an inherent stromatolitic nature and has the potential for karst topography to develop. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Dissolution of these soluble Malmani dolomites created voids – karst caves – that filled with fine- to coarse-grained alluvium during periodic flooding. The alluvium may be represented by bodies of breccia, sandstone and siltstone.

The Witwatersrand Supergroup lithostratigraphy dates to 2800 – 2650 Ma. The West Rand Group of the Witwatersrand Supergroup comprise of formations consisting of quartzite, shale and minor / subordinate conglomerate.

9.1.2.2 Local Geology

The geological map of the area indicates that the site is covered with Quaternary age sediment (Plan 12). However, the quaternary sediment was only found partially on site while shale and diabase outcrop are common. Information regarding the local geology of the WRTRP was obtained from percussion-drilled borehole logs for this project and data collected by Golder in 2009. Twenty-eight boreholes from around the vicinity of the proposed development footprint of the RTSF were drilled.

The geological profiles of the boreholes show that the development footprint of the proposed RTSF is underlain (from north to south) by Strubenkop shale, Daspoort quartzite and Silverton shale units. In addition to shales, sills of diabase intrusions were also encountered in some boreholes. No dolomite was encountered in any of the boreholes. The dolomite is expected to be more than 1500 km underneath the proposed RTSF development footprint, based on deep exploration boreholes drilled at the Goldfields TSF site.

In addition to this stratigraphic profile, two north-south striking negative magnetic diabase dykes (Gemsbokfontein No.1 and No.2 dykes), associated with the Pilanesburg tectonic event (approximately 1 300 million years ago) pass approximately 1 km east of the proposed RTSF development footprint area.

Plan 12: Project Area Geology

9.1.3 Groundwater

A Groundwater Impact Assessment was undertaken for the project and included in Appendix F.

9.1.3.1 Aquifer Characteristics

A hydrocensus was undertaken for the project area during February 2015 and June 2015 and focused on a 5 km radius around the proposed RTSF complex footprint. Data from the hydrocensus undertaken in 2012 for the proposed Geluksdal TSF was also utilised.

9.1.3.1.1 Groundwater Levels and Flow Direction

Groundwater levels and flow direction were determined in 181 boreholes located within a 10 km radius of the RTSF complex footprint. The water elevation shows a 99.11% correlation with the topography; groundwater flow mimics the topography and is towards surface water drainage courses as baseflow which is generally northwest to southeast.

9.1.3.1.2 Aquifer Properties

The aquifers underlying the proposed RTSF complex are characterised as low yielding, semi-confined weathered and fractured aquifer systems and comprise the Pretoria Group geology. The water strikes in the aquifers were predominantly below the measured groundwater levels which is indicative of confining groundwater flow conditions. The difference between the groundwater levels and water strikes varied from a couple of centimetres to 52 m. A continuous confining layer appears to be absent and the aquifers underlying the site have been classified as being semi-confined, however.

The groundwater levels and water strikes are detailed in Figure 9-3. The water level in borehole DM5 and 10307-03 are below the water strike levels; this is most likely due to small scale fractures below the major water strike positions through which water seeps away from the boreholes either laterally or vertically.

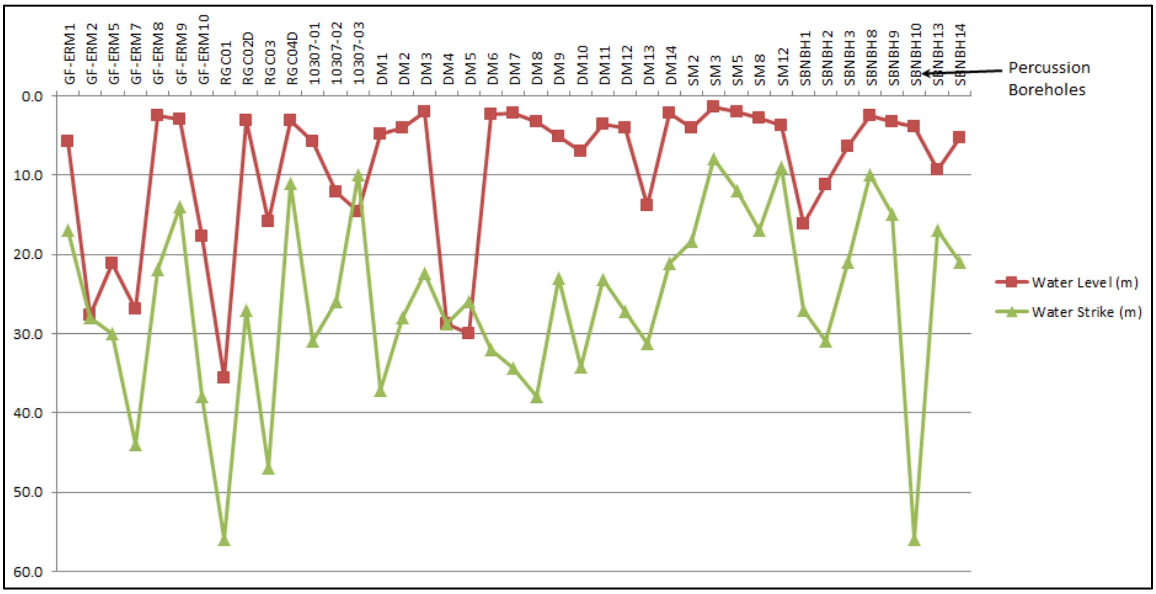

Figure 9-3: Correlation between Groundwater Levels and Water Strikes

9.1.3.1.3 Aquifer Layers and Thickness

The water strikes are encountered at depths between 10 m and 60 m below ground level (mbgl), with the majority of strikes occurring between 20 m and 40 mbgl. Shallow (12 m to 24 m) and deep (70 m) percussion boreholes were drilled by Golder (2009) and indicated that water levels between the shallow and deep boreholes were generally less than 0.1 m. This implies that there is no major head difference between the shallow and deep boreholes which is confirmation that the boreholes intersected the same aquifer.

The water qualities in the shallow and deep boreholes also display the character of recent recharge from rainfall which is consistent with the connectivity between the two sets of boreholes. The connectivity of the two aquifers is also indicated through the aquifer testing whereby pumping of deep boreholes will have an immediate influence on the shallow boreholes.

9.1.3.1.4 Aquifer Permeability

The aquifers underlying the proposed RTSF complex are characterised by low hydraulic conductivity ranging between 0.0002 m per day (borehole SBNBH2) and 0.806 m per day (borehole DM12), with a mean of 0.005 m per day. This indicates that the groundwater flow rate is limited and the contamination plume migration will be limited; the plume will migrate very slowly but high concentrations are expected to remain in the aquifer for long periods of time.

Borehole SNBBH3 had a significantly higher permeability of 4.1 m per day; this is suspected to be a local fracture and is not representative of the project area.

9.1.3.2 Groundwater Use

The groundwater uses within 5 km of the RTSF complex footprint included boreholes for human consumption, livestock watering, agriculture and groundwater monitoring uses. The boreholes identified and their uses are illustrated in Plan 13.

A total of 193 water sources were located within a 5 km radius of the proposed RTSF complex area. Of the identified boreholes, 163 were private boreholes and 28 were monitoring boreholes drilled by SGL. The details of the hydrocensus results are provided in Appendix F and are summarised as follows:

- 24 (12%) boreholes are used for human consumption;
- 29 (15%) boreholes are used for drinking and livestock;
- 5 (3%) boreholes are used for drinking and irrigation;
- 6 (3%) boreholes are used for drinking, livestock and irrigation;
- 11 (6%) boreholes are used for livestock watering only;
- 4 (2%) boreholes are used for irrigation only;
- 28 (15%) boreholes are SGL's monitoring boreholes;
- 68 (35%) boreholes are not used for any purpose; and
- The usage of the remaining 18 (9%) could not be confirmed.

Plan 13: Hydrocensus Boreholes

9.1.3.3 Groundwater Quality

During the hydrocensus, 21 boreholes were sampled to determine the water quality of the groundwater. The groundwater samples were analysed at an accredited SANAS laboratory and the results were compared to the SANS 241:2011 Drinking Water Standards. The results of the water quality are provided in Table 9-5.

All of the boreholes sampled fall within the recommended (Class I) standards for drinking water, with only ammonia and manganese concentrations exceeding the Class I limits for borehole CDVBH2. Borehole CDVBH2 is located in the south-eastern portion of the proposed RTSF complex footprint and the ammonia levels exceeded the Class III limits for drinking water. The borehole has been drilled in a wetland area and it is possible that the elevated ammonia level is a result of the reducing environment created by the wetland, combined with the decomposing organic matter. No other possible pollution sources were identified during the hydrocensus.

Table 9-5: Groundwater Quality Benchmarked Against the SANS 241:2011 Drinking Water Standards

		Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F	Uranium
Class I	**(Recommended)**	**<1000**	**<10**	**<200**	**N/S**	**<400**	**<150**	**<70**	**<200**	**<50**	**<0.2**	**<0.1**	**<150**	**5-9.5**	**<0.3**	**<1**	**<1**	**<0.015 (WHO)**
Class II	(Max. Allowable)	1000-2400	10-20	200-600	N/S	400-600	150-300	70-100	200-400	50-100	0.2-2	0.1-1	150-370	4-5 or 9.5-10	0.3-0.5	1-2	1-1.5	
	Duration	7 years	7 years	7 years	N/S	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	No Limit	1 year	None	1 year	
Class III	(Not recommended)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.5	>2	>1.5	
DM11	2015/01/31	296.00	7.90	9.80	214.00	12.90	41.00	25.00	39.00	3.70	0.01	0.00	48.20	7.90	0.01	-0.10	0.20	-0.004
CDVBH4	2015/01/31	90.00	0.20	2.90	84.00	5.00	9.70	12.00	9.80	3.20	0.03	0.00	17.30	8.20	0.01	-0.10	0.20	-0.004
DGV02	2015/01/31	198.00	4.70	9.50	133.00	9.50	28.00	17.50	21.00	3.60	0.01	0.00	32.70	7.80	0.01	-0.10	0.20	-0.004
CDVBH6	2015/01/31	164.00	1.40	6.20	127.00	6.40	23.00	13.90	19.40	2.00	0.11	0.00	27.00	7.40	0.02	-0.10	0.20	-0.004
CDVBH2	2015/01/31	182.00	-0.10	25.00	167.00	0.50	34.00	14.40	19.80	3.70	0.06	0.15	39.10	7.60	0.01	3.20	0.10	-0.004
COVBH7	2015/01/31	244.00	5.00	26.00	123.00	5.10	34.00	15.10	19.50	2.70	0.04	0.01	36.30	8.00	0.01	-0.10	0.10	0.004
WDBBH1	2015/01/31	54.00	-0.10	3.70	44.00	7.00	4.70	5.20	12.40	1.70	0.01	0.00	10.60	7.10	0.03	-0.10	0.20	-0.004
WDBBH2	2015/01/31	152.00	3.20	5.40	98.00	3.00	19.00	10.70	14.80	0.88	0.05	0.02	24.00	7.50	0.01	-0.10	0.40	-0.004
WDBBH7	2015/01/31	156.00	3.00	2.00	116.00	1.50	21.00	12.50	16.10	1.40	0.00	0.01	25.20	7.60	0.01	-0.10	0.20	-0.004
WDBBH6	2015/01/31	182.00	-0.10	5.00	165.00	1.60	32.00	17.50	11.90	2.30	0.02	0.00	31.40	7.50	0.01	0.20	0.10	-0.004
RTNBH12	2015/01/31	76.00	0.20	1.30	69.00	3.90	5.40	11.90	9.00	1.10	0.04	0.00	14.20	7.40	0.01	-0.10	0.40	-0.004
RTNBH1	2015/01/31	228.00	2.00	11.70	189.00	8.40	39.00	19.10	18.60	3.50	0.01	0.00	39.50	7.80	0.01	-0.10	0.10	-0.004
RTNBH3	2015/01/31	324.00	7.20	19.70	188.00	22.00	50.00	26.00	19.90	1.60	0.01	0.00	50.20	7.80	0.00	-0.10	0.10	-0.004

		Total Dissolved Solids	Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Iron as Fe	Manganese as Mn	Conductivity at 25° C in mS/m	pH-Value at 25° C	Aluminium as Al	Free and Saline Ammonia as N	Fluoride as F	Uranium
Class I	**(Recommended)**	**<1000**	**<10**	**<200**	**N/S**	**<400**	**<150**	**<70**	**<200**	**<50**	**<0.2**	**<0.1**	**<150**	**5-9.5**	**<0.3**	**<1**	**<1**	**<0.015 (WHO)**
Class II	(Max. Allowable)	1000-2400	10-20	200-600	N/S	400-600	150-300	70-100	200-400	50-100	0.2-2	0.1-1	150-370	4-5 or 9.5-10	0.3-0.5	1-2	1-1.5	
	Duration	7 years	7 years	7 years	N/S	7 years	7 years	7 years	7 years	7 years	7 years	7 years	7 years	No Limit	1 year	None	1 year	
Class III	(Not recommended)	>2400	>20	>600	N/S	>600	>300	>100	>400	>100	>2	>1	>370	<4 or >10	>0.5	>2	>1.5	
RTNBH7	2015/01/31	326.00	6.60	19.90	182.00	32.00	31.00	35.00	18.90	1.20	0.00	0.00	48.40	7.80	0.00	-0.10	0.30	-0.004
RTNBH9	2015/01/31	158.00	3.80	5.50	89.00	4.50	20.00	10.50	11.20	2.40	0.02	0.00	21.70	7.50	0.02	-0.10	0.10	-0.004
SBNBH3	2015/03/27	242.00	0.97	4.94	201.00	2.34	32.60	20.90	18.70	1.63	0.00	0.00	37.40	7.84	0.00	0.08	-0.21	-0.001
SBNBH5	2015/03/27	199.00	3.95	6.95	119.00	2.61	21.20	14.00	18.10	0.79	0.00	0.00	29.40	7.59	0.00	0.04	0.25	-0.001
SBNBH9	2015/03/27	293.00	2.10	16.60	219.00	16.40	32.40	27.70	30.30	1.59	0.00	0.00	50.10	7.84	0.00	0.23	0.22	-0.001
SBNBH10	2015/03/27	304.00	4.39	11.00	268.00	2.15	14.50	26.80	60.80	1.44	0.00	0.00	54.80	8.33	0.00	0.93	0.32	-0.001
SBNBH13	2015/03/27	142.00	0.30	6.36	125.00	1.64	15.30	10.30	20.60	1.42	0.00	0.00	25.20	8.19	0.00	0.61	0.22	-0.001
SBNBH14	2015/03/27	220.00	2.34	9.18	152.00	2.18	22.90	11.30	30.90	1.68	0.00	0.00	32.60	7.76	0.00	0.04	0.28	-0.001
Note: "-" values should be read as "<" (e.g. "-1" = "<1")																		

Concentrations highlighted in orange fall within the Class II limits, with concentrations highlighted in red exceeding the recommended drinking water standards.

9.1.3.3.1 Diagnostic Plots

Stiff diagrams (Figure 9-4) were used to characterise the groundwater by analysing the concentrations of the major cations (Ca, Mg, Na+K) and anions (SO_4, Cl and HCO_3). In Stiff diagrams cations are plotted in meq per litre on the left side of the zero axis and anions are plotted on the right side. This diagram is useful in making a rapid visual comparison between water of different sources.

The diagram shows that there are two types of water – those with Ca+Mg-HCO_3 signature (15 boreholes) and those that contain small amount of Na and are dominated by Na+Mg-HCO_3 (6 boreholes). The former signature is typically encountered in recently recharged groundwater. This means that the groundwater does not have significant residence time and is relatively freshly recharged. The remaining 6 boreholes are Na+Mg-HCO_3 type water and could be a result of natural ion exchange between Ca in the groundwater and Na in the rock matrix.

The water chemistry is also displayed using a Piper diagram as shown in Figure 9-5. A Piper diagram is used to classify the water type by plotting the ratios of the major cations (Ca, Mg, Na and K) and anions (Cl, SO_4 and HCO_3+CO_3) as two points in tri-linear fields. These two points are then extended into the main diamond-shaped field of the Piper diagram to plot as one point.

The Piper diagram also confirms the results observed in the Stiff diagrams. The dominant anion is HCO_3, typical of natural water that is not contaminated by mine activities. The lack of sulfate is another confirmation that the groundwater in the proposed RTSF area is not contaminated by the gold mines. The dominant cations range from Ca to Mg to Na+K and are suspected to be results of ion exchanges between waters of higher residence time and those that are recently recharged.

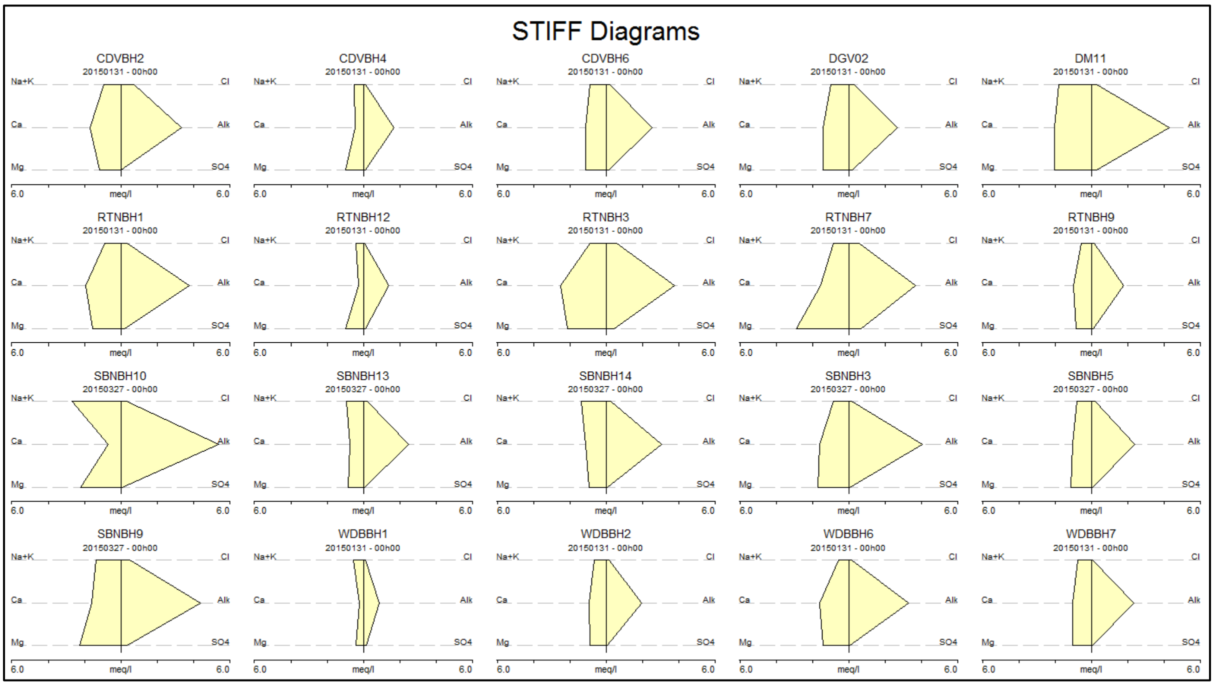

Figure 9-4: Stiff Diagram of the Groundwater for the RTSF Complex

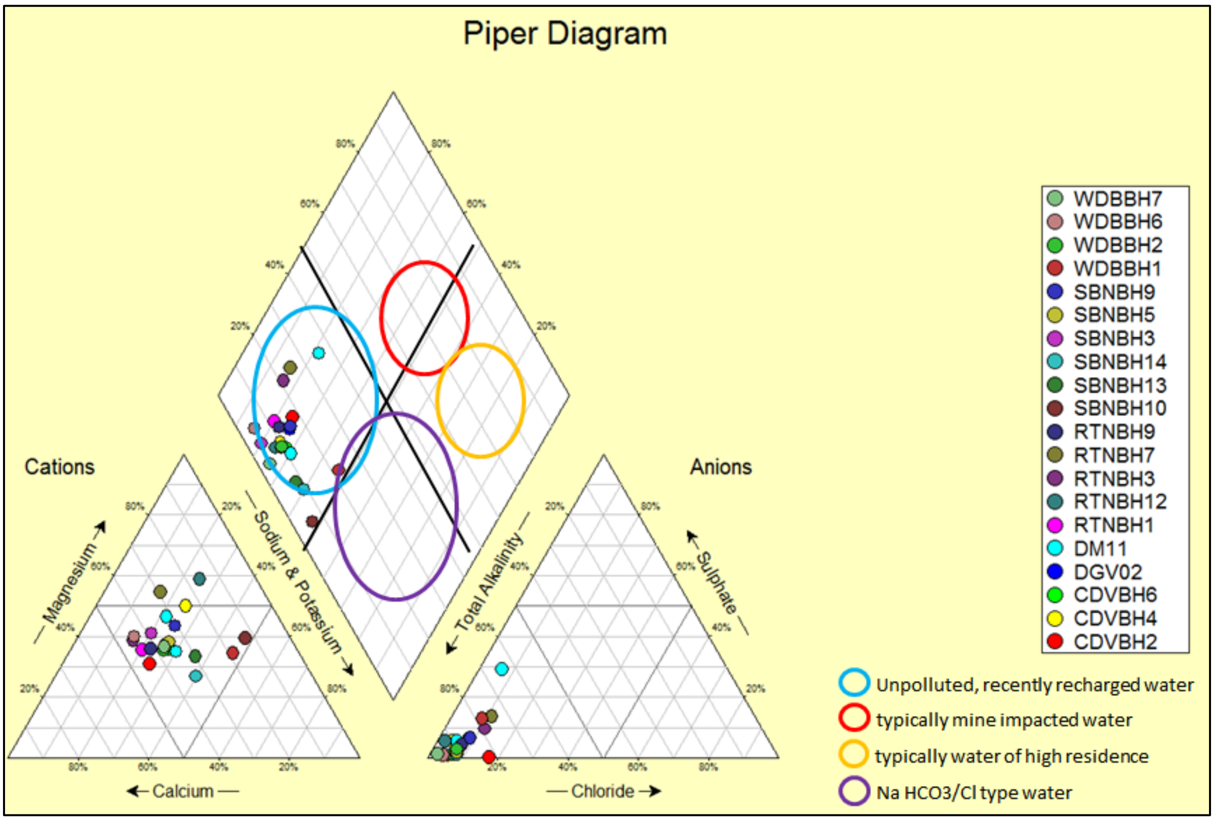

Figure 9-5: Piper Diagram of the Groundwater for the RTSF Complex

9.1.3.3.2 Isotope Analysis

Isotopes of a particular element have the same atomic number, but different atomic weights due to varying numbers of neutrons in the nucleus. Environmental isotopes are naturally occurring isotopes; stable isotopes are not involved with any natural radioactive decay process, while radioactive isotopes undergo spontaneous radioactive decay to form new elements or isotopes. Certain stable isotopes of hydrogen, oxygen, carbon, nitrogen and sulfur can be used in hydrogeological investigations to study processes that affect groundwater and surface water. Radioactive isotopes can be used to determine the age of groundwater (Mazor, 1991).

Two surface water samples (KLPSW01 and RFNSW01) and one groundwater sample (DFN08) were collected for stable isotope analysis and were analysed by iThemba Laboratory in Johannesburg. The samples were collected by Digby Wells (2012) as part of the Geluksdal TSF project, but were collected from within 5 km of the RTSF. Sample KLPSW01 is located approximately 5.6 km east of the RTSF, RFNSW01 is 2.8 km west of the TSF and borehole DFN08 is 3.4 km south of the RTSF.

Environmental stable isotopes (^{2}H and ^{18}O) were analysed to identify the interaction of the surface and groundwater. The three samples plot below the Global Meteoric Water Line (GMWL) on an evaporation line (Appendix F); this indicates that evaporation has taken place and may also indicate surface and groundwater interaction whereby the groundwater is the source of the streams.

Radioactive isotopes can be used for age dating. Tritium, ^{3}H, is an unstable isotope of hydrogen with a half-life of 12.3 years. Prior to 1953, rainwater had less than 10 tritium units (TU) (Abbott, 1997). Thereafter, the manufacturing and testing of nuclear weapons has increased the amount of tritium in the atmosphere and in groundwater and, thus, Tritium can be used in a qualitative manner to date groundwater prior to and post 1953: if the tritium amount is less than 4 TU the water is dated prior to 1953, if the amount is greater than 10-20 TU, the water has been in contact with the atmosphere since 1953.

The tritium in the groundwater at the RTSF has a concentration of 1.1 TU, indicating that the groundwater has a long residence time of more than 60 years. As observed from aquifer tests (Section 9.1.3.1), the hydraulic conductivity of the aquifers west of the RTSF is approximately 0.007 m per day and the higher residence time could possibility be associated with the limited permeability. This, however, is inconsistent with the Ca-Mg-HCO_3 type of signature obtained from the inorganic analysis of the water chemistry. This may indicate the unsuitability of tritium as a tracer at the site and further investigation may be required to characterise and fingerprint the age and residence time of the groundwater.

9.1.3.4 Source Areas

Following the reprocessing of the historical TSFs, the reprocessed tailings material will be deposited on the RTSF which, as a result, is expected to be the predominant source of contamination. SLR (2015) analysed the geochemistry of the reprocessed tailings material, with the list of expected contaminants provided in Table 9-6. The leachate analysis has been conducted for a range of chemical constituents and provides minimum, average and maximum expected leachate concentrations. The conservative constituents with the highest concentrations identified were sulfate and manganese with maximum seepage concentrations of 2 600 mg per litre and 22 mg per litre respectively. Arsenic and uranium have been highlighted due to their perceived contaminants of concern for gold processing, although they are not expected to leach at significant concentrations.

Table 9-6: Anticipated Concentrations in Drainage for the RTSF (SLR, 2015)

Contaminant	Unit	Minimum concentration expected	Average concentration expected	Maximum concentration expected	Most Stringent Standard
Al	mg/L	0.01	0.05	0.3	0.3
As	mg/L	0.001	0.033	0.17	0.01
B	mg/L	0.01	0.054	0.2	2.4
Ba	mg/L	0.01	0.03	0.04	0.7
Cd	mg/L	0.001	0.0025	0.01	0.003
Co	mg/L	0.3	0.4845	1	0.5
Cr	mg/L	0.002	0.0125	0.01	0.05
Cu	mg/L	0.001	0.0125	0.06	0.3
Fe	mg/L	0.01	1.295	50	0.3
Mg	mg/L	5	91.5	200	500
Mn	mg/L	0.005	14.5	22	0.1
Mo	mg/L	0.002	0.0125	0.1	0.01
Na	mg/L	150	352.5	600	200
Ni	mg/L	0.002	0.028	1	0.07
Pb	mg/L	0.005	0.01	0.02	0.01
Sb	mg/L	0.005	0.005	0.005	0.02
Se	mg/L	0.005	0.01	0.05	0.01
Zn	mg/L	0.01	0.04875	0.5	0.5
pH	pH	5.3	6.9	9.3	0

Contaminant	Unit	Minimum concentration expected	Average concentration expected	Maximum concentration expected	Most Stringent Standard
Cl	mg/L	300	470	700	300
SO_4	mg/L	1000	1746.5	2600	250
U	mg/L	0.0005	0.01	0.1	0.03
Nitrate as N	mg/L	0.05	0.1	0.5	11

Constituents highlighted in yellow exceed the SANS 241:2011 Drinking water standards, or are selected based on their anticipated potential for pollution associated with gold ore.

9.1.4 Soils

A Soils Impact Assessment report has been included as Appendix G.

9.1.4.1 Land Type

The land type data for the project area includes the following dominant soils:

- Red well-drained soils on foot slopes of Land Type Ab;
- Shallow rocky soils on the steep escarpment of Land Type Fb;
- Red soils and rocky soils on crests of Land Type Ba; and
- Various hydromorphic and shallow soils on rock in midslopes and foot slopes of Land Type Bb.

The soils associated with the respective land types are summarised in Table 9-7, with the land type for the project area illustrated in Plan 14.

Table 9-7: Dominant Land Types and Slopes within the WRTRP Project Area

Dominant Land Type	Description	Dominant soil types	Dominant Land Capability	Potential occurrence % per land type
Ab	Land Type Ab is dominated by the foot slope landscape position (82%). Red well drained soils are common in this landscape position.	Red well drained soils for example Hutton soils.	II	90
Fb	Land Type FB is dominated by midslope (33%) and footslope (42%) positions but also contains scarp (5%) landscape positions due to the presence of rocky outcrops.	Shallow stony soils and rocks are common in this Land Type.	VI	59
Ba	Land Type Ba is dominated by crest (30%) and midslope (55%) landscape positions. The crest positions are dominated by red soils but also contain a fair amount of rock outcrops.	Deep red and shallow stony soils for example Hutton and Mispah soils respectively.	III	47
Bb	Land Type Bb is dominated by midslope (38%) and footslope positions (42%).	This Land Type is characterised by mixed soils such as shallow Mispah soils, wet soil such as Longlands and Wasbank soils as well as heavy clay soils such as Valsrivier and Sterkspruit soils.	III	59

Plan 14: Land Types

9.1.4.1.1 Kloof Mining Right Area Soil Forms

The potential locations of the infrastructure associated with the Kloof Mining Right area were investigated to determine the site specific soil forms. The proposed RTSF site was dominated by the plinthic catena soils of the Avalon, Wetleigh, Dresden and Tukulu soil forms, accounting for 77.5% of the RTSF footprint area. The dominant soils associated with the RTSF are summarised in Table 9-8.

The proposed CPP consists predominantly of the Ba1 land type and comprises a mix of deep red Hutton soils in the midslopes and shallow rocky Mispah soils in the crest areas of the landscape. The pipeline route from the CPP to the RTSF falls within both the Ba1 land type, associated with the CPP, and Bb23 land type. The Bb23 land type is dominated by Longlands and Wasbank soil forms in the midslope landscape position and Valsrivier soils in the footslope positions in the landscape.

Table 9-8: Dominant Soils Associated with the Proposed RTSF Site

Soil Form	Area Occupied (Ha)	Percentage Occupied (%)
Avalon	653	48.8
Arcadia	263	19.7
Dresden	218	15.5
Tukulu	168	12.6
Clovelly/Oakleaf	37	2.8
Westleigh	7	0.6
Total	**1 336**	**100**

9.1.4.2 Land Capability and Land Use

Land capability is determined by a combination of soil, terrain and climate features. Land capability classes reflect the most intensive long term use of land under rain-fed conditions. The land capability and land use for the project area is provided in Plan 15 and Plan 16, respectively. The current land use for the region is dominated by agricultural and mining activities, with agriculture including both cultivation of crops and grazing.

The land capability for the Kloof Mining Right area to be impacted upon by the project activities is dominated by Class II and Class III, which is intensive cultivation and moderate cultivation/intensive grazing respectively. The pipeline route and CPP is dominated by Class III land capability, although the pipeline routes are located predominantly within existing servitudes.

Plan 15: Land Capability

Plan 16: Land Use

9.1.5 Surface Water

The Surface Water Impact Assessment report is included as Appendix H.

South Africa is divided into 19 Water Management Areas (WMA), managed by its respective water boards. Each of the WMAs are made up of quaternary catchments, which relate to the drainage regions of South Africa. Each of the quaternary catchments have associated hydrological parameters including area, Mean Annual Precipitation (MAP), Mean Annual Evaporation (MAE) , and Mean Annual Runoff (MAR).

9.1.5.1 Regional Hydrology

The WRTRP is situated in the Upper Vaal WMA 8 and within the quaternary catchments C23E, C23J, C23D, C22J and C22H (Plan 17), with the Kloof Mining Right area falling within quaternary catchments C23J, C22J and C23D.

The surface water attributes of the affected catchments namely the MAR in million cubic meters (Mm^3), MAP (mm) and MAE (mm) are summarised in Table 9-9 (WRC, 2005).

Table 9-9: Summary of the Surface Water Attributes for Quaternary Catchments

Quaternary Catchment	Total Area (km^2)	MAP (mm)	MAR (Mm^3)	MAE (mm)
C22H	454	639	8.38	1650
C22J	669	633	11.81	1 650
C23D	510	664	9.12	1 650
C23E	850	631	13.41	1 675
C23J	890	620	18.49	1 670

Runoff emanating from quaternary catchment C23D drains in a south westerly direction into the Mooirivierloop River, which is the largest river in the quaternary catchment. Runoff emanating from quaternary catchment C23D drains in a south westerly direction via the Mooirivierloop River. The C23D quaternary catchment is a contributing catchment to C23E and consequently all runoff from C23D eventually drains to the outlet of C23E. The C23E quaternary catchment is also made up of urban areas which are greater than 5 km^2.

The C22J quaternary catchment area is 669 km^2 and has an MAR of 11.81 Mm^3. Runoff emanating from quaternary catchment C22J drains in a southerly direction, also via the Leeuspruit River. The C23J quaternary catchment area is 890 km^2 and has an MAR of 18.49 Mm^3. Runoff emanating from quaternary catchment C23J drains in a south westerly direction via the Loopspruit River.

Runoff from the A21D quaternary catchment drains in a south westerly direction from the WRTRP area and into the Klein Wes Rietspruit which in turn flows into the Rietspruit. The Rietspruit River is the largest river within the quaternary catchment.

Plan 17: Quaternary Catchments and Monitoring Locations

9.1.5.1.1 Mean Annual Runoff

Based on GN 704[7] requirements, all runoff emanating from dirty water areas such as mine infrastructures, including the RTSF complex and CPP need to be contained within these areas, so as not to mix with the downstream clean water areas.

The 1:50 year storm rainfall depth, to be adopted in the design of conveyance and containment infrastructures for all dirty water areas, is indicated in Table 9-10 (SLR Consulting, 2015).

Table 9-10: Summary of Storm Rainfall Depths

	24 Hour Storm Rainfall Depths (mm)						
Return Period (Years)	**2**	**5**	**10**	**20**	**50**	**100**	**200**
Storm Rainfall Depths (mm)	62	83	97	111	128	142	155

The footprint areas of the new proposed infrastructure are characterised as dirty water areas, therefore based on GN 704 requirements, all runoff emanating from these new areas will have to be captured and contained, resulting in a decrease in runoff that will report to the downstream watercourse, thereby decreasing the MAR of the affected quaternary catchment. The proposed infrastructures for the Kloof MRA fall within quaternary catchment C22J (Table 9-11). The percentage loss of MAR from the C22J quaternary catchment is considered negligible at 2%.

Table 9-11: Loss in Mean Annual Runoff due to Proposed Infrastructure within Kloof Mining Right Area

Quaternary Catchment	Total Quaternary Catchment Area (km^2)	Infrastructure Area (Km^2)	Location	River/Drainage	MAR (Mm^3)	% Loss in MAR	Loss in MAR (Mm^3)
C22J	669	14.47	Kloof MRA	Leeuspruit West	11.81	2.162	0.2554

9.1.5.2 Water Quality

Where data from SGL's current monitoring networks were not sufficient to characterise the baseline of the WRTRP, additional samples were taken. Surface water quality samples were collected from the rivers and dams within and around the project area to determine the baseline water quality for the project area. The sampled rivers include the Leeuspruit, Loopspruit and other unnamed rivers around the project area.

Samples were submitted to Aquatico Laboratory (Pty) Ltd, a SANAS accredited laboratory in Pretoria for analysis of their physical and chemical quality status, as well as additional water

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[7] Regulations on Use of Water for Mining and Related Activities aimed at the Protection of Water Resources; GN R704 in Government Gazette 20119 of 4 June 1999

quality data sets (January 2013 to July 2015) also provided to Digby Wells and used to describe the current water quality status for those monitoring points.

Water quality results have been benchmarked against the SANS 241-1: 2015 drinking water standards. This part of SANS 241 specifies the quality of acceptable drinking water, defined in terms of microbiological, physical, aesthetic and chemical determinants, at the point of delivery. Water that complies with this part of SANS 241 is deemed to present an acceptable health risk for lifetime consumption (this implies an average consumption of 2 L of water per day for 70 years by a person that weighs 60 kg).

The results were also benchmarked with the In-stream Water Quality Guidelines for the Vaal Barrage sub-catchment. This is due to the fact that the project area lies within the Vaal Dam drainage region/catchment. The predominant water use around the project area was agriculture (irrigation and livestock watering). For that reason, the results were also benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996).

The Resource Water Quality Objectives (RWQOs) are defined by the NWA as “clear goals relating to the quality of the relevant water resources” (DWAF, 2006a). In South Africa, the South African Water Quality Guidelines (SAWQG) has been developed as discrete values that set out the change from one category of fitness for use to another (DWAF, 1996).

The water quality guidelines describe the “fitness for use” of a water resource, while the Water Quality Objectives defines “what management action is required” for a water resource. The fitness for use of water defines how suitable the quality of water is for its intended use. The following fitness for use categories are linked to the SAWQGs:

- **Ideal –** the use of water is not affected in any way; 100% fit for use by all users at all times; desirable water quality (TWQR);
- **Acceptable** – slight to moderate problems encountered on a few occasions or for short periods of time;
- **Tolerable** – moderate to severe problems are encountered; usually for a limited period only; and
- **Unacceptable** – water cannot be used for its intended use under normal circumstances at any time (DWAF, 2006c).

The surface water monitoring locations are provided in Plan 17 and Table 9-12, with the water quality results benchmarked against the SANS 241:2011 drinking water quality standards in Table 9-13, against the RWQOs in Table 9-14 and against the Water Quality Guidelines for Agricultural Use (DWAF, 1996) in Table 9-15.

Table 9-12: Surface Water Monitoring Locations

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
LP002	26.431°E	27.552°S	Kloof Mining Right
LP004	26.44°E	27.549°S	Kloof Mining Right
LP005	26.457°E	27.549°S	Kloof/Driefontein Mining Rights
LP006	26.467°E	27.548°S	Kloof/Driefontein Mining Rights
LU014	26.473°E	27.615°S	Kloof Mining Right
DSW9	26.349°E	27.432°S	Driefontein Mining Right
DSW42	26.342°E	27.428°S	Driefontein Mining Right
L1	26.367°E	27.704°S	Cooke 4 South/Ezulwini mining rights
L2	26.396°E	27.700°S	Cooke 4 South/Ezulwini mining rights
L3	26.423°E	27.681°S	Cooke 4 South/Ezulwini mining rights
W12	26.233°E	27.737°S	Kloof/Cooke Mining Rights
W13	26.242°E	27.734°S	Kloof/Cooke Mining Rights
W15	26.266°E	27.699°S	Kloof/Cooke Mining Rights
DP006	26.424°E	27.640°S	Kloof Mining Right
DP003	26.416°E	27.635°S	Kloof Mining Right
LU009	26.429°E	27.600°S	Kloof Mining Right
GOL2376-SW1	26.397°E	27.646°S	Kloof Mining Right
GOL2376-SW2	26.455°E	27.637°S	Kloof Mining Right
GOL2376-SW3	26.526°E	27.676°S	Kloof Mining Right
GOL2376-SW4	26.472°E	27.617°S	Kloof Mining Right

Site Name	Latitude	Longitude	Origin of Surface Water Runoff
GOL2376-SW5	26.428°E	27.601°S	Kloof Mining Right
GOL2376-SW6	26.479°E	27.539°S	Kloof/Driefontein Mining Rights
GOL2376-SW7	26.422°E	27.553°S	Kloof Mining Right
GOL2376-SW8	26.411°E	27.406°S	Driefontein Mining Right
GOL2376-SW9	26.398°E	27.403°S	Driefontein Mining Right
GOL2376-SW13	26.434°E	27.552°S	Kloof Mining Right
GOL2376-SW21	26.375°E	27.592°S	Kloof Mining Right
GOL2376-SW23	26.418°E	27.602°S	Kloof Mining Right
GOL2376-SW26	26.453°E	27.604°S	Kloof Mining Right

Table 9-13: Water Quality Results benchmarked against the SANS 241-1:2011 Drinking Water Quality Standards

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
SANS241:2015	(Standard limits)		5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<11	<1.5	<0.3	<0.3	<0.1	<1.5
		Date	pH	EC mS/m	TDS mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Cl mg/L	SO_4 mg/L	NO_3-N mg/L	F mg/L	Al mg/L	Fe mg/L	Mn mg/L	Ammonia mg/L
LP002		03/03/2015	6.9	8	34	7	5	5	0	5	7	0	0.2	0.1	0.0	0.0	0.00
LP004		03/03/2015	7.2	92	688	95	31	75	0	31	95	1	0.4	0.0	0.0	0.0	0.00
LP005		03/03/2015	7.5	93	708	96	31	75	0	31	96	1	0.4	0.0	0.0	0.0	0.00
LP006		03/03/2015	8.0	101	754	106	36	78	0	36	106	1	0.4	0.0	0.0	0.0	0.00
LU014		02/03/2015	7.5	113	970	124	50	65	0	50	124	0	0.4	0.0	0.0	0.0	0.00
DSW9	50th percentile	2013 to 2015	8.3	90	662	183	212	52	0	42	278	1	0.3	0.1	0.0	0.0	0.0
	95th percentile		8.8	101	1009	224	225	61	0	49	304	2	0.6	0.1	0.1	0.1	0.1
DSW42	50th percentile	2013 to 2015	8.3	74	520	158	192	26	0	35	143	1	0.1	0.1	0.0	0.0	0.0
	95th percentile		8.5	80	579	175	207	29	0	38	149	1	0.2	0.1	0.1	0.0	0.1
L1	50th percentile	Jan 2013-March 2015	7.7	90	743	96	41	32	0	19	428	2	0.5	0.0	0.0	0.1	2.9
	95th percentile		8.2	100	933	125	55	53	0	29	502	5	0.7	0.1	0.0	0.4	6.1
L2	50th percentile	Jan 2013-March 2015	7.5	88	696	84	48	37	0	17	387	1	0.6	0.0	0.0	0.1	0.2
	95th percentile		8.0	94	889	155	62	44	0	24	410	1	1.1	0.0	0.0	0.3	0.4
L3	50th percentile	Jan 2013-March 2015	7.6	114	877.0	119	38	76	0	70	415	2	0.4	0.0	0.0	1.2	2.1
	95th percentile		8.0	173	1480.0	186	54	144	0	97	719	5	0.7	0.1	0.0	9.7	4.6
W12	50th percentile	Jan 2013-March 2015	7.8	75	460.0	59	18	57	0	36	415	75	0.4	0.0	0.1	1.4	4.0
	95th percentile		8.1	82	538.2	116	22	85	0	50	719	215	0.7	0.1	0.1	3.7	18.4
W13	50th percentile	Jan 2013-March 2015	7.8	75	474.0	55	19	57	0	40	82	8	0.4	0.0	0.0	1.3	4.8
	95th percentile		8.1	82	606.0	119	25	92	0	52	236	14	0.5	0.1	0.0	3.0	19.8
W15	50th percentile	Jan 2013-March 2015	8.0	94	692.0	86	28	73	0	50	267	5	0.3	0.0	0.1	0.0	3.6
	95th percentile		8.3	107	853.6	128	48	105	0	64	310	9	0.6	0.0	0.2	0.6	6.7

Sample ID		pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
SANS241:2015	**(Standard limits)**	5-9.5	<170	<1200	<150	<70	<200	<50	<300	<250	<11	<1.5	<0.3	<0.3	<0.1	<1.5
	Date	**pH**	**EC mS/m**	**TDS mg/L**	**Ca mg/L**	**Mg mg/L**	**Na mg/L**	**K mg/L**	**Cl mg/L**	**SO_4 mg/L**	**NO_3-N mg/L**	**F mg/L**	**Al mg/L**	**Fe mg/L**	**Mn mg/L**	**Ammonia mg/L**
Klein Wes Rietspruit		7.7	85	690	93	41	32		19	379	0.9	0.4	0.0	0.0	0.0	2.4
C2H080		7.6	103	747	98	39	80		53	322	3	0.3	0.0	0.3	0.0	1.0
DP006	**02/03/2015**	7.7	11	82	11	6.6	6	0	4	6	0	0.0	0.004	0.0	0.2	0.2
DP003	**02/03/2015**	7.0	36	306	33	23.1	14	0	65	14	0	0.0	0.021	0.0	0.2	0.2
LU009	**02/03/2015**	7.6	114	896	133	55	63	0	112	386	1	0.0	0.001	0.019	0.0	0.1
GOL2376-SW1	**25/03/2015**	7.0	5	32	3	3	3	1	5	1	0	0.3	-0.003	0.115	-0.001	0.1
GOL2376-SW2	**25/03/2015**	7.7	57	358	49	28	36	5	42	78	0	0.3	-0.003	-0.003	0.003	0.2
GOL2376-SW3	**25/03/2015**	7.9	120	764	149	50	72	11	98	417	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW4	**25/03/2015**	8.3	119	826	156	50	67	10	90	454	2	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW5	**25/03/2015**	7.8	123	862	157	46	70	13	83	494	3	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW6	**25/03/2015**	8.1	101	654	102	41	81	8	90	315	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW7	**25/03/2015**	7.6	7	48	4	4	3	1	6	1	0	0.2	-0.003	-0.003	-0.001	0.1
GOL2376-SW8	**10/07/2015**	8.4	110	777	107	43	81	5	88	362	1	0.3	-0.002	-0.004	-0.002	0.1
GOL2376-SW9	**10/07/2015**	8.3	111	790	109	44	84	6	90	372	1	0.3	-0.002	-0.004	0.196	0.1
GOL2376-SW13	**10/07/2015**	8.2	91	616	82	28	77	6	70	283	4	0.5	-0.002	-0.004	-0.002	0.1
GOL2376-SW21	**10/07/2015**	8.8	89	628	70	42	66	2	55	343	2	0.6	-0.002	-0.004	-0.002	0.0
GOL2376-SW23	**10/07/2015**	7.8	131	985	142	58	77	6	95	490	10	0.4	-0.002	-0.004	0.060	0.0
GOL2376-SW26	**10/07/2015**	8.3	117	810	126	48	73	7	109	358	1	0.4	-0.002	-0.004	-0.002	0.0

Concentrations highlighted in orange exceed the SANS 241:2015 standards.

Table 9-14: Water Quality Results benchmarked against the In-Stream Water Quality Guidelines for the Vaal Barrage Sub-catchment

Sample ID			Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F	Phosphate as PO_4	Aluminium as Al	Iron as Fe	Manganese as Mn	Magnesium as Mg
In-stream Water Quality Guidelines for the Vaal Barrage sub-catchment		Ideal	<0.5	<5		<20	<18	6.5-8.5	<0.2	--	--				<8
		Acceptable	0.3-3	5-50		20-100	18-30	-	0.2-0.5	<0.5	<0.03	<0.3	<0.5	<0.15	8-30
		Tolerable	3-6	50-75		100-200	30-70	-	0.5-1.0	0.5-1	0.03-0.05	0.3-0.5	0.5-1.0	0.15-0.20	30-70
		Unacceptable	>6	>75		>200	>70	<6.5;>8.5	>1	>1	>0.05	>0.5	>1.0	>0.2	>70
LP002		03/03/2015	18.0	4.9	0	7.2	8.3	6.9	0.0	20.0	0.2	0.1	0.0	0.0	5
LP004		03/03/2015	237.0	31.0	0	94.8	91.7	7.2	0.0	127.1	0.4	0.0	0.0	0.0	31
LP005		03/03/2015	240.0	30.8	0	96.0	93.3	7.5	0.0	126.3	0.4	0.0	0.0	0.0	31
LP006		03/03/2015	265.0	35.8	0	106.0	101.0	8.0	0.0	147.8	0.4	0.0	0.0	0.0	36
LU014		02/03/2015	310.0	49.8	0	124.0	113.0	7.5	0.0	204.2	0.4	0.0	0.0	0.0	50
DSW9	50th percentile	2013 to 2015	1.5	42.5	0	278.0	89.8	8.3	0.0	0.3	0.1	0.1	0.0	0.0	212
	95th percentile		2.0	49.1	0	303.8	100.9	8.8	0.1	0.6	0.1	0.1	0.1	0.1	225
DSW42	50th percentile	2013 to 2015	1.2	35.0	0	143.0	74.1	8.3	0.0	0.1	0.3	0.1	0.0	0.0	192
	95th percentile		1.3	38.3	0	148.8	80.2	8.5	0.1	0.2	0.3	0.1	0.1	0.0	207
L1	50th percentile	Jan 2013-March 2015	2.3	19		428	90	7.7	2.9	0.45		0.0	0.0	0.1	41
	95th percentile		5.3	29.2		502	99.8	8.24	6.1	0.74		0.1	0.0	0.4	55
L2	50th percentile	Jan 2013-March 2015	0.6	16.5		387	87.5	7.5	0.2	0.6		0.0	0.0	0.1	48
	95th percentile		0.775	24		410	93.75	7.975	0.37	1.05		0.0	0.0	0.3	62
L3	50th percentile	Jan 2013-March 2015	1.9	70		415	114	7.6	2.1	0.43		0.0	0.0	1.2	38
	95th percentile		5.45	97.4		718.8	172.8	8.04	4.6	0.745		0.1	0.0	9.7	54
W12	50th percentile	Jan 2013-March 2015	74.5	36		415	75	7.8	4	0.4		0.0	0.1	1.4	18

Sample ID			Nitrate NO_3 as N	Chlorides as Cl	Total Alkalinity as $CaCO_3$	Sulfate as SO_4	Conductivity at 25° C in mS/m	pH-Value at 25° C	Free and Saline Ammonia as N	Fluoride as F	Phosphate as PO_4	Aluminium as Al	Iron as Fe	Manganese as Mn	Magnesium as Mg
In-stream Water Quality Guidelines for the Vaal Barrage sub-catchment		Ideal	<0.5	<5		<20	<18	6.5-8.5	<0.2	--	--				<8
		Acceptable	0.3-3	5-50		20-100	18-30	-	0.2-0.5	<0.5	<0.03	<0.3	<0.5	<0.15	8-30
		Tolerable	3-6	50-75		100-200	30-70	-	0.5-1.0	0.5-1	0.03-0.05	0.3-0.5	0.5-1.0	0.15-0.20	30-70
		Unacceptable	>6	>75		>200	>70	<6.5;>8.5	>1	>1	>0.05	>0.5	>1.0	>0.2	>70
	95th percentile		215.25	50.2		718.8	82.4	8.1	18.4	0.725		0.1	0.1	3.7	22
W13	50th percentile	Jan 2013-March 2015	7.8	40		82	75	7.8	4.8	0.4		0.0	0.0	1.3	19
	95th percentile		14.2	52.2		235.8	82.2	8.12	19.8	0.525		0.1	0.0	3.0	25
W15	50th percentile	Jan 2013-March 2015	5.2	50		267	94	8	3.6	0.3		0.0	0.1	0.0	28
	95th percentile		8.74	64		310	107	8.3	6.74	0.56		0.0	0.2	0.6	48
Klein Wes Rietspruit			0.9	19		379	85	7.7	2.4	0.4	0.2	0.0	0.0	0.0	41
C2H080			2.6	53		322	103	7.6	1.0	0.3	3.0	0.0	0.3	0.0	39
DP006		02/03/2015	0.3	3.56		5.72	10.8	7.67	0.15	0		0.004	0.0	0.2	6.6
DP003		02/03/2015	0.3	64.7		13.5	36	7.02	0.22	0		0.021	0.0	0.2	23.1
LU009		02/03/2015	1.4	112		386	114	7.63	0.08	0		0.001	0.019	0.0	55
GOL2376-SW1		25/03/2015	0.24	5.48	19.2	0.53	5.25	6.97	0.11	0.25	0.08	-0.003	0.115	-0.001	3
GOL2376-SW2		25/03/2015	0.21	41.5	205	78	56.5	7.72	0.22	0.34	0.06	-0.003	-0.003	0.003	28
GOL2376-SW3		25/03/2015	0.84	97.7	149	417	120	7.89	0.22	0.39	0.06	-0.003	-0.003	-0.001	50
GOL2376-SW4		25/03/2015	1.52	89.9	139	454	119	8.28	0.13	0.32	0.06	-0.003	-0.003	-0.001	50
GOL2376-SW5		25/03/2015	2.53	82.8	133	494	123	7.76	0.1	0.3	0.08	-0.003	-0.003	-0.001	46
GOL2376-SW6		25/03/2015	1.16	90.1	131	315	101	8.14	0.15	0.41	0.44	-0.003	-0.003	-0.001	41
GOL2376-SW7		25/03/2015	0.17	5.83	24.5	0.9	6.5	7.55	0.11	0.22	0.07	-0.003	-0.003	-0.001	4
GOL2376-SW8		10/07/2015	0.833	88.2		362	110	8.35	0.079	0.319	0.017	-0.002	-0.004	-0.002	43
GOL2376-SW9		10/07/2015	0.554	90.1		372	111	8.29	0.083	0.337	-0.002	-0.002	-0.004	0.196	44
GOL2376-SW13		10/07/2015	4	70		283	91	8.17	0.068	0.457	0.509	-0.002	-0.004	-0.002	28
GOL2376-SW21		10/07/2015	1.55	54.6		343	89.4	8.8	0.006	0.633	-0.002	-0.002	-0.004	-0.002	42
GOL2376-SW23		10/07/2015	9.86	95.1		490	131	7.82	0.009	0.353	-0.002	-0.002	-0.004	0.060	58
GOL2376-SW26		10/07/2015	1.19	109		358	117	8.34	0.031	0.372	-0.002	-0.002	-0.004	-0.002	48

Concentrations highlighted in green and orange indicate acceptable and tolerable limits respectively, with concentrations highlighted in red being deemed unacceptable.

Table 9-15: Water Quality Results benchmarked against the South African Water Quality Guidelines for Agricultural Use: Irrigation (DWAF, 1996)

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
South Africa Water Quality Guidelines: Agriculture Irrigation	Ideal		<6.5 - >8.4	N/A	<90	N/A	N/A	<115	N/A	N/A	N/A	N/A	<2	<5	<5	<0.02	N/A
	Max. Allowable		<6.5 - >8.4	N/A	>540	N/A	N/A	>460	N/A	N/A	N/A	N/A	>15.0	>20	>20	>10.0	N/A
		Date	pH	EC mS/m	TDS mg/l	Ca mg/l	Mg mg/l	Na mg/l	K mg/l	Cl mg/l	SO_4 mg/l	NO_3-N mg/l	F mg/l	Al mg/l	Fe mg/l	Mn mg/l	Ammonia mg/l
LP002		03/03/2015	6.9	8	34	7	5	5	0	5	7	0	0.2	0.1	0.0	0.0	0.00
LP004		03/03/2015	7.2	92	688	95	31	75	0	31	95	1	0.4	0.0	0.0	0.0	0.00
LP005		03/03/2015	7.5	93	708	96	31	75	0	31	96	1	0.4	0.0	0.0	0.0	0.00
LP006		03/03/2015	8.0	101	754	106	36	78	0	36	106	1	0.4	0.0	0.0	0.0	0.00
LU014		02/03/2015	7.5	113	970	124	50	65	0	50	124	0	0.4	0.0	0.0	0.0	0.00
DSW9	50th Percentile	2013 to 2015	8.3	90	662	183	212	52	0	42	278	1	0.3	0.1	0.0	0.0	0.0
	95th Percentile		8.8	101	1009	224	225	61	0	49	304	2	0.6	0.1	0.1	0.1	0.1
DSW42	50th Percentile	2013 to 2015	8.3	74	520	158	192	26	0	35	143	1	0.1	0.1	0.0	0.0	0.0
	95th Percentile		8.5	80	579	175	207	29	0	38	149	1	0.2	0.1	0.1	0.0	0.1
L1	50th Percentile	Jan 2013-March 2015	7.7	90	743	96	41	32	0	19	428	2	0.5	0.0	0.0	0.1	2.9
	95th Percentile		8.2	100	933	125	55	53	0	29	502	5	0.7	0.1	0.0	0.4	6.1
L2	50th Percentile	Jan 2013-March 2015	7.5	88	696	84	48	37	0	17	387	1	0.6	0.0	0.0	0.1	0.2
	95th Percentile		8.0	94	889	155	62	44	0	24	410	1	1.1	0.0	0.0	0.3	0.4
L3	50th Percentile	Jan 2013-March 2015	7.6	114	877.0	119	38	76	0	70	415	2	0.4	0.0	0.0	1.2	2.1
	95th Percentile		8.0	173	1480.0	186	54	144	0	97	719	5	0.7	0.1	0.0	9.7	4.6
W12	50th Percentile	Jan 2013-March 2015	7.8	75	460.0	59	18	57	0	36	415	75	0.4	0.0	0.1	1.4	4.0
	95th Percentile		8.1	82	538.2	116	22	85	0	50	719	215	0.7	0.1	0.1	3.7	18.4
W13	50th Percentile	Jan 2013-March 2015	7.8	75	474.0	55	19	57	0	40	82	8	0.4	0.0	0.0	1.3	4.8
	95th Percentile		8.1	82	606.0	119	25	92	0	52	236	14	0.5	0.1	0.0	3.0	19.8

Sample ID			pH-Value at 25° C	Conductivity at 25° C in mS/m	Total Dissolved Solids	Calcium as Ca	Magnesium as Mg	Sodium as Na	Potassium as K	Chlorides as Cl	Sulfate as SO_4	Nitrate NO_3 as N	Fluoride as F	Aluminium as Al	Iron as Fe	Manganese as Mn	Free and Saline Ammonia as N
W15	50th Percentile	Jan 2013-March 2015	8.0	94	692.0	86	28	73	0	50	267	5	0.3	0.0	0.1	0.0	3.6
	95th Percentile		8.3	107	853.6	128	48	105	0	64	310	9	0.6	0.0	0.2	0.6	6.7
DP006		02/03/2015	7.7	11	82	27	11	6	0	4	6	0	0.0	6.6	0.0	0.2	0.2
DP003		02/03/2015	7.0	36	306	95	33	14	0	65	14	0	0.0	23.1	0.0	0.2	0.2
LU009		02/03/2015	7.6	114	896	0	226	63	0	112	386	1	0.0	133.0	55.0	0.0	0.1
GOL2376-SW1		25/03/2015	7.0	5	32	3	3	3	1	5	1	0	0.3	-0.003	0.115	-0.001	0.1
GOL2376-SW2		25/03/2015	7.7	57	358	49	28	36	5	42	78	0	0.3	-0.003	-0.003	0.003	0.2
GOL2376-SW3		25/03/2015	7.9	120	764	149	50	72	11	98	417	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW4		25/03/2015	8.3	119	826	156	50	67	10	90	454	2	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW5		25/03/2015	7.8	123	862	157	46	70	13	83	494	3	0.3	-0.003	-0.003	-0.001	0.1
GOL2376-SW6		25/03/2015	8.1	101	654	102	41	81	8	90	315	1	0.4	-0.003	-0.003	-0.001	0.2
GOL2376-SW7		25/03/2015	7.6	7	48	4	4	3	1	6	1	0	0.2	-0.003	-0.003	-0.001	0.1
GOL2376-SW8		10/07/2015	8.4	110	777	107	43	81	5	88	362	1	0.3	-0.002	-0.004	-0.002	0.1
GOL2376-SW9		10/07/2015	8.3	111	790	109	44	84	6	90	372	1	0.3	-0.002	-0.004	0.196	0.1
GOL2376-SW13		10/07/2015	8.2	91	616	82	28	77	6	70	283	4	0.5	-0.002	-0.004	-0.002	0.1
GOL2376-SW21		10/07/2015	8.8	89	628	70	42	66	2	55	343	2	0.6	-0.002	-0.004	-0.002	0.0
GOL2376-SW23		10/07/2015	7.8	131	985	142	58	77	6	95	490	10	0.4	-0.002	-0.004	0.060	0.0
GOL2376-SW26		10/07/2015	8.3	117	810	126	48	73	7	109	358	1	0.4	-0.002	-0.004	-0.002	0.0

Concentrations highlighted in red exceed the maximum allowable limit, with concentrations highlighted in orange exceeding the ideal limits for agricultural use.

The overall water quality data indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the Vaal Barrage RWQO. High pH levels that exceed the In-Stream Water Quality Guidelines for the Vaal Barrage sub-catchment (<6.5 and > 8.5) were observed at sampling sites DSW9 and SW12. Monitoring point SW03, located downstream of the RTSF and associated infrastructure on the Leeuspruit, indicated a high sulfate concentration (417 mg per litre), with existing mine sampling points L2 and L3 located on the upstream tributary of the Leeuspruit measuring sulfate concentrations of 387 mg per litre and 415 mg per litre respectively. Sampling point SW05, located on a tributary of the Leeuspruit, indicate a sulfate concentration of 494 mg per litre. This indicates that rivers within this area are already impacted. The project area is comprised of various land uses which includes mining, historical TSFs, industrial areas, residential areas and agricultural activities. All these land uses could possibly have contributed to the current water quality status.

Ammonia occurs naturally in water bodies arising from the breakdown of nitrogenous organic and inorganic matter in soil and water, excretion by biota, reduction of the nitrogen gas in water by micro-organisms and from gas exchange with the atmosphere. It is also discharged into water bodies by some industrial processes and also as a component of municipal or community waste. Higher concentrations could be an indication of organic pollution such as from domestic sewage, industrial waste and fertiliser run-off. Ammonia is, therefore, a useful indicator of organic pollution (Chapman, 1996). This will also contribute in high nitrate levels as nitrates form when microorganisms break down organic residues such as decaying plants, fertilisers and manures.

Manganese is a relatively abundant element, constituting approximately 0.1% of the earth's crust. It is found in solution predominantly as the manganous Mn(II) ion, which can be stabilised by complexation to humic acids. On oxidation to the manganic, ion, Mn(IV), manganese tends to precipitate out of solution to form a black hydrated oxide, which is responsible for the staining problems often associated with manganese bearing waters. Its concentration in the soil solution is largely determined by soil pH and oxidation-reduction reactions. This is further modified by sorption and desorption reactions with the soil exchange complex. Manganese is reduced (and the solubility increased) under waterlogged conditions in association with low pH (DWAF, 1996). The study area is also underlain by dolomites, commonly associated with elevated manganese concentrations in local water sources.

Possible sources of chloride could include wastewater runoff, agricultural runoff and industrial effluent.

9.1.5.3 Surface Water Quantity

The project area is drained by the Wonderfonteinspruit, Leeuspruit and the Loopspruit. The Wonderfonteinspruit flows westwards and eventually becomes the Mooirivierloop before a confluence with the Mooi River downstream. The Wonderfonteinspruit is divided into the Upper and the Lower Wonderfonteinspruit; the Upper Wonderfonteinspruit ends at the outflow of the Donaldson Dam, where a 1 m diameter pipeline signifies the beginning of the Lower Wonderfonteinspruit. The Lower Wonderfonteinspruit is made up of the 1 m diameter pipeline which extends approximately 30 km down the natural drainage path of the Wonderfonteinspruit.

Currently, approximately 33 Mℓ/day of mine impacted water is being discharged into the Wonderfonteinspruit from K10 shaft, along with additional discharges into the Wonderfonteinspruit including 20 Mℓ/day from Cooke 1 Shaft, 15 to 20 Mℓ/day from the Flip Human Waste Water Treatment Works (WWTW) and 10 Mℓ/day from the Hannes van Niekerk WWTW. It is SGL’s intention to abstract 20 Mℓ/day of the mine impacted water from K10 shaft, as well as 12 Mℓ per day from Cooke 1 Shaft, for use as part of the WRTRP. Following the reclamation processes, water from the RWD of the RTSF will be treated and approximately 15 Mℓ/day of water will be discharged into the Leeuspruit. The average flows of water per day for the Wonderfonteinspruit (C2H080 flow gauge system), Leeuspruit (based on catchment size and runoff) and Loopspruit (C2H051 and C2H169 flow gauge systems) are detailed in Table 9-16.

Table 9-16: Average Surface Water Flows for the Project Area (DWS, 1990 to 2014)

Months	**Wonderfonteinspruit (DWS Monitoring Point C2H080)**	**Leeuspruit West**	**Loopspruit (DWS Monitoring Point C2H169)**
	Average Flows (m^3/day)	**Average Flows (m^3/day)**	**Average Flows (m^3/day)**
January	70 006	21 055	5 348
February	66 401	12 033	5 923
March	79 602	6 178	7 720
April	70 837	2 686	6 204
May	66 715	269	5 858
June	77 652	150	5 853
July	71 681	31	5 169
August	87 647	601	4 351
September	80 061	2 054	4 035
October	57 867	12 581	5 756
November	67 706	17 673	4 665
December	69 296	24 593	4 672
Average	**72 123**	**8 325**	**5 463**

9.1.5.4 Floodline Assessment

The 1:50 year and 1:100 year floodlines were determined for sections of the Leeuspruit which passes along the eastern side of the proposed RTSF area, as well as for the adjacent unnamed tributary located to the south of the RTSF. The model results indicated that the RTSF and associated infrastructure, such as the AWTF and RWD, fall outside of the 1:100 year floodline, as well as outside the 100 m buffer of the 1:100 year floodline. The 1:100 year floodlines are detailed further in Appendix H.

9.1.6 Fauna and Flora

A Fauna and Flora Impact Assessment is included as Appendix I.

9.1.6.1 Regional Vegetation

The project area falls within four vegetation types according to Mucina and Rutherford (2006) as described below and shown in Plan 18. The sections below also discuss the fauna and flora of the area.

9.1.6.1.1 Carletonville Dolomite Grassland

This vegetation unit mainly occurs in the North-West Province but also in Gauteng and marginally into the Free State Province. It is distributed in the region of Potchefstroom, Ventersdorp and Carletonville, extending westwards to the vicinity of Ottoshoop, but also occurring as far east as Centurion and Bapsfontein in Gauteng Province.

This vegetation occurs on slightly undulating plains dissected by prominent rocky chert ridges. It forms a complex mosaic pattern dominated by many species. Grasses such as *Loudetia simplex* (Common Russet Grass), *Hyparrhenia hirta* (Common Thatching Grass), *Brachiaria serrata* (Velvet Signal Grass) and *Heteropogon contortus* (Spear Grass) are prominent while shrubs such as *Euclea undulata* (Common Guarri), *Searsia magalismontana* (Berg Taaibos), *Zanthoxylon capense* (Small Knobwood) and *Diospyros lycioides* (Bluebush) are scattered in protected places (e.g. among rocks and boulders). The geology of this vegetation unit consists of dolomites and cherts of the Malmani subgroup from the Transvaal Super Group.

Conservation status is currently considered vulnerable, with only a small extent conserved in statutory reserves (Sterkfontein Caves— part of the Cradle of Humankind World Heritage Site, Oog Van Malmani, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof) and in at least six private conservation areas. Almost a quarter of the vegetation type has already been transformed by cultivation, urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams.

9.1.6.1.2 Gauteng Shale Mountain Bushveld

This vegetation unit occurs in Gauteng and North-West Provinces, mainly on the ridge of the Gatsrand south of Carletonville–Westonaria–Lenasia. It occurs on low broken ridges varying in steepness and generally with a high surface rock cover. The vegetation is a short, semi-open thicket, dominated by a variety of woody species such as *Acacia caffra*, *Searsia leptodictya*, *Cussonia spicata* and *Englerophytum magalismontanum*. The understory is dominated by grasses such as *Cymbopogon pospischilii* and *Digitaria eriantha*. Some of the ridges form plateaus that carry scrubby grassland. The geology consists of shale and andesite from the Pretoria group (Transvaal supergroup).

Conservation status is currently considered to be Vulnerable, statutorily conserved in Skanskop and Hartebeesthoek Nature Reserves, Magaliesburg Nature Area and Groenkloof National Park.

9.1.6.1.3 Rand Highveld Grassland

Rand Highveld Grassland is found in the highly variable landscape with extensive sloping plains and ridges in the Gauteng, North-West, Free State and Mpumalanga Provinces. The vegetation type is found in areas between rocky ridges from Pretoria to Witbank, extending onto ridges in the Stoffberg and Roossenekal regions as well as in the vicinity of Derby and Potchefstroom, extending southwards and north-eastwards from there. The vegetation is characterised by species rich, sour grassland alternating with low shrubland on rocky outcrops. The most common grasses on the plains belong to the genera *Themeda, Eragrostis, Heteropogon* and *Elionurus*. High numbers of herbs belonging to the Asteraceae family are also found. In rocky areas, shrubs and trees also prevail and are mostly *Protea caffra, Acacia caffra, Celtis africana* and *Searsia* spp.

Due to the low conservation status, this vegetation type is classified as Endangered. Almost half of the vegetation type has been transformed by cultivation, plantations, urbanisation or dam-building. Scattered aliens (most prominently *Acacia mearnsii*) are present in the unit.

9.1.6.1.4 Soweto Highveld Grassland

This vegetation unit occurs in Mpumalanga, Gauteng (and to a very small extent also in neighbouring Free State and North West) Provinces. It lies in a broad band roughly delimited by the N17 road between Ermelo and Johannesburg in the north, Perdekop in the southeast and the Vaal River (border with the Free State) in the south. It extends further westwards along the southern edge of the Johannesburg Dome (including part of Soweto) as far as the vicinity of Randfontein. In southern Gauteng it includes the surrounds of Vanderbijlpark and Vereeniging as well as Sasolburg in the northern Free State.

The vegetation occurs on gently to moderately undulating landscape on the Highveld plateau supporting short to medium high, dense, tufted grassland dominated almost entirely by *Themeda triandra* (Rooi grass) and accompanied by a variety of other grasses such as *Elionurus muticus* (Wire grass), *Eragrostis racemosa* (Small heart grass), *Heteropogon contortus* (Spear grass) and *Tristachya leucothrix* (Trident grass).

Only small scattered wetlands, narrow streams and occasional ridges or rocky outcrops interrupt the continuous grassland cover. The geology of the Soweto Integration consists mainly of shale, sandstone or mudstone of the Madzarinwe formation (Karoo supergroup).

The conservation status is currently considered to be Endangered, only small areas are statutorily conserved (Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, and Rolfe's Pan Nature Reserves) or privately conserved (Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves, Heidelberg Natural Heritage Site). Almost half of the area already transformed by cultivation, urban sprawl, mining and building of road infrastructure. Some areas have been flooded by dams (Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer dams). Erosion is generally very low (93%).

Plan 18: Vegetation Types

9.1.6.2 Floral Species of Special Concern

The project area lies within three Quarter Degree Square (QDS) grids, namely 2627AD and 2627BC and 2627DA. According to the PRECIS (National Herbarium Pretoria Computerised Information System), no Red Data species are expected to occur for the QDS for each of the sites.

The Plants of South Africa (http://posa.sanbi.org) website list was obtained from the South African National Biodiversity Institute (SANBI) website; it lists all the Red Data plant species officially recorded by SANBI for Quarter degree square grids. For a plant species to be included in this list, a specimen collected in this grid must be supplied to SANBI. This list is therefore not a comprehensive list representing only those species that may occur in these grids, but rather a guideline as to what is likely to occur. The sites sampled are also only a very small portion of the whole grid and habitats suitable for certain species in these Plants of South Africa (POSA) lists may not be present at the sites sampled. It is therefore not unusual for species in the POSA list to be absent from the sampling sites.

Certain species included in the list below was confirmed by scrutinising previous specialist studies that were undertaken in the past. The IUCN category descriptions, for fauna and flora, are provided in Table 9-17, with the Species of Special Concern (SSC) likely to occur on site are listed in Table 9-18.

Table 9-17: Red Data Categories (SANBI, 2012)

Category		Description
Extinct	(EX)	No known individuals remaining.
Extinct in the Wild	(EW)	Known only to survive in captivity.
Critically Endangered	(CR)	Extremely high risk of extinction in the wild.
Endangered	(EN)	High risk of extinction in the wild
Vulnerable	(VU)	High risk of endangerment in the wild.
Near Threatened	(NT)	Likely to become endangered in the near future.
Least Concern	(LC)	Lowest risk. Does not qualify for a more at risk category. Widespread and abundant taxa are included in this category.
Data Deficient	(DD)	Not enough data to make an assessment of its risk of extinction.
Not Evaluated	(NE)	Has not yet been evaluated against the criteria.
	Extinct	**Threatened species** are species that are facing a high risk of extinction. Any species classified in the IUCN categories **CR, EN** or **VU** is a threatened species. **Species of conservation concern** are species that have a high conservation importance in terms of preserving South Africa's high floristic diversity and include not only threatened species, but also those classified in the categories**, NT, LC** and **DD**
	Threatened	
	Other categories of conservation concern	
	Other categories	

Table 9-18: Plant SSC likely to occur on site

Plant species	Status
Kniphofia typhoides	NT (confirmed)
Trachyandra erythrorrhiza	NT (confirmed)
Hypoxis hemerocallidea	Declining (confirmed)
Eucomis autumnalis subsp. clavata	Not Evaluated (confirmed)
Boophone disticha	*Declining*
Adromischus umbraticola subsp. umbraticola	NT
Drimia sanguinea	NT
Khadia beswickii	VU

9.1.6.3 Kloof Mining Right Area Vegetation Delineation

The infrastructure associated with the Kloof Mining Right area, namely the RTSF complex, the CPP and pipelines associated and between the CPP and RTSF complex, is located within grassland, wetland, agricultural (cultivation and grazing) and transformed areas. The delineated communities within the Kloof Mining Right area are discussed further below.

9.1.6.3.1 Grasslands

The grassland is composed of dominant and well developed graminoid components, as well as a healthy forb component. Within the grassland delineation, two sub communities were identified. The dominant grassland sub community associated with the infrastructure within the Kloof Mining Right area is the *Themeda triandra – Hyparhennia hirta* grassland, with the *Cymbopogon excavatus – Themeda triandra – Acacia karroo* open to closed woodland sub community delineated towards the north of the Kloof Mining Right area infrastructure associated with the CPP.

The *Themeda triandra – Hyparhennia hirta* grassland falls within the Soweto Highveld Vegetation type. Fifty four (54) species were identified within this sub community. This area is estimated to be 19% natural, through comparison of expected species (Mucina and Rutherford, 2006) and identified species. Much of this vegetation type is assumed to have been transformed for agricultural purposes.

The *Cymbopogon excavatus – Helichrysum regulosum* sub community was dominated by *Acacia karroo* (Sweet Thorn) and falls within the Rand Highveld Grassland (Mucina and Rutherford, 2006). Due to the favourable microclimate created by *Acacia karroo,* there are a larger number of small shrubs and forbs in the areas where it occurs. The ecological health is estimated to moderate to poor, due to the high number of alien invasive species, such as Wild Verbena *(Verbena bonariensis*).

9.1.6.3.2 Wetland

Wetland and riparian vegetation is associated predominantly with proposed pipeline crossings, as well as adjacent and within the CPP and RTSF complex. The delineated wetlands are discussed in further detail in Section 9.1.8.

9.1.6.3.3 Agricultural

Agricultural activities are undertaken within the Kloof Mining Right area, as well as within the proposed RTSF complex. Agricultural crops which have replaced natural vegetation include Maize (*Zea mays*) which is the primary crop in the area, Soybean (*Glycine max*) and Sunflowers (*Helianthus annulus*). Small plots of commercial vegetables, Lucerne and Peaches are also cultivated in the area. Livestock farming (including sheep and cattle) is also popular, which has resulted in degradation of the natural grassland biodiversity. This is evident through the presence of Bankrupt Bush (*Seriphium plumosum)*, which has overtaken numerous fields in the area, as well as a number of other problem plants and general assumed diminished species richness.

9.1.6.3.4 Transformed

Transformed areas are associated with alien invasive and exotic vegetation and features prominently in the grassland landscape, with areas where the natural grasslands having been transformed in its entirety occurring. This is typically in the form of stands of exotic trees that have been planted, usually for the uptake of water. Red River Gum ((*Eucalyptus camaldulensis*) surrounds much of the mining areas, often planted for their robust nature and ability to take up toxic leachates from the groundwater surrounding retention dams. Pampas grass (*Cortaderia selloana)* is a similarly robust plant which has been planted in an effort to rehabilitate areas which have been mined. Alien invasive vegetation recorded on site is listed in Appendix I.

9.1.6.3.5 Ecological Importance

The ecological importance of the vegetation communities is described in Table 9-19. The remnant natural vegetation communities illustrate high ecological importance due to their ecosystem functioning. Despite their diminished ecological integrity they are seen to be valuable for biodiversity maintenance and therefore these communities, namely; grasslands and wetland vegetation should be conservation priorities. Transformed vegetation is not regarded to have high ecological importance due to poor integrity, limited ecosystem functioning and abundance of introduced alien vegetation species.

Table 9-19: Ecological Integrity of the Vegetation Communities within the Kloof Mining Right Area Infrastructure

Community	Ecological State	Ecological Function	Conservation Importance	Reasoning
Grassland Vegetation	Natural	Moderate	High	Grassland areas have been transformed and impacted by surrounding land uses and must be protected.
Wetland Vegetation	Natural	Moderate	High	Impacted by surrounding land uses. Important Habitat. Protected (NWA).
Transformed Vegetation	Transformed	Poor	Low	Largely modified vegetation. High number of alien invasive species.

9.1.6.3.6 Plant species of special concern

After consultation with Lorraine Mills, the Red List Manager from Gauteng Nature Conservation, GDARD, the following species of plants were identified as having previous distribution over the study areas.

Table 9-20: Expected list of plant SSC

Plant species	Threat Status	Current Threats	Proffered habitat on site
Hypoxis hemerocallidea	Declining	Commercial exploitation, habitat loss and degradation	Open, rocky grassland, dry, stony, grassy slopes
Boophone disticha	*Declining*	habitat loss, trade, harvesting	Grassland, rocky areas
Adromischus umbraticola subsp. umbraticola	NT	South African endemic, habitat loss	South-facing rock crevices on ridges, restricted to Gold Reef Mountain Bushveld in the northern parts of its range, and Andesite Mountain Bushveld.
Drimia sanguinea	NT	Highly poisonous bulb that has caused mass livestock mortality in the pass and was subject to frequent land clearance by farmers, hence its status	Open veld and scrubby woodland in a variety of soil types.
Khadia beswickii	VU	Habitat loss, invasive alien species (direct effects), harvesting	Yes, open shallow soil over rocks in grassland.

Plant species	Threat Status	Current Threats	Proffered habitat on site
Kniphofia typhoides	NT	Habitat loss, plant invasion	Wetlands and seasonally wet areas in climax *Themeda triandra* grasslands on heavy black clay soils.
Gunnera perpensa	Declining	Traditional medicine	Grassland areas.
Lithops lesliei subsp.lesliei	NT	Harvesting (gathering), specifically for commercial sale	Arid grasslands, usually in rocky places, growing under the protection of forbs and grasses.

9.1.6.4 Fauna

Fauna expected to occur within the Kloof Mining Right area and larger WRTRP area include assemblages within terrestrial and wetland ecosystems: mammals, birds, reptiles, amphibians and invertebrates. Each of these assemblages occurs within unique habitats and the ecological state of these habitats directly relates to the number of species found within them. The main habitats occurring in the project area are grassland plains and pans, with little altitudinal variation.

Large areas of the terrestrial vegetation and habitat have been modified within the project area. It is assumed that these impacts have had a subsequent effect on the fauna species diversity and abundance. The findings of the fauna survey are used as a secondary reflection of the ecosystem health. Low numbers of Mammalia, Avifauna, Reptiles, Amphibians and Invertebrates were identified within the project area and many of these species are associated with the sensitive habitats associated with the grassland and wetland areas.

9.1.6.4.1 Mammals

A number of small mammals were identified within the project area, such as Steenbok (*Raphicerus campestris*), Ground Squirrels (*Xerus inauris)*, and Porcupine (*Hystrix africaeaustralis*). Species were identified through actual sightings and visual evidence, although none of the identified species are considered SSC. A list of expected mammals to occur within the project area, as well as those species observed and recorded, is provided in Table 9-21.

Table 9-21: Expected Mammals within the Kloof Mining Right Area and WRTRP Area

Family	Species	Common Name	Recorded on site	Status
Bovidae	*Raphicerus campestris*	Steenbok	X	LC
Bovidae	*Sylvicapra grimmia*	Common Duiker	X	LC
Bovidae	*Damaliscus pygargus phillips*	Blesbuck	X	LC
Chrysochloridae	*Chrysospalax pillosus*	Rough Haired Golden Mole		VU
Chrysochloridae	*Amblysomus septentrionalis*	Highveld Golden Mole		NT
Herpestidae	*Cynictis penicillata*	Yellow Mongoose	X	LC
Herpestidae	*Galerella sanguineus*	Slender Mongoose	X	LC
Hysticidae	*Hystrix africaeaustralis*	Porcupine	X	LC
Muridae	*Rhabdomys pumilio*	Striped Field Mouse	X	LC
Muridae	*Mus musculus*	House Mouse	X	LC
Muridae	*Rattus rattus*	House Rat	X	LC
Muridae	*Myosorex varius*	Forest Shrew		LC
Muridae	*Dasmys incomtus*	African Marsh Rat House rat		LC
Muridae	*Hydrictis maculicollis*	Spotted Necked Otter		NT
Muridae	*Xerus inauris*	Ground Squirrel	X	LC
Mustelidae	*Mystromys albicaudatus*	White-Tailed Mouse		EN

9.1.6.4.2 Avifauna

A number of birds were identified within the area of the proposed RTSF and pipeline routes. The birds are associated with a variety of habitats which correspond with the vegetation communities namely, grassland, wetland and transformed habitats. 37 bird species were identified during the survey and are detailed in Appendix I. No Listed Red Data bird species were identified during the field survey. The Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder, 2008) and is expected to occur within the wetland habitats identified within the project area. This species has been allocated a status of Vulnerable.

9.1.6.4.3 Reptiles

One species of reptile, a Rinkhals (*Hemachatus haemachatus*) was identified during the field survey. It should be noted that all land tortoises are protected in the Gauteng Province, however the probability of occurrence of the species in the study area are seen as low. Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*), listed as Vulnerable, and the Striped Harlequin Snake (*Homoroselaps dorsalis*), identified as Rare; both species are allocated a low probability of occurrence.

9.1.6.4.4 Amphibians

Six amphibians were encountered during the field survey. The amphibian species identified and expected for the area are listed in Table 9-22; the species identified were all encountered within the wetlands habitat types.

Table 9-22: Amphibian Species Identified

Scientific Name	Common Name	Occurrence	Habitat
Afrana angolensis	Common River Frog	Widespread; confirmed	Grassland, savanna and forest fringe, breeds in shallow water of pools, dams, streams and slow-flowing rivers
Afrana fuscigula	Cape River Frog	Widespread; high; SA Endemic.	Streams and ponds. Prefers well-vegetated waterways.
Amietophrynus gutturalis	Guttural Toad	Widespread; confirmed	Habitat generalist; breeds in open pools, dams, or streams
Amietophrynus rangeri	Raucous Toad	Marginal, low	Grassland, usually when inundated, man-made impoundments
Cacosternum boettgeri	Common Caco	Widespread; confirmed	Varied including grassland; breeds in vleis and inundated grassland or shallow pans

Scientific Name	Common Name	Occurrence	Habitat
Kassina senegalensis	Bubbling Kassina	Widespread; confirmed	Grasslands; breeds in vleis, pans and dams
Phrynobatrachus natalensis	Snoring Puddle Frog	Marginal; medium	Breeds in pools or marshy areas associated with pans, streams or vleis
Pyxicephalus adspersus	Giant Bullfrog	Confirmed;	Mainly grassland and savanna; breeds in temporary pans or pans.
Schismaderma carens	Red Toad	Widespread; high	Streams and rivers, and still permanent bodies water
Strongylopus fasciatus	Striped Stream Frog	Widespread; confirmed	Streams and rivers, and still permanent bodies water
Tomopterna cryptotis	Tremolo Sand Frog	Widespread; high	Varied habitats; breeds in water bodies that have vegetation
Tomopterna natalensis	Natal Sand frog	Widespread; high	Savanna; breeds in temporary pans
Xenopus laevis	Common Platanna	Widespread; confirmed	Breeds in shallow permanent streams, of temporary water bodies in grassland

9.1.6.4.5 Invertebrates

Butterflies are a good indication of the habitats available in a specific area (Woodhall 2005). Although many species are eurytropes (able to use a wide range of habitats) and are widespread and common, South Africa has many stenotrope (specific habitat requirements with populations concentrated in a small area) species which may be very specialised (Woodhall 2005). Red Data species expected to occur on site are the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey. This may be due to the timing of the survey and it is expected that species will be encountered in the area.

9.1.6.5 Sensitivity Analysis

The sensitivity assessment takes into account all of the desktop information (Gauteng C-Plan, Threatened Ecosystems and the NPAES), as well as the field data gathered during the site visits. This forms as assessment of the perceived biodiversity value and the result assigns sensitivity to the vegetation delineated on site. The sensitivity analysis is provided in Plan 19.

Ridges and wetlands constitute High Sensitivity areas due to their role as process areas within the ecosystem. In addition, high sensitivity was given to areas occurring within a Threatened Ecosystem, and those areas that were pristine or close to pristine with low or no anthropogenic impacts. Areas occurring within Highly Significant C-Plan areas (unless heavily degraded) were also given a High Sensitivity, as were areas on steep rocky slopes and those that have high numbers of species of special concern.

Areas of Medium Sensitivity include those natural areas with some anthropogenic change or degradation, with high numbers of species of special concern and moderate rocky slopes.

Low Sensitivity was assigned to areas completely transformed or heavily degraded, on relatively flat ground.

Plan 19: Sensitivity Analysis

9.1.7 Aquatics

The Aquatics Impact Assessment is included as Appendix J.

Within the quaternary catchments (as identified in the surface water baseline section), a total of nine river systems will be affected by the proposed project and a total of 13 Sub Quaternary Reaches (SQRs). The SQR within the WRTRP area are associated with the Wonderfonteinspruit, Mooirivierloop, Loopspruit and the Leeuspruit.

The majority of the river systems in the WRTRP area are largely modified with the Present Ecological Status (PES) of these systems ranging from Class D to Class E and an ecological importance and sensitivity ranging from Low to Moderate (DWA, 2013). The modification of these systems is largely attributed to the location of the sources of the associated river systems. The sources of the river systems are located within urban and industrial areas and as such, associated impacts to instream and riparian conditions have resulted in the large modification of the systems. Consequently, aquatic biota is considered to be of low importance with low sensitivities within these systems.

High flow and low flow site surveys were undertaken for the project area to assess the baseline aquatic environment. The following aspects were assessed and are detailed below for the aquatic environments associated with the Kloof Mining Right area activities:

- Water quality;
- Intermediate Habitat Integrity Assessment (IHIA); and
- Macroinvertebrate Assessment including:
  - Integrated Habitat Assessment System (IHAS);
  - South African Scoring System version 5 (SASS5); and
  - Macroinvertebrate Response Assessment Index (MIRAI).

9.1.7.1 Water Quality

The location of the aquatic sampling locations is provided in Plan 20. The results of the aquatic sampling has been provided for the locations associated with the Wonderfonteinspruit, as water from K10 shaft is discharged into the water resource, as well as results for the Leeuspruit which is the predominant water resource associated with the Kloof Mining Right area. It must be noted that a section of the Wonderfonteinspruit has been piped and, as a result, is significantly modified. Sampling locations WON1 and WON4 occur upstream and downstream of the piped section respectively.

The water quality results from the aquatic sampling are listed in Table 9-23.

Table 9-23: In Situ Water Quality Results

		High Flow survey					Low Flow survey	
Constituent	**Guideline**	**WON1**	**WON4**	**LEEU1**	**LEEU2**	**LEEU3**	**WON1**	**WON4**
Temperature (ºC)	5-25	16	13.8	9.8	11.1	10	9.5	13.8
pH	6-9	7.5	8.6	6.7	7.3	7.3	7.8	8.6
Conductivity (µS/cm)	<700	774	1035	1909	1318	1122	879	1035
Dissolved oxygen (mg/l)	>5	3.77	8.6	8.6	7.2	5.14	4.5	6.34
Dissolved oxygen saturation (%)	>50	38	81	73.6	66	62	40	61
*Red colour denotes constituent exceeding recommended DWAF (1996) Aquatic guideline								

Plan 20: Aquatic Monitoring Locations

When considering the *in situ* results from the high flow survey, temperatures are observed to range between 9.8 ºC at LEEU1 to 16ºC at WON1. The pH levels obtained during the survey ranged between 6.7 at LEEU1 to 7.5 at WON1 to 8.6 at WON4. The conductivity recordings of all of the monitoring locations exceeded the recommended Aquatic guideline (DWAF, 1996) of 700 µS/cm, with a maximum concentration of 1 909 µS/cm recorded at site LEEU1.ranged from 774 µS/cm at WON1 to 1035 µS/cm at WON4. Sampling location WON1 exceeded the aquatic guideline (DWAF, 1996) for dissolved oxygen.

The low flow survey for WON1 and WON4 indicated similar results as the high flow survey, with both sites exceeding the conductivity concentrations and sampling site WON1 exceeding the dissolved oxygen concentrations for the aquatic guidelines (DWAF, 1996).

9.1.7.2 Intermediate Habitat Integrity Assessment

To define a general habitat the instream and riparian habitat was assessed and characterised according to “Procedure for Rapid Determination of Resource Directed Measures for River Ecosystems (Section D), 1999”. The Intermediate Habitat Integrity Assessment (IHIA) model was used to assess the integrity of the habitats from a riparian and instream perspective. The habitat integrity of a river refers to the maintenance of a balanced composition of physico-chemical and habitat characteristics on a temporal and spatial scale that are comparable to the characteristics of natural habitats of the region (Kleynhans, 1996).

The criteria utilised as part of the IHIA are detailed in Appendix J, with the scores placed into IHIA categories. The IHIA categories are detailed in Table 9-24, with the results of the instream and riparian IHIA provided in Table 9-25 and Table 9-26 respectively.

Within the SQRs of the Wonderfonteinspruit and Leeuspruit, the IHIA results of the instream habitats are classified as class E or seriously modified, with the riparian habitat as Class D or largely modified.

Table 9-24: Intermediate Habitat Integrity Assessment Categories (Kleynhans, 1996)

Category	Description	Score
A	Unmodified, natural.	90-100
B	Largely natural with few modifications. A small change in natural habitats and biota may have taken place but the ecosystem functions are essentially unchanged.	80-90
C	Moderately modified. A loss and change of natural habitat and biota have occurred but the basic ecosystem functions are still predominantly unchanged.	60-79
D	Largely modified. A large loss of natural habitat, biota and basic ecosystem functions has occurred.	40-59
E	The loss of natural habitat, biota and basic ecosystem functions is extensive.	20-39

Category	Description	Score
F	Modifications have reached a critical level and the lotic system has been modified completely with an almost complete loss of natural habitat and biota. In the worst instances the basic ecosystem functions have been destroyed and the changes are irreversible.	0-19

Table 9-25: IHIA for Instream Habitats

Instream	Wonderfonteinspruit		Leeuspruit	
	Average Score	Score	Average score	Score
Water abstraction	13.33	7.46	8.33	4.67
Flow modification	25	13	16.67	8.67
Bed modification	25	13	18.33	9.53
Channel modification	25	13	15.00	7.80
Water quality	11.66	6.53	17.00	9.52
Inundation	20.33	8.13	11.67	4.67
Exotic macrophytes	8	2.88	5.00	1.80
Exotic fauna	10	3.2	11.67	3.73
Solid waste disposal	11.66	2.8	10.00	2.40
Total Instream	**29.98**		**47.2**	
Category		**Class E**		**Class D**

Table 9-26: IHIA for Riparian Habitats

Riparian	Wonderfonteinspruit		Leeuspruit	
	Average Score	Score	Average score	Score
Indigenous vegetation removal	13.33	7.46	11.00	5.7
Exotic vegetation encroachment	25	13	10.00	4.8
Bank erosion	25	13	13.33	7.5

Riparian	Wonderfonteinspruit		Leeuspruit	
	Average Score	Score	Average score	Score
Channel modification	25	13	15.00	7.2
Water abstraction	11.66	6.53	6.67	3.5
Inundation	20.33	8.13	8.33	3.7
Flow modification	8	2.88	13.33	6.4
Water quality	10	3.2	16.67	8.7
Total Riparian	**42.56**		**52.6**	
Category		**Class D**		**Class D**

9.1.7.3 Habitat Assessment

9.1.7.3.1 Integrated Habitat Assessment System

The IHAS was specifically designed to be used in conjunction with the SASS5, benthic macroinvertebrate assessment. The IHAS assesses the availability of the biotopes at each site and expresses the availability and suitability of habitat for macroinvertebrates, which is determined as a percentage, where 100% represents "ideal" habitat availability. A description based on the IHAS percentage scores is presented in Table 9-27.

Table 9-27: Description of IHAS scores with the respective percentage category (McMillan, 1998)

IHAS Score (%)	Description
>75	Very Good
65–74	Good
55–64	Fair/Adequate
<55	Poor

The results of the IHAS are presented in Table 9-28, with the invertebrate biotope diversity results provided in Table 9-29. The results of the IHAS show that invertebrate habitat is suitable or fair at monitoring locations WON1 and WON4 and poor at monitoring locations LEEU1 and LEEU 2.

Table 9-28: IHAS Results for the WRTRP

Site	WON1	WON4	LEEU1	LEEU2
Flow	Moderate	Fast	Slow	Slow
Score	63	60	33	44
Suitability	Fair	Fair	Poor	Poor

Table 9-29: Invertebrate Biotope Diversity

Biotope	WON1	WON4	LEEU1	LEEU2
Stones in current	4	4	3	1
Stones out of current	1	0	2	1
Bedrock	4	0	0	1
Aquatic Vegetation	1	3	0	0
Marginal Vegetation In Current	3	3	2	2
Marginal Vegetation Out Of Current	4	0	3	3
Gravel	3	0	3	1
Sand	3	2	3	1
Mud	2	3	2	3
Biotope Score	25	15	18	13
Biotope Score (%)	**56**	**33**	40	28
Biotope suitability	**Good**	**Fair**	**Fair**	**Poor**

9.1.7.3.2 South African Scoring System Version 5

The SASS5 is the current biological index being used to assess the status of riverine macroinvertebrates in South Africa. According to Dickens and Graham (2002), the index is based on the presence of aquatic invertebrate families and the perceived sensitivity to water quality changes of these families. Different families exhibit different sensitivities to pollution, these sensitivities range from highly tolerant families (e.g. Muscidae and Psychodidae) to highly sensitive families (e.g. Oligoneuridae). SASS5 results are expressed both as an index score (SASS5 score) and the Average Score Per recorded Taxon (ASPT value).

All SASS5 and ASPT scores are compared with the SASS5 Data Interpretation Guidelines (Dallas, 2007) for the Highveld lower ecoregion. This method seeks to develop biological bands depicting the various ecological states and is derived from data contained within the Rivers Database and supplemented with other data not yet in the database. Table 9-30 illustrates the biological banding and classification.

Table 9-30: Highveld Low Biological Banding

Class	SASS5 Score	ASPT	Condition
A	>123	>5.6	Natural/unmodified
B	83-122	5.5–5.8	Minimally modified
C	64–82	5.1–5.5	Moderately modified
D	51–63	4.6–5.1	Largely modified
E	<50	<4.6	Seriously modified

The results of the SASS5 assessments for the project area are provided in Table 9-31 and indicate that the sampling locations are largely to seriously modified.

Table 9-31: SASS5 Results for the Project Site

	High Flow Survey				Low Flow Survey	
Site	**WON1**	**WON4**	**LEEU1**	**LEEU2**	**WON1**	**WON4**
SASS5	35	62	18	58	36	56
Taxa	10	16	6	14	10	12
ASPT	3.5	3.8	3	4.14	3.6	4.6
Category	E	D	E	D	E	D

9.1.7.3.3 Macroinvertebrate Assessment Index

The MIRAI was used to provide a habitat-based cause-and-effect foundation to interpret the deviation of the aquatic invertebrate community from the calculated reference conditions for the Highveld Lower Ecoregion. This does not preclude the calculation of SASS5 scores if required (Thirion, 2007). The four major components of a stream system that determine productivity for aquatic macroinvertebrates are as follows:

- Flow regime;
- Physical habitat structure;
- Water quality; and

- Energy inputs from the watershed Riparian vegetation assessment.

The results of the MIRAI provide an indication of the current ecological category and therefore assist in the determination of the PES. The MIRAI scores are provided in Table 9-32.

Table 9-32: MIRAI Scores for the WRTRP

Invertebrate Metric Group	Wonderfonteinspruit	Leeuspruit
	Score Calculated	**Score Calculated**
Flow modification	45.7	52
Habitat	52.5	55
Water Quality	40.1	50
Connectivity and seasonality	24.6	72
Ecological Score	**41**	**57.3**
Invertebrate Category	**Class D**	**Class D**

The results of the IHAS and SASS5 biotope assessment indicates that there is sufficient habitat to support a diverse community of macroinvertebrates at the sites considered in the Wonderfonteinspruit and Leeuspruit systems.

Despite the available habitat, seriously and largely modified classes were derived for the SASS5 assessments. These low scores are expected to be related to poor water quality in the river systems and due to flow modification.

9.1.7.4 Present Ecological Status

The results of the ecological classification and PES for the considered water resources are provided in Table 9-33. The systems are considered to be Class D/E or largely to seriously modified.

Table 9-33: Present Ecological Status

Category	Wonderfonteinspruit		Leeuspruit	
	Score	**Ecological category**	**Score**	**Ecological category**
Riparian Habitat Ecological Category	42	Largely modified	52	Largely modified
Macroinvertebrate Ecological Category	39	Largely modified	57.3	Largely modified
Ecostatus		**Largely/Seriously modified**	**Largely modified**	

9.1.8 Wetlands

The Wetland Impact Assessment for the WRTRP is provided in Appendix K.

The WRTRP area spans over several quaternary catchments and therefore is characterised by several different watercourses as summarised in Section 9.1.5. The project area is found to have many valley bottom systems which mostly correlate to the rivers and their tributaries. These systems are both channelled and unchannelled. There are also multiple pan systems that occur within the area.

The majority of river systems associated with the project area are largely modified. The modification of these systems is largely attributed to the location of the sources of the associated river systems, which are located within urban and industrial areas and associated impacts to instream and riparian conditions have resulted in the large modification of the systems. The project area is characterised by the valley bottom systems associated with the Wonderfonteinspruit, Leeuspruit, Loopspruit and other tributaries. In addition, in the midslopes and valley heads of the catchments, there are pan and seep systems associated with the landscapes. The National Freshwater Ecosystem Priority Areas (NFEPA) wetlands within the Ultimate Project area are shown in Plan 21.

Plan 21: NFEPA Wetlands for the WRTRP

9.1.8.1 Wetland Delineation and Classification for Kloof Mining Right Area

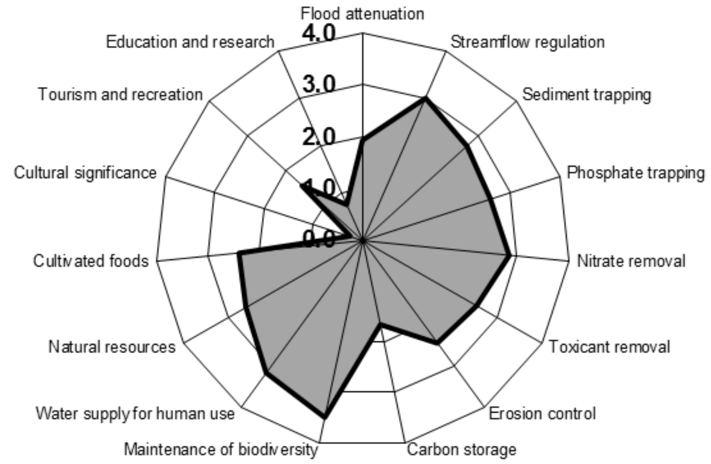
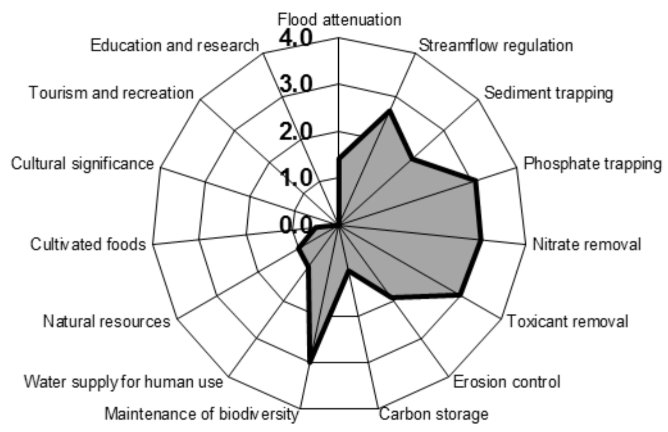
Wetland delineations were undertaken for the Kloof Mining Right area. A description of the identified wetland units is summarised in Table 9-34. The identified wetlands are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems and has contributed to the direct loss of wetland habitat. The WET-Health assessment was undertaken to determine the PES and Ecological Importance Sensitivity (EIS) for each delineated wetland, as summarised in Plan 22 and Table 10-35.

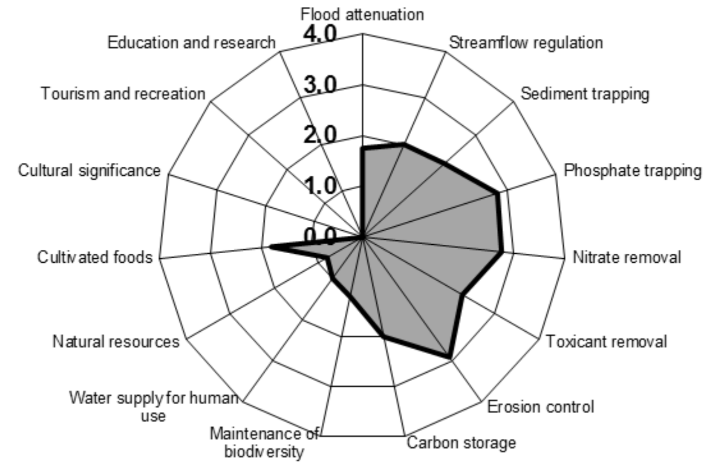
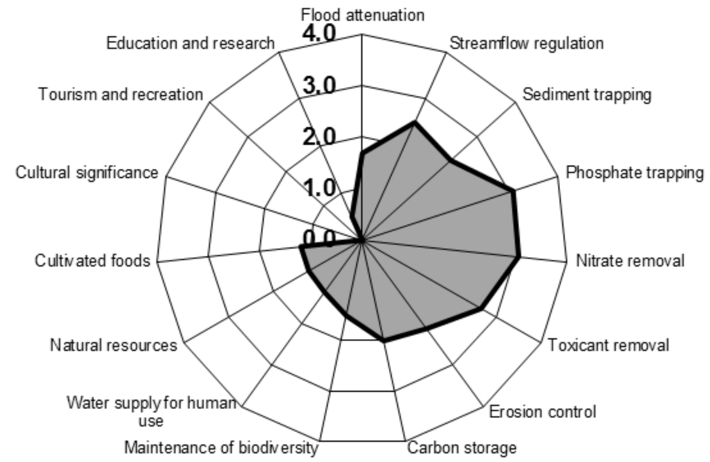
Table 9-34: Wetlands Units occurring in the Kloof Mining Right Area

Wetland type	Description	Inputs	Throughputs	Outputs
Channelled Valley Bottom CVB	Valley bottom areas with a well-defined stream channel but lacking characteristic floodplain features. Water inputs are mainly from adjacent slopes while the channel itself is typically not a major source of water for the wetland.	Channel flow and adjacent hill slopes	Diffuse flow on elevated valley bottom and channel flow	Channel flow and evapotranspiration
Valley Bottom without a Channel VB	Valley bottom areas of low relief with no clearly defined stream and situated on alluvial fill	Channel entering the wetland and adjacent slopes.	Diffuse surface and subsurface flow	Channel outflow and evapotranspiration.
Depression / Pan	A basin shaped area with a closed elevation contour that usually is not connected via an outlet to the drainage network.	Variable	Insignificant	Evapotranspiration

Plan 22: Delineated Wetlands

Table 9-35: Wetland Findings

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
C22J	**8**	**CVB**	754.3	This channelled valley bottom system is associated with the Leeuspruit. Wetland vegetation recorded in the studied transects included Common Reed (*Phragmites australis),* Common Bulrush (*Typha capensis*) and Common Rush (*Juncus effuses).* This river and wetland are greatly impacted by the surrounding mining and industrial activities as well as farming practices. This includes impacts to the hydrology due to the river being dammed multiple times in the upper reaches, as well as significant impacts to the natural vegetation as dense stands of alien invasive trees are present within the wetland and the catchment, mainly Black Wattle (*Acacia mearnsii*). The industrial and agricultural land-uses in the catchment of the Leeuspruit have led to the water quality being significantly compromised as well as over sedimentation occurring as erosion is a problem. This therefore leads to the characteristic dominance of parts of the wetland and stream by the Common Reed (*Phragmites australis)* and Common Bulrush (*Typha capensis*). The EIS of this wetland was determined to be moderate as the Leeuspruit is an important tributary to the Vaal River. The system therefore plays an important role in water supply for human use. There is diversity still within the system that would support important species and thus the wetland plays a role in the maintenance of biodiversity. As a main river system, the wetland is also playing an important service for streamflow regulation and trapping of sediments. Although this wetland has received a low health state of D (largely modified), it is still a very important wetland and river and all efforts to protect and rehabilitate it should be done. This wetland and river interacts with the proposed infrastructure on more than one occurrence. The CPP is found in close proximity to this wetland, which interacts with a wetland tributary to the Leeuspruit. From the CPP, a pipeline containing the residual tailings will run southwards, crossing over this wetland towards the new RTSF location, which is found adjacent to this wetland further downstream. The RTSF and the associated PCD is proposed to be immediately southwest of this wetland; between this wetland and Wetland 11. This wetland is delineated as a large connected river and channelled tributaries and therefore is the wetland that is to be the most interacted with for the proposed project infrastructure.	D 5.3	Moderate 2.0	
	9b	**VB**	11	This wetland consists of two unchannelled valley bottom wetlands which head westwards towards Wetland 8 associated with the Leeuspruit. The natural vegetation of the wetlands is impacted by the surrounding land uses which are predominantly cattle grazing, infrastructure and mining related activities. An existing pipeline runs through the wetlands and was found to be leaking; the pipe appears to have been leaking for a significant time period through investigation of historical imagery. This has also led to permanently wet conditions being created that may not be present naturally, thus altering the natural hydrological conditions of the wetland. Industrial activities and infrastructure is found upstream of and around these wetlands; which include a TSF, substation and processing plant; this impacts on the water quality. Due to the current impacts, the wetlands were found to be of low ecological importance and their main ecological services provided are trapping and some removal of the toxicants and sediments that are unnaturally fed to this system due to the surrounding land-use impacts. The wetland, too, would play a role in maintenance of biodiversity as it is a sensitive ecological system and is a tributary of the Leeuspruit. These wetlands will be impacted by the proposed placement of the CPP as well as the pipelines leading to and from the CPP. 11 ha is designated to be removed by placement of the CPP.	D 5.2	Low 1.0	

Quaternary Catchment	Wetland and HGM unit		Area (ha)	Description and Associated infrastructure	PES	EIS	EcoServices Radial Plot
	10	**PAN**	38.54	Five pans, between 100-250 m apart, form a cluster across a relatively flat topography. These pans were small and shared the same catchment. Found completely within agricultural farms of maize and sunflowers, the natural vegetation of this area has been significantly altered. This has also impacted the soil, which comprised of mostly black turf, showing limited signs of wetness. In some places, soft and hard plinthite had been displaced by the farming activities. Due to these impacts, the pans are characterised by limited natural vegetation indicators, and therefore dominated by plants such as Garden Cosmos (*Cosmos bipinnatus*) (a problem plant) and Garden Bristle Grass (*Setaria pumila*), which is a grass that dominates in disturbed places especially where water collects. These pans are largely modified and their EIS was scored to be low. Their main role is trapping of inputs and erosion control. Due to these pans being transformed hydrologically as well as having little to no natural vegetation left as they are found fully within agricultural fields, their role in biodiversity maintenance is little to none. These pans are designated to be destroyed through the placement of the new RTSF.	D 5.0	Low 1.0	
	11	**VB**	811.6	This is an extensive unchannelled valley bottom wetland system leading to the Leeuspruit. Similar to the other wetlands in this area, much of the natural vegetation has been removed and, thus, the remaining wetland indicator species include Garden Cosmos (*Cosmos bipinnatus*), Yellow Nut Sedge (*Cyperus esculentus*), Garden Bristle Grass (*Setaria pumila*) and Golden Bristle Grass (*Setaria sphacelata var. sericea*), most of which are or can be problem plants. There is a spring present in this wetland at 26°31'15.61"S; 27°36'44.71"E according to the farm owner; it was not observed to be flowing at the time of assessment. This wetland is significantly impacted by the surrounding land-use of agricultural practices. Through investigation of historical imagery, a portion of this wetland has been ploughed through the entirety of the wetland width. This doesn't seem to be the case for the entire wetland length where crops are only planted up to the approximate wetland edge. Given the highly compromised hydrology of this wetland as well as very little natural vegetation remaining, this wetland is found to be low in EIS. Due to the extensive nature of this diffuse unchannelled wetland, the main ecological services it provides is streamflow regulation (as it leads towards the Leeuspruit) and phosphate and nitrate trapping. This wetland is immediately adjacent to the placement of the new RTSF. Some small upper parts of the wetland, 4.4 ha, will be removed as it falls within the footprint.	D 5.2	Low 1.0	

9.1.9 Topography and Visual

The Topography and Visual Impact Assessment is provided in Appendix L.

The nearest settlement to the Kloof Mining Right area activities is Hermina situated approximately 750 m northeast of the proposed CPP. The nearest major town is Westonaria situated approximately 12.3 km north-northeast of the proposed CPP.

The residential areas and road users near the proposed activities are all potential visual receptors of the proposed project. The closest towns and settlements, as well as their direct distance and direction from the proposed activities are summarised in Table 9-36. All distances are straight line distances measured from the edge of the proposed activities to the centre of the towns / settlements unless otherwise stated.

Table 9-36: Closest Towns and Settlements to the Kloof Mining Right Area

Name	Type	Direct Distance	Direction	Proposed Activity
Hermina	Settlement	0.75 km	NE	CPP
Glenharvie	Settlement	3.5 km	N	CPP
Leeudrif	Settlement	6.6 km	SW	RTSF
Libanon	Settlement	7.1 km	N	CPP
Hillshaven	Settlement	7.5 km	NE	CPP
East Driefontein	Other Town	10.2 km	WNW	CPP
Fochville	Other Town	10.2 km	W	RTSF
Westonaria	Major Town	12.3 km	NNE	CPP
Vlakplaas	Settlement	12.7 km	SSE	RTSF
Jagfontein	Settlement	12.8 km	NE	CPP
Losberg	Settlement	13 km	SW	RTSF
Patriotsfontein	Settlement	14.9 km	SSW	RTSF
Bank	Settlement	16 km	NW	CPP
Venterspos	Other Town	17.1 km	N	CPP
Bekkersdal	Other Town	17.8 km	NE	CPP
Lawley Estate	Other Town	19.9 km	ENE	CPP

The topography of the Kloof Mining Right area is undulating with ridges and river valleys. The topographical model indicates that the elevation of the Kloof Mining Right area increases from 1 456 metres above mean sea level (mamsl) in the Loopspruit River valley in the southern part of the project area to 1 791 mamsl on the ridge running east to west. In the northern part of the Kloof Mining Right area, the elevation decreases from this central ridge to approximately 1 540 mamsl in the Wonderfonteinspruit River valley.

The majority of the project area has gentle slopes of less than 7°. Steeper slopes of between 7.1° and 11.6° occur on the slopes of the ridges and river valleys. The slope aspect / direction of the Kloof Mining Right area is not in any specific direction.

The elevation of the proposed CPP decreases from 1 609 mamsl in the north to 1 589 mamsl in the west. The slope of the proposed CPP is undulating and ranges from 0° to 6.2°. The proposed CPP is surrounded on the north, east and south by ridges. These ridges are expected to provide some screening of the proposed CPP.

The elevation of the proposed RTSF decreases from 1 541 mamsl in the northwest to 1 498 mamsl in the southeast. The slope of the proposed RTSF is gently undulating and ranges from 0° to 2.8°. The proposed RTSF is situated on a spur between the Leeuspruit River and one of its tributaries.

9.1.10 Noise

The Noise Impact Assessment is attached as Appendix M.

9.1.10.1 Current Ambient Noise

The current noise soundscape of the WRTRP area has been characterised by means of baseline noise measurements near the major noise emitting components from the WRTRP. The measurements were carried out in accordance with the Gauteng Noise Control Regulations. The measured baseline will be compared to the guidelines of the SANS 10103:2008 which compares environmental noise with respect to annoyance and speech communication. The SANS 10103:2008 noise level guidelines for districts is provided in Table 9-37.

Table 9-37: Acceptable Rating Levels for Noise in Districts (SANS 10103:2008)

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
RESIDENTIAL DISTRICTS						
a) Rural districts	45	45	35	35	35	25
b) Suburban districts with little road traffic	50	50	40	40	40	30

Type of District	Equivalent continuous rating level ($L_{Reg.T}$) for noise (dBA)					
	Outdoors			Indoors, with open windows		
	Day-night	Day-time	Night-time	Day-night	Day-time	Night-time
	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]	$L_{R,dn}$ [a]	$L_{Req,d}$ [b]	$L_{Req,n}$ [b]
c) Urban districts	55	55	45	45	45	35
NON-RESIDENTIAL DISTRICTS						
d) Urban districts with some workshops, with business premises, and with main roads	60	60	50	50	50	40
e) Central business districts	65	65	55	55	55	45
f) Industrial districts	70	70	60	60	60	50
NOTE 1 If the measurement or calculation time interval is considerably shorter than the reference time intervals, significant deviations from the values given in the table might result.						
NOTE 2 If the spectrum of the sound contains significant low frequency components, or when an unbalanced spectrum towards the low frequencies is suspected, special precautions should be taken and specialist advice should be obtained. In this case the indoor sound levels might significantly differ from the values given in columns 5 to 7.						
NOTE 3 In districts where outdoor $L_{R,dn}$ exceeds 55 dBA, residential buildings (e.g. dormitories, hotel accommodation and residences) should preferably be treated acoustically to obtain indoor $L_{Req,T}$ values in line with those given in table 1.						
NOTE 4 For industrial districts, the $L_{R,dn}$ concept does not necessarily hold. For industries legitimately operating in an industrial district during the entire 24 h day/night cycle, LReq,d = LReq,n =70 dBA can be considered as typical and normal.						
NOTE 5 The values given in columns 2 and 5 in this table are equivalent continuous rating levels and include corrections for tonal character, impulsiveness of the noise and the time of day.						
NOTE 6 The noise from individual noise sources produced, or caused to be produced, by humans within natural quiet spaces such as national parks, wilderness areas and bird sanctuaries, should not exceed a maximum Weighted sound pressure level of 50 dBA at a distance of 15 m from each individual source.						
a The values given in columns 2 and 5 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness of the noise and the time of day.						
b The values given in columns 3, 4, 6 and 7 are equivalent continuous rating levels and include corrections for tonal character and impulsiveness.						

The noise monitoring locations are provided in Plan 23 and Table 9-38. The criteria used to site the measurement locations include:

- The locations nearest noise sensitive receptors to the proposed CPP and RTSF, as well as the Driefontein 3 and 5 TSFs; and
- The locations served as suitable reference points for the measurement of ambient sound levels surrounding the proposed project area. The noise measurement locations cover rural as well as suburban and urban areas that represent a comprehensive soundscape of the area.

Table 9-38: Noise Measurement Locations

Site ID	Farm/location	Category of Receiver	GPS Coordinates
N1	Leslie Williams Private Hospital	Urban/industrial	26° 24.077'S & 27° 25.322'E
N2	Wildebeestkuil 360 IQ portion 6	Rural	26° 28.459'S & 27° 36.615'E
N3	Letsatsing Village	Suburban	26°15'17.95"S & 28°29'22.04"E
N4	Rietfontein 349 IQ portion 42	Rural	26° 25.346'S & 27° 37.832'E

Plan 23: Noise Monitoring Locations

The results from the noise meter recordings for all the sampled points as well as the rating limits according to the SANS 10103:2008 guidelines are presented in Table 9-39.

Table 9-39: Results of the Baseline Noise Measurements

Sample ID	SANS 10103:2008 Rating Limit					
	Type of district	**Period**	**Acceptable rating level dBA**	**$L_{Areq,T}$ dBA**	**Maximum/Minimum dBA**	**Date**
N1	Urban	Daytime	60	52	80/ 39	23/02/2015
		Night time	50	52	68 / 41	23/02/2015
N2	Rural	Daytime	45	51	87 / 29	26/02/2015
		Night time	35	43	67 / 28	26/02/2015
N3	Suburban	Daytime	50	44	77 / 38	02/03/2015
		Night time	40	40	66 / 37	02/03/2015
N4	Rural	Daytime	45	45	72 / 29	05/03/2015
		Night time	35	48	70 / 37	05/03/2015
	Indicates current $L_{Aeq,T}$ levels above either the daytime rating limit or the night time rating limit					

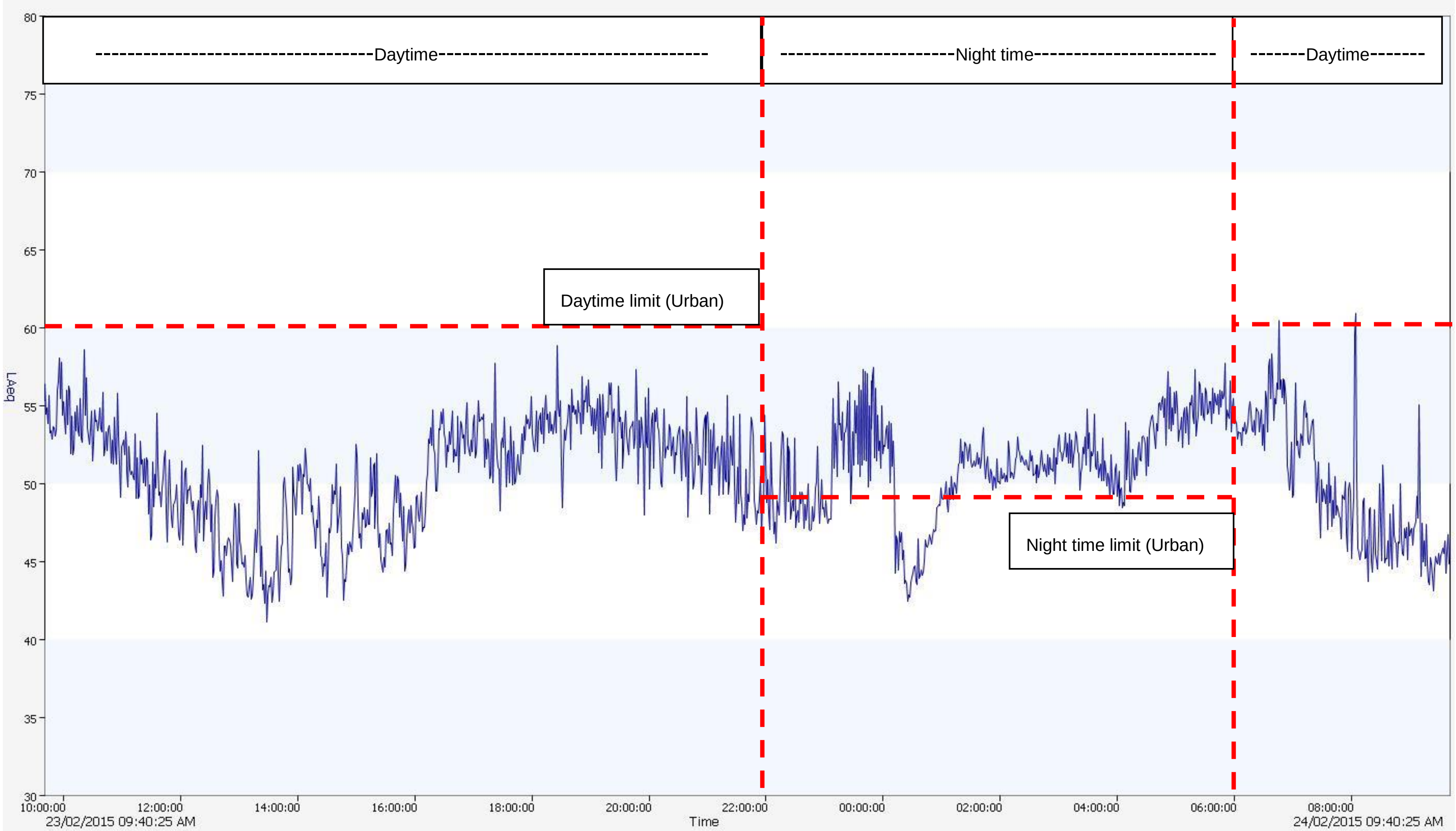


Figure 9-6: Noise Time History Graph for Monitoring Site N1

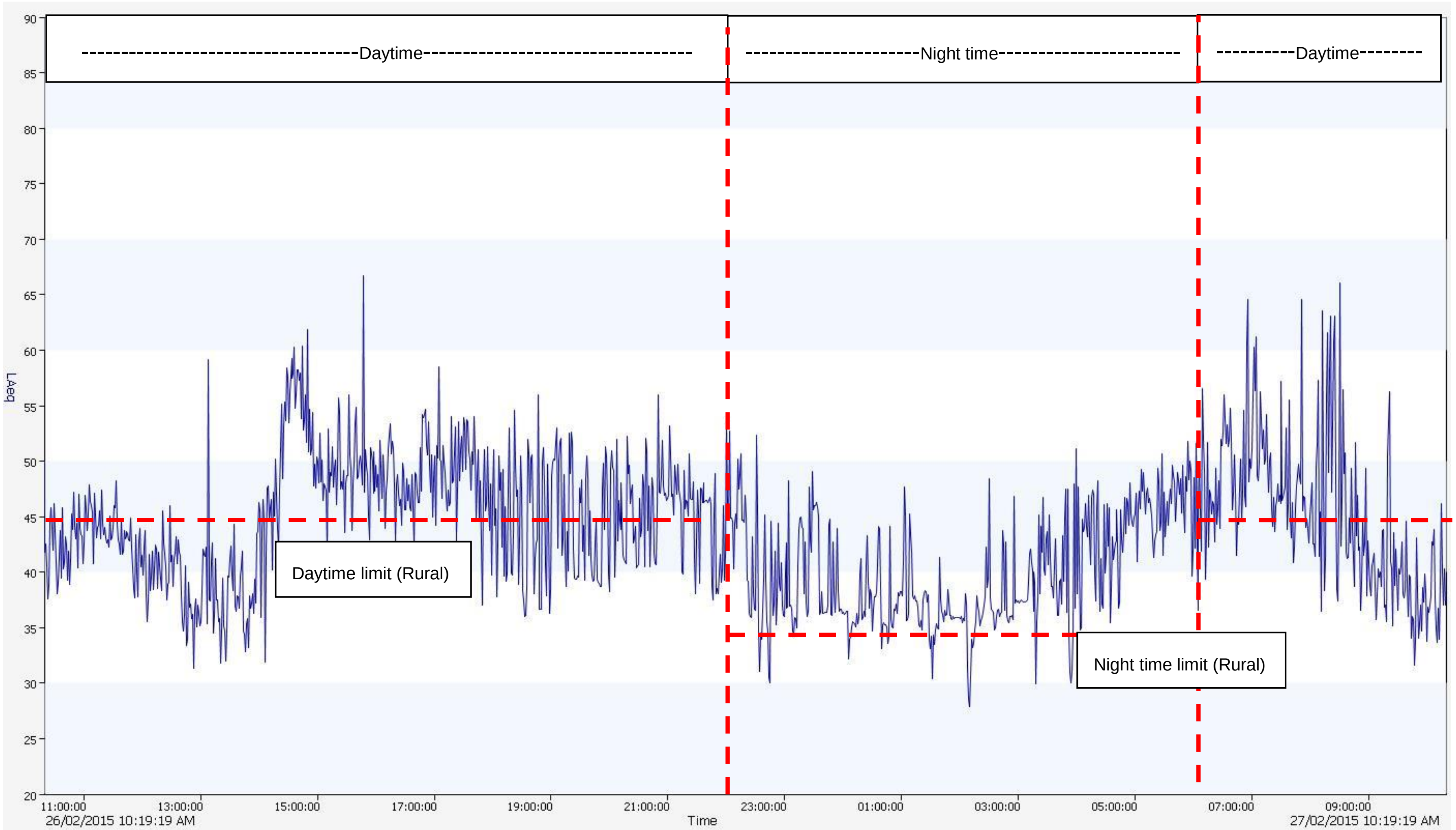


Figure 9-7: Noise History Graph for Monitoring Site N2

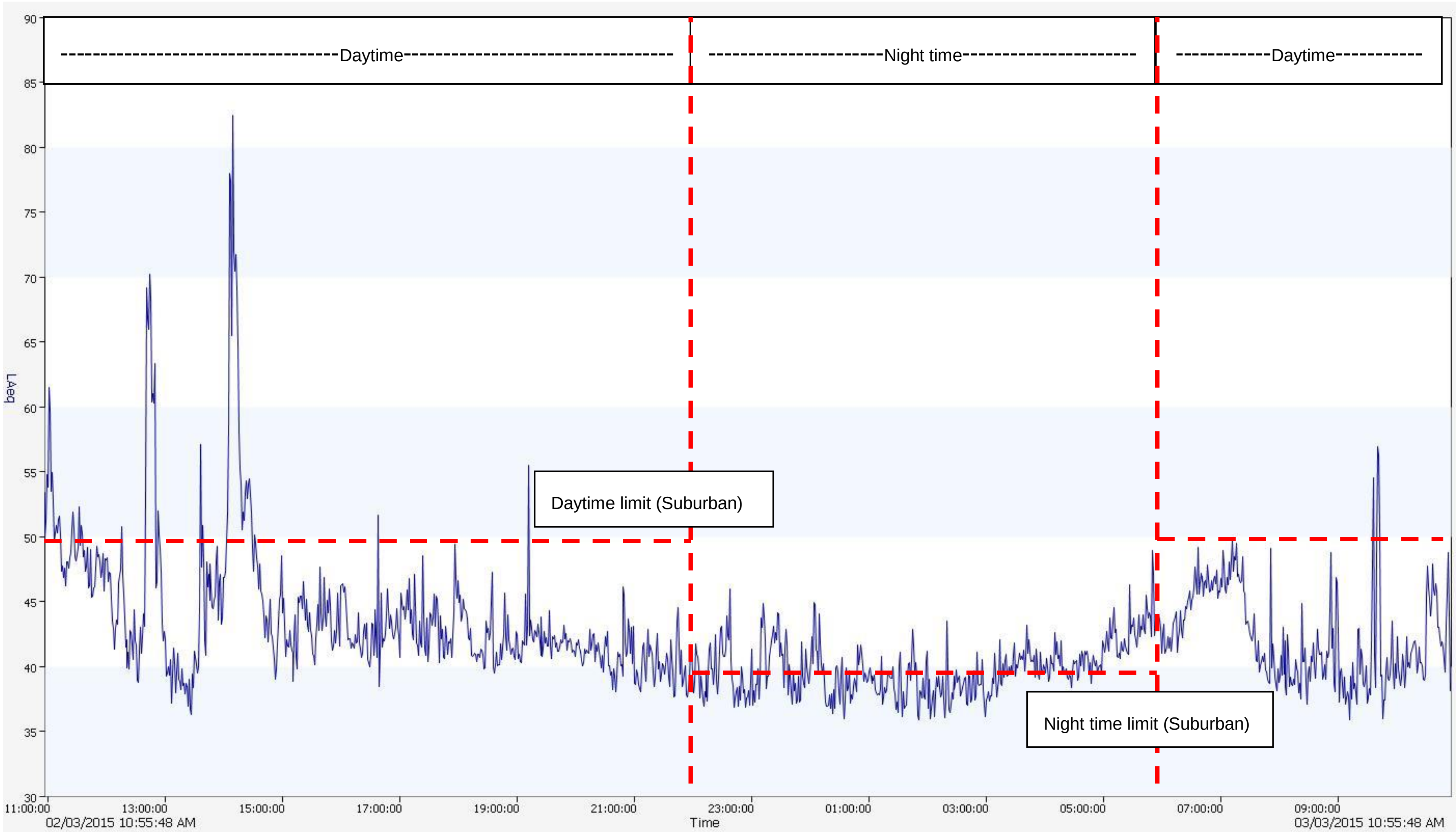


Figure 9-8: Noise History Graph for Monitoring Site N3

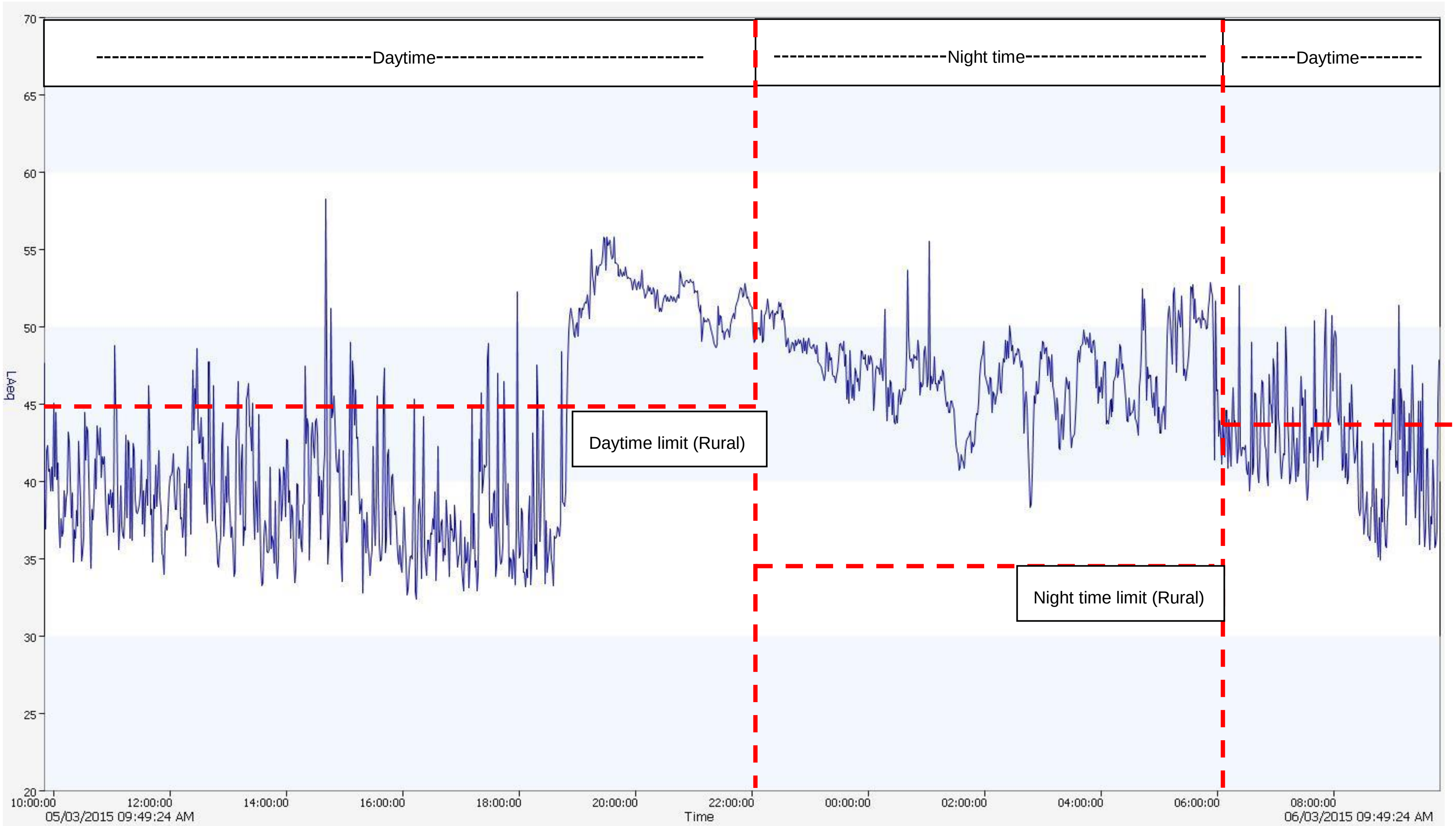


Figure 9-9: Noise History Graph for Monitoring Site N4

9.1.10.1.1 Ambient Noise at the Proposed RTSF (N2)

Noise monitoring location N2 (RTSF) was taken at the nearest noise sensitive receptor, which was the farmstead of Mr Frans de Bruyn on Portion 6 of Wildebeestkuil 360 IQ. The location is an agricultural farmstead and was determined to be rural.

The baseline noise results indicated that the ambient noise levels are above the daytime and night time noise guidelines for rural districts. The overall ambient noise levels at N2 were impacted by birdsong and vehicle movement on the Fochville Road 200 m south of the monitoring location. During the night time *Gryllidae* (crickets) were the main noise source.

9.1.10.1.2 Ambient Noise at the Proposed CPP (N4)

Noise monitoring location N4 (CPP) was taken at the nearest noise sensitive receptor, which is the farmstead, portion 42 of Rietfontein 349 IQ, leased by SGL. The location is an agricultural farmstead and was determined as rural.

The baseline results indicated that the existing ambient noise is at the same level as the daytime noise guideline for rural districts. The ambient daytime noise levels at N4 were impacted by operational activities at Kloof 4, birdsong and intermittent aircraft flying over the area, with night time noise levels being impacted from the Kloof 4 operations as well as *Gryllidae* (crickets) and *Cicada* with intermittent birdsong. The night time baseline results indicated that the existing ambient noise is above the night time noise guideline for rural districts.

9.1.10.1.3 Ambient Noise Levels for the Driefontein 3 and 5 TSFs (N1 and N3)

Noise monitoring locations N1 and N3 are located at the nearest sensitive receptors at Driefontein 5 TSF and Driefontein 3 TSF respectively. The noise monitoring locations were deemed to be urban industrial areas as the TSFs are associated with the Driefontein Mining Right area and Driefontein Gold Mine.

Both monitoring locations were below the SANS thresholds for daytime and night time levels. Noise levels were a result of mining activities and vehicle traffic, as well as the Letsatsing Combined School in the case of Driefontein 3 TSF.

9.1.11 Heritage

The Heritage Impact Assessment is included as Appendix N.

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography. Karst topography refers to landscapes formed from the dissolution of soluble rocks, including dolomite and limestone. Karst topography is characterised by underground drainage systems with sinkholes, dolines and caves. This geological phenomenon creates karst caves that can be filled with fine to coarse-grained alluvium during periodic flooding. The alluvium may be represented by bodies of breccia, sandstone and siltstone which have an increased potential to contain archaeological material. This geological feature is one of the motivating factors in implementing the proposed project. Many of the historical TSFs are at risk as the potential for sinkholes is high in some areas.

Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger area under consideration here. Stone Age lithics recorded have been found as surface scatters outside of any discernible context thereby limiting the information potential and overall significance of these resources. Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg. Only one potential stonewalled site has been identified in the routing option for the powerlines on Portion 73 of the farm Doornpoort 347 IQ. No other archaeological sites have been identified within the development footprint of the proposed infrastructure associated with the WRTRP.

Within regional, local and site specific contexts, the project is located in historically significant mining-industrial and agricultural-rural cultural landscapes. In terms of the mining landscape, there are several features and markers such as many of the historical TSFs created by the original mines established during the first half of the 20th century. The agricultural landscape is represented in turn by several structures and werwe that were recorded during the scoping survey completed on 16 February 2015. The potential impacts to these will be assessed during the Impact Assessment phase of the project.

9.1.11.1 Kloof Mining Right Area Heritage Resources

The identified heritage resources associated with the Kloof Mining Right area are provided in Plan 24. The werwe identified have been deemed to have a negligible cultural significance (Appendix N). The heritage resources identified as being of significance were two burial grounds which were determined to have a cultural significance of very high. Burial grounds and graves are protected under Section 36 of the NHRA.

Burial ground site BGG-015 contained at least 27 graves; three graves had granite headstones, one is marked with a board and 23 consist of stone packed cairns. The burial ground is unfenced and unkempt and is located between agricultural fields and access roads and within the proposed RTSF development footprint.

Burial ground site BGG-022 is also situated within the proposed RTSF footprint along a fence line and contains at least 4 graves; none of the graves have headstones. Burial ground site BGG-023 is located adjacent to the pipeline that extends from the CPP to RTSF contains at least 15 graves comprising of a mixture between stone dressing, concrete dressing and formal headstone. Potential families associated with the burial ground are the Rapoo and Ntaopane. The graves where dates could be identified indicate that the burials are older than 60 years. At present, the burial ground is unmaintained and in an unkempt state.

Burial ground site BGG-027 is also situated along the pipeline route between the CPP and RTSF. The burial ground contains a single grave associated with the du Plessis family. The grave comprises concrete dressing and formal granite headstone. The grave dates to 1919, indicating that the burial is older than 60 years. At present, the burial ground is unmaintained and in an unkempt state.

Plan 24: Identified Heritage Resources

9.1.12 Socio-Economic

The Social Impact Assessment for the WRTRP is provided in Appendix O, with the Macro-economic Impact Assessment in Appendix C.

The West Rand DM encompasses 2 442 km^2 of the province's land mass and is predominantly rural. The main economic hubs in the DM are Krugersdorp, Randfontein, and Westonaria; the dominant land uses in the region include mining, residential, and agriculture. Developments of residential settlements are concentrated towards the east of the district, and are reflective of current developmental dynamics and historical patterns and trends. As a result of the mining activities, and due to the dolomitic nature of the land in the district, land use patterns are often dispersed. This has meant that major economic centres in the district take on a fragmented form. In addition to the significant impact mining has had on the district, tourism and conservation opportunities exist to the north and north-east of the district, while agricultural holdings in the western side of the district represent possibility for development of the agricultural sector in the region.

The dispersed main economic centres are linked by various roads and rail routes, which also provide links to areas beyond the DM. The N14 and N12 form a strong south-east and north-west linkage, while the R500 provides road connection to the north via the linkage with the N14. The R512 is the access road to Lanseria airport, and the R559 links Soweto and Randfontein.

9.1.12.1 Towns, Resources and Land Capabilities

The Westonaria LM is bordered by the Randfontein LM, Johannesburg Metropolitan Municipality, Merafong City LM, Sedibeng DM, and Emfuleni LM. The LM's residential development is generally dispersed with the dominant townships including:

- Westonaria;
- Bekkersdal;
- Hillshaven;
- Glenharvie;
- Venterspost;
- Simunye; and
- Mining towns such as Libanon and Waterpan.

The only significant business node occurs within Westonaria town's Central Business District (CBD); the rest of the Westonaria LM is characterised by scattered residential areas and various mining developments. The main reason for the perceived low population density in the LM is due to the dolomitic conditions in the region. Westonaria town is linked to Johannesburg via the N12; various developments are planned for along this route.

The only notable agricultural holdings areas in the LM are located to the north-eastern and central parts of the district. The local government, based on the vision of a global city, or the Unicity, supports future development to the west of the LM. Development on this side of the LM would mean that the area's development follows the natural market forces, ensuring that commercial and industrial developments remain close to the current and future workforces.

The Westonaria LM's Spatial Development Framework makes mention of the fact that apart from the development potential to the west of the LM, as discussed above, the south of the LM has been demarcated for mining and conservation. The dolomitic nature of the areas located to the north of the LM make the land primarily suitable for the agricultural and mining activities. In addition to mining, the northern regions of the LM have potential for the development of small-scale or subsistence farming opportunities.

Land uses in the Merafong City LM can be categorised in three main divisions, i.e. agriculture, mining, and residential. Agriculture is the dominant land use in the LM, followed by mining and residential land uses, with the latter accounting for approximately 8% of the total land area of the LM.

The municipality's human settlements are relatively scattered due to the mining activities taking place, the prominent settlements are:

- Fochville;
- Carletonville;
- Welverdiend;
- Greenspark;
- Wedela;
- Blyblank;
- Khutsong; and
- Kokosi.

Carletonville is located to the north of the LM, which is also where the majority of the municipality's high value agricultural land is located. The Carletonville-Khutsong-Welverdiend area is also the LM's most populous region. The townships of Kokosi and Greenspark and the relatively wealthier Fochville is located to the South of the LM, with the central part of the LM being characterised by mining activities and the associated scattered housing developments. As with the rest of the West Rand mining belt, the LM's infrastructure development is hindered by the high occurrence of dolomite.

The economy of Merafong is dominated by the mining activities, which has led to the development of dispersed human settlements leading to a loss of purchasing power across the region as central town functions are not well developed in the LM.

9.1.12.2 Demographic Profile and Income Levels

Based on a combined population of 333 444, the Westonaria and Merafong City LMs comprise just about 40.1% of the West Rand DM's total population, which was estimated at 831 241 individuals in 2013. The average household size in the DM is 2.8. Based on Census 2011 (Stats SA, 2015), approximately 65% of households in the district are living in formal residential properties; the remaining 35% reside in informal or traditional dwellings. In South Africa, approximately 71% of households reside in formal residences (Stats SA, 2015). Traditionally, smaller household sizes are indicative of an increase in development, however, based on the relatively high number of households living in informal dwellings and considering the fact that the region is classed as a mining region it can be assumed that in this case the smaller household size is rather a result of migrant workers working or searching for opportunities, with the aim of sending money home to their families.

The male population of the West Rand DM exceeds the female population at 52% versus the 48% females residing in the region (Stats SA, 2015). The fact that 71% of the DM's population is of working age (Stats SA, 2015), i.e. between the ages of 15 and 65, could be seen as an additional indicator of the fact that the area attracts migrant workers. Moreover, in the two local municipalities within which Phase 2 of the project will be located an even higher number of individuals are of working age with 73.3% in the Westonaria LM, and 72.6% in the Merafong City LM (Stats SA, 2015).

Within the Westonaria and Merafong City LM's, the proportion of the population aged 20 and older with no education is greater than in the district, with 6.2% and 6% versus the 5.0% observed in the DM (Stats SA, 2015). Furthermore, the percentages of individuals who have obtained a matric qualification in these local municipalities are also below that of the district, province, and even South Africa.

The average income within the Westonaria and Merafong City LMs was significantly lower than that of the other study areas at R5 597 and R6 625 per month (in 2011 in current prices), respectively (based on Stats SA, 2015).

9.1.12.3 Economy and Sectoral Structure

In 2013, the economies of the Westonaria and Merafong City LM's represented 35.8% of the total GDP of the West Rand DM, which was valued at R61 466 million (2013 current prices). Between 2003 and 2013, the West Rand DM economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year.

The West Rand economy is primarily based on the tertiary services with 66.7% of its GDP being generated by industries in this sector. Finance and personal services, as well as government services are the major contributors to the Western Rand economy. Its dependency on mining though is also quite substantial as the mining sector contributed 11.2% of GDP in the district. It should be noted that manufacturing is also quite prominent in the West Rand economy with 15.7% contribution to its GDP.

The Westonaria and Merafong City economies though are far more dependent on the mining industry than the district in general.

9.1.12.4 Labour Force and Employment Structure

In South Africa, the unemployment rate is defined as comprising of those individuals aged between 16 and 65 years old, actively looking for employment that are unable to find gainful opportunities; it therefore does not take into consideration discouraged job seekers. Based on Stats SA's Census 2011 data, the West Rand DM had 590 206 individuals of working age in 2011 with 3.3% of these individuals being discouraged job seekers. The situation was slightly worse in the Westonaria and Merafong City LMs, where 4.1% and 3.6% respectively of the working age population groups were discouraged job seekers; however, it was still better than at the national level where the figure was 5.5% (Stats SA, 2015).

The labour force participation rate in the West Rand DM was estimated at 56.9% in 2013. The unemployment rate in the West Rand DM was 24.4% in 2013. In the Westonaria LM, unemployment was recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%.

Between 2003 and 2013, the economy of Westonaria, due to the decline in its mining sector's production output lost over 24 000 employment opportunities. At the same time, the Merafong City economy managed to increase its employment by over five thousand people during the same period, despite experiencing negative economic growth rate. This means that the losses in the mining sector's employment due to the contraction of that industry in the Merafong City LM were possible to offset by the increased employment in other industries.

In the West Rand DM, 75.3% of jobs are formal employment opportunities, while in the LMs formal employment opportunities comprise even a greater percentage, i.e. 81.5% and 80.5% in the Westonaria and Merafong City LMs, respectively (Quantec Research, 2015). At the same time, it is estimated that 2.4% of those employed in the West Rand DM are working in private households.

It is estimated that just about two thirds of all employment opportunities within the DM are created by the tertiary sector. Mining provides 15.0% of employment opportunities in the West Rand DM.

Within the Westonaria LM the importance of the mining sector for job security is significantly greater than in the district, as it provides 36.7% of opportunities in the LM's economy. It again shows the economy's reliance on the mining sector. In 2003, though, the mining sector contributes 74.2% of all jobs created in Westonaria; at the same time, though, the total employment in the local area was 51 409.

In the Merafong City LM, the employment structure was largely skewed towards the tertiary and mining industries. The mining sector created 42.7% of all employment opportunities in this economy in 2013 with the tertiary industries accounting for 48.8%. Unlike the situation observed in the Westonaria LM, employment in mining has increased between 2003 and 2013 despite the sector experiencing decline post 2008 period. Losses in employment in agriculture, manufacturing and finance and business service, though offset some of the employment gained during that period in mining and other industries.

9.1.12.5 Kloof Mining Right Area

Major land uses within the Kloof Mining Right area mirror the land uses for the region and include agriculture, grazing, residential, mining and business uses. Residential land use comprises both formal and informal uses. Formal structures are either occupied by land users who rent properties from mining companies and farm owners, or landowning families farming on privately owned property.

Agricultural activities within the area comprise commercial maize and soya farming, as well as livestock grazing. The largest section of commercial farming land coinciding with the primary study area is located within the proposed RTSF complex, followed by the area within the proposed CPP site. Livestock, mostly cattle, also graze throughout the Kloof Mining Right area.

An overview of the land owners and land use within the affected properties associated with the Kloof Mining Right area infrastructure are provided in Table 9-40.

Table 9-40: Farm Portions and Land Uses for the Kloof Mining Right Area Infrastructure

Infrastructure	Affected Properties		Land Ownership								Current Land Use on Property within Buffer						Occupants			Structures					
	Farm name	Portion	South Deep	Private ownership	Kloof Gold Division	Rand Uranium/Sibanye	Kloof gold mining company	Far west rand dolomitic water association	Driefontein consolidated	If private, name of landowner/s	Residential	Business	Government	Commercial cultivation	Livestock (cattle)	Mining	Landowner households	Tenants	Vulnerable households	Formal residential	Informal residential	Business	Water infrastructure	Access roads	Mining infrastructure
RTSF and ancillary infrastructure	Cardoville 364	13	x								x			x	x			x	x	x	x	x	x	x	
		8	x											x											
		RE/6	x											x											
		11	x								x			x	x				x				x		
		RE/5	x											x	x										
		RE/3	x											x	x										
		7		x						J Badenhorst	x	x		x	x		x	x	x	x	x	x	x	x	
	Kalbasfontein 365	RE/1	x											x	x									x	
	Cardoville 358	3		x						J Badenhorst				x	x									x	
		4		x						J Badenhorst				x										x	
		2		x						J Badenhorst				x	x									x	
		0		x						J Badenhorst				x	x									x	
	Droogheuwel 512	2		x						J Badenhorst				x	x										
	Wildebeestkuil 360	7		x						De Akker Trust				x	x										
		5		x						De Akker Trust				x	x										
		18		x						De Akker Trust	x	x		x	x		x	x	x	x	x	x	x	x	
		7		x						J Oosthuizen	x			x	x			x	x		x			x	
		6		x						F de Bruin	x														
RWD	Kalbasfontein 365	51	x											x	x							x			
	Cardoville 364	13	x								x			x	x		x	x	x	x	x	x		x	
		8	x											x											
Power and pipe lines from CPP – RSFT	Wildebeestkuil 360	7		x						J Oosthuizen	x			x				x	x		x			x	
	Doornpoort 347	1	x																						
		1	x										x	x										x	
		1	x								x				x			x	x		x				
		1	x								x				x			x	x		x				
		19	x																						
		18	x																						
		11	x												x										
		5	x											x	x									x	
		37		x						Unknown				x										x	
	Davonia 363	RE		x						Unknown															
		73			x										x									x	
CPP and ancillary infrastructure	Rietfontein 349	42			x									x										x	
		41			x									x											
		9			x						x							x		x					
		34			x									x											
		76			x																				
		16			x																				
		74			x																				
		32			x																				
		20			x																				

Infrastructure	Affected Properties		Land Ownership							If private, name of landowner/s	Current Land Use on Property within Buffer						Occupants			Structures					
	Farm name	Portion	South Deep	Private ownership	Kloof Gold Division	Rand Uranium/Sibanye	Kloof gold mining company	Far west rand dolomitic water association	Driefontein consolidated		Residential	Business	Government	Commercial cultivation	Livestock (cattle)	Mining	Landowner households	Tenants	Vulnerable households	Formal residential	Informal residential	Business	Water infrastructure	Access roads	Mining infrastructure
		7			x																				
		19			x																				
		4			x									x											
		39			x																			x	
		5																							
		35									x	x		x	x			x	x	x	x	x	x	x	
	Doornkloof 350	R			x						x			x				x						x	
		10			x																			x	

9.1.13 Traffic

A Traffic Impact Assessment was undertaken by Aurecon South Africa (Pty) Ltd (Aurecon) and is included in Appendix P.

The surrounding road network is provided in Plan 25, with the traffic demand established from the Siyaza traffic count surveys carried out on 11 September 2015.

9.1.13.1 Road Network

The road network in proximity to the Project area consists of the N12 Moroka by-pass, the D671 (K170) minor road, D962 road and the Glenharvie and Waterkloof roads (Plan 25). The N12 is an east-west major arterial that connects Potchefstroom with Johannesburg. The N12 road is a predominantly four-lane, dual carriageway but narrows to a two-lane highway in the west of the Project area. The N12 is surfaced and deemed to be in good condition and carries approximately 1 000 to 1 300 vehicles per hour in both directions during the AM and PM peak hours. Due to the high volumes of vehicles on the N12, minor roads intersecting the N12 experience high levels of delay.

The D671 road is a minor arterial road that links the N12 national road with the D962 road; the latter of which is a two lane minor arterial road running in an east-west direction between Randfontein Road and the R500 in Fochville. Both the D671 and D962 roads were deemed to be in relatively good surface condition. The D671 road provides access to the Glenharvie community, the Kloof Mine and indirect access to Kloof Shafts No. 4 and No.7. The D671 road carries approximately 480 and 620 vehicles per hour during the AM and PM peak hours, respectively, with the D962 carrying approximately 120 vehicles per hour.

The Glenharvie and Waterkloof roads are two land local distributor roads; the Glenharvie road provides access to the Glenharvie community and connects the D671 road with the D114 road in Hillshaven, with the Waterkloof road running in a north-south direction between Kloof Shaft No. 7 and Glenharvie. Approximately 220 and 280 vehicles per hour were counted travelling in both directions on the Glenharvie road for the AM and PM peak times respectively, with 120 vehicles per hour on the Waterkloof road.

9.1.13.2 Trip Generation Calculation

Trip generation was estimated using the development and traveller characteristics, along with estimated trip generation details provided by SGL. It was assumed that employment trips would occur during peak times. The trip generation calculations indicated that the CPP is expected to generate a total of 193 peak hour vehicle trips during the construction phase, reducing to 99 peak hour vehicle trips during the operational phase (Appendix P). The RTSF is expected to generation 113 and 12 peak hour trips during the construction and operational phases respectively.

9.1.13.3 Capacity Analysis

Level of Service (LOS) at intersections is a measure of intersection performance, determined based on delay for signalised and un-signalised intersections. Most urban areas have an overall delay of up to 35 seconds, with delays less than 25 seconds considered desirable.

The LOS analysis (Appendix P) indicated that the intersections (Plan 25) are operating at acceptable levels, with the exception of two intersections. Delays were experienced during PM peak times on the D671 road where it intersected with the N12, with delays greater than 50 seconds. The predominant cause of the delays was due to the lack of gaps in the main traffic stream on the N12, preventing traffic entering the intersection from the D671 road. The Gauteng Department of Roads and Transport (GDRT) is considering the upgrade of the N12 and D671 intersection, which will comprise of additional acceleration and deceleration lanes on the N12, as well as provision of a ramp to replace the current right turn on the N12 from the D671. The timeframes for these upgrades were not confirmed (Appendix P).

The D671 approaches were operating at an acceptable LOS with minor delays; however the Kloof Mine access approach experienced major delays during PM peak hour due to high volume of right turning movement. Upgrades are required for this intersection.

Plan 25: Surrounding Road Network

9.1.14 Radiation

A Radiological Impact Assessment was undertaken by Dr. JJ van Blerk, a Radiation Protection Specialist, and is attached as Appendix Q.

Many radioactive isotopes (or radionuclides) occur naturally throughout the Earth's crust and are present in rocks, soils, river water, as well as in seawater. Most of these naturally occurring radionuclides, which are also associated with the gold bearing reefs of the Witwatersrand, are members of three radioactive series identified as the uranium (U-238), actinium (U-235), and thorium (Th-232) series. In undisturbed environmental conditions, these radionuclides form part of the natural background radiation, to which all humans are exposed on a daily basis through the air, water, soil and food (Kathren, 1998).

As part of the regulatory process administrated by the NNR, SGL is required to characterise the radiological baseline for the areas potentially affected by the WRTRP. This process, which normally includes area gamma and dose rate surveys of the affected areas, full spectrum radioanalysis of soil, water and sediment, as well as measurements of airborne radon concentrations, was sub-contracted to the South African Nuclear Energy Corporation (Necsa). The purpose of the survey was to characterise the baseline radiological conditions of the potentially affected areas and to determine the levels of naturally occurring radionuclides.

The following sections present a summary of the gamma survey and dose rate measurement results.

9.1.14.1 Gamma Survey

Measurements were collected during July and August 2015 at all accessible areas within the proposed infrastructure footprints and immediate surroundings, such as the RTSF complex and CPP. The readings included K-40, Ra-226 and Ra-228 nuclide concentrations in surface soil. The gamma survey results are based on comparing the measured activity concentration to the regulatory exclusion level for radioactive nuclides in the soil which is defined as the maximum activity concentration of 0.5 Bq per gram for uranium and thorium and 10 Bq per gram for K-40 (NNR, 1999). The average and median results for all measurement locations associated with the Kloof Mining Right area infrastructure were within the maximum concentrations.

9.1.14.2 Gamma Dose Rate Measurements

Gamma dose-rate measurements were collected using a calibrated dose-rate monitor equipped with a Geiger Muller counter. Similarly with the gamma survey, all measurements associated with the Kloof Mining Right area infrastructure were within natural background concentrations.

9.2 Description of the Current Land Uses

The current land use for the region is dominated by agricultural and mining activities, with agriculture including both cultivation of crops and grazing. The location of the proposed RTSF complex and CPP is agricultural land. The land use for the project area is illustrated in Plan 16, as discussed in Section 9.1.4.2.

9.2.1 Land Claims

A request to identify lands over affected farm portions was submitted to the Development and Land Reform, Land Claims Commission on 13 February 2015. Based on feedback from the Commission, there are land claims on the following properties associated with the Kloof Mining Right area:

- Portion 19 of Gemspost 288 (within the Kloof Mining Right Area south of Venterspost South TSF);
- Portion 15 of Doornfontein 522 (farm portion adjacent to Kloof Mining Right area); and
- Portion 4 of Kalbasfontein 365 (farm portion adjacent to Kloof Mining Right area).

9.3 Description of Specific Environmental Features and Infrastructure on the Site

The environmental features within the WRTRP and Kloof Mining Right area are discussed in detail in Section 9.1.

9.3.1 Water Resources

The WRTRP is situated in the Upper Vaal WMA 8 and within the quaternary catchments C23E, C23J, C23D, C22J and C22H, with the Kloof Mining Right area falling within quaternary catchments C23J, C22J and C23D. The project area is drained by the Wonderfonteinspruit, Leeuspruit and the Loopspruit. The Wonderfonteinspruit flows westwards and eventually becomes the Mooirivierloop before a confluence with the Mooi River downstream.

The overall surface water quality for the WRTRP area indicated elevated concentrations of sulfates, nitrates, fluorides, manganese and ammonia exceeding the Vaal Dam RWQO. This indicates that rivers within this area are already impacted; the majority of river systems associated with the project area are largely modified. The modification of these systems is largely attributed to the location of the sources of the associated river systems, which are located within urban and industrial areas and associated impacts to instream and riparian conditions have resulted in the large modification of the systems.

Wetlands within the project area are characterised by valley bottom systems associated with the Wonderfonteinspruit, Leeuspruit, Loopspruit and other tributaries. In addition, in the midslopes and valley heads of the catchments, there are pan and seep systems associated with the landscapes. The identified wetlands are considered to be impacted upon as a result of the surrounding land uses, including mining, agriculture and road infrastructure. This has led to serious impacts to the quality of these systems and has contributed to the direct loss of wetland habitat. The wetlands have been demarcated a PES of D (largely modified) and an EIS of low to moderate.

The aquatic ecosystems associated with the project area mirror the impacted nature of the surface water quality and wetlands functioning, with the aquatic systems determined to have PES of Class D and E, which is moderately to seriously modified. The conductivity cencentrations exceeded the DWAF (1996) aquatic guidelines for all monitoring sites sampled, during the high and low flow surveys.

Groundwater levels within a 10 km radius of the RTSF complex footprint shows a 99.11% correlation with the topography; groundwater flow mimics the topography and is towards surface water drainage courses as baseflow which is generally northwest to southeast. The aquifers underlying the proposed RTSF complex are characterised as low yielding, semi-confined weathered and fractured aquifer systems, with the water strikes in the aquifers being predominantly below the measured groundwater levels which is indicative of confining groundwater flow conditions; he aquifers underlying the proposed RTSF complex are characterised by low hydraulic conductivity. This indicates that the groundwater flow rate is limited and the contamination plume migration will be limited; the plume will migrate very slowly but high concentrations are expected to remain in the aquifer for long periods of time.

Groundwater use within 5 km of the RTSF complex footprint included boreholes for human consumption, livestock watering, agriculture and groundwater monitoring uses. All of the boreholes sampled fall within the recommended (Class I) standards for drinking water (SANS 241:2011) with only ammonia and manganese concentrations exceeding the Class I limits for borehole CDVBH2. Borehole CDVBH2 is located in the south-eastern portion of the proposed RTSF complex footprint and the ammonia levels exceeded the Class III limits for drinking water. The borehole has been drilled in a wetland area and it is possible that the elevated ammonia level is a result of the reducing environment created by the wetland, combined with the decomposing organic matter.

9.3.2 Terrestrial Landscape Habitat

The project area is comprised of various land uses which includes mining, historical TSFs, industrial areas, residential areas and agricultural activities. The regional vegetation of the WRTRP area consists of the Carletonville Dolomite Grassland, Gauteng Shale Mountain Bushveld, Rand Highveld Grassland and Soweto Highveld Grassland, with the two former vegetation types being classified as Vulnerable and the Highveld Grassland vegetation types classified as Endangered.

The infrastructure associated with the Kloof Mining Right area, namely the RTSF complex, the CPP and pipelines associated and between the CPP and RTSF complex, is located within grassland, wetland, agricultural (cultivation and grazing) and transformed areas. The grassland is composed of dominant and well developed graminoid components, as well as a healthy forb component. Within the grassland delineation, two sub communities were identified. The dominant grassland sub community associated with the infrastructure within the Kloof Mining Right area is the *Themeda triandra – Hyparhennia hirta* grassland, with the *Cymbopogon excavatus – Themeda triandra – Acacia karroo* open to closed woodland sub community delineated towards the north of the Kloof Mining Right area infrastructure associated with the CPP.

No Red Data mammal or bird SSC were identified during the field survey, although the Grass Owl (*Tyto capensis*), has previously been identified within the project area (Golder, 2008) and is expected to occur within the wetland habitats identified within the project area. This species has been allocated a status of Vulnerable. Reptile Red Data species that may occur within the project area include the Giant Girdled Lizard (*Cordylus giganteus*) (Vulnerable) and the Striped Harlequin Snake (*Homoroselaps dorsalis*) (Rare). Invertebrate Red Data species expected to occur on site include the Marsh sylph (*Metisella meninx*), Roodepoort Copper (*Aloeides dentatis dentatis)* and Highveld Blue (*Lepidochrysops praeterita*), although no species were identified during the survey.

9.3.3 Cultural Heritage

Geologically, the project area is largely underlain by dolomitic rock that has the potential for karst topography which is characterised by underground drainage systems with sinkholes, dolines and caves. Archaeologically, Stone Age and Late Farming Community sites have been recorded within the larger, regional area. Stone Age lithics recorded have been found as surface scatters outside of any discernible context, limiting the overall significance of these resources. Late Farming Community sites within the region have primarily been identified as stone walled settlements classified as Type N and Klipriviersberg.

The heritage resources identified of significance within the Kloof Mining Right area were two burial grounds which were determined to have a cultural significance of very high. The two sites contained a combined at least 31 graves and are located within the proposed RTSF development. In addition, a further two burial grounds were located that may be impacted upon by the pipeline route from the CPP to the RTSF and were also deemed to have a high cultural significance.

9.3.4 Infrastructure

The WRTRP area is located throughout the West Rand, with towns such as Carletonville, Westonaria and Randfontein located adjacent and within the Mining Right areas. The proposed CPP is located approximately 5 km southeast of the N12 national highway and south of the Kloof Processing Plant. There is no infrastructure within the CPP footprint, with farmsteads located adjacent to the footprint to the northeast. The proposed RTSF complex is located on agricultural land and is approximately 8 km south of the CPP. There are farmsteads and houses located intermittently throughout the proposed RTSF area; SGL intends to purchase the land associated with the RTSF footprint. The proposed pipelines will be constructed within existing servitudes where possible.

9.4 Environmental and Current Land Use Map

The environmental and land use features for the Kloof Mining Right area are detailed in the respective plans included above, as referenced in Table 9-41.

Table 9-41: Environmental and Land Use Features Plans

Environmental Feature	Plan Number
Geology	Plan 12
Land Type	Plan 14
Land Use	Plan 16
Surface Water Resources	Plan 17
Vegetation Types	Plan 18
Sensitivity Analysis	Plan 19
NFEPA Wetlands	Plan 21
Delineated Wetlands	Plan 22
Heritage Resources	Plan 24

10 Item 3(g)(v): Impacts and Risks Identified including the Nature, Significance, Consequence, Extent, Duration and Probability

The potential impacts associated with the project have been identified as part of the specialist investigations undertaken for the WRTRP, as well as from input provided by affected parties through consultations and submitted comments. The significance of the potential impacts have been assessed by the specialists as part of their respective Impact Assessment reports.

The potential impacts, potential mitigation and management measures for the impacts and the significance rating prior to and post mitigation have been provided in the sections below per environmental aspect and activity. The potential impacts contained in this report are specific to the activities associated with the Kloof Mining Right area and do not assess all of the activities and impacts, positive and negative, associated with the Ultimate WRTRP. It is important to note the impacts and benefits of the Ultimate WRTRP, as well as the Mining Right specific impacts and benefits; the WRTRP requires each of the Mining Right area infrastructure and activities, should one element of the project not be approved, the entire WRTRP would not proceed.

Regarding the Ultimate WRTRP, it must be noted that the presence of historical TSFs on the landscape are a permanent source of pollution on the surrounding environment. The TSFs are a source of dust generation which reduces the ambient air quality, as well as impacting on surrounding soils, wetlands and surface water resources due to the mobilised contaminants. In addition, the leaching and seepage of contaminants have significant impacts on the groundwater resources, specifically as the historical TSFs are located on sensitive dolomitic aquifers. The reclamation of these historical TSFs will result in long term positive impacts as the pollution source is removed from the regional landscape, although reclamation activities will result in operational impacts. This EIA report associated with the Kloof Mining Right area does not include the reclamation of historical TSFs, however it is pertinent to note the potential negative and positive impacts associated with the overall WRTRP and reclamation of numerous TSFs throughout the West Rand.

The activities associated with the Kloof Mining Right area, which may result in potential impacts, includes the following:

- Abstraction of makeup water from the K10 shaft; and
- The construction and operation of:
  - The CPP;
  - The RTSF complex (including the RTSF, RWD, AWTF and subsequent treated water discharge); and
  - Roads, power lines, pipelines and pump stations associated with the above listed infrastructure.
- Employment and Procurement.

The methodology used to determine the significance of the potential impacts is provided in Section 10.6. The potential impacts have been discussed per phase of the project, per environmental aspect and according to each activity.

The impacts described in the following sections do not constitute the entire array of impacts that have been assessed by the various specialists. The impacts highlighted here are those considered significant; all low and medium-low negative and negligible and minor positive impacts ratings have not been included. Please refer to the individual specialist studies for a detailed impact assessment of all potential impacts identified.

Potential project risks, such as hydrocarbon spillages, pipeline leaks, flooding of dams and storm water management facilities have not been assessed as part of the impact assessment as the probability of these events occurring is not covered by the impact assessment methodology. Mitigation and management measures to prevent project risks from occurring have been provided in the EMP section of this report, however.

10.1 Construction Phase

The construction phase includes site clearing activities of all of the proposed infrastructure footprints and includes vegetation removal and soil stripping, as well as the construction of the infrastructure.

10.1.1 Air Quality Impacts

Table 10-1 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-1: Interactions and Impacts on Air Quality during the Construction Phase

Interaction	Impact
Site clearing	Generation of dust from vehicle wheels travelling on gravel roads
	Direct reduction in the quality of ambient air due to airborne dust
Exposure of loose soils due to loss of vegetation cover	Wind erosion of loose particulate matter
	Increased particulate matter load in the atmosphere leading to deteriorated air quality
	Soiling of surfaces due to fall out dust
	Health implications from inhalation of airborne dust

10.1.1.1 CPP, RTSF Complex and Pipelines and Roads

10.1.1.1.1 Impact Description

The removal of vegetation, stripping of soil and grading of the landscape in preparation for construction activities uses a range of construction equipment. These activities leads to the generation of fugitive dust, which comprises Total Suspended Particles (TSPs), PM_{10} and $PM_{2.5}$, from the equipment and during material handling. The movement of vehicles and equipment, contractors and permanent workforce and the levelling and compacting of the landscape all contribute to dust emissions.

10.1.1.1.2 Management Objectives

The management objective is to ensure that nuisance and contaminated dust emissions, associated with the construction of the CPP, RTSF complex and associated pipelines and roads, comply with regulatory guidelines and standards for the protection of the environment, human health and wellbeing; the management objective is to ensure that both on-site and off-site airborne dust concentrations comply with the relevant health protection criteria.

10.1.1.1.3 Management Actions and Targets

On-site monitoring must be undertaken daily to capture peak emissions. Monitoring will be undertaken upwind and downwind of active operation, as well as at the site of active operation. Fine particulate monitoring for public exposure will be undertaken at the closest public area downwind. All monitoring results must be maintained on a logging sheet for reference and proof of compliance to the air quality standards. All test results must be assessed against the relevant standards (NDCR and NAAQS) for PM_{10} (75 µg /m^3) and dust fallout (600 mg/m^2/day).

10.1.1.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-2.

Table 10-2: Potential Impacts on Air Quality due to the RTSF Complex, CPP and Pipelines and Roads

Site Clearing for the development of the RTSF complex, CPP and pipelines and roads.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of dust and reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Medium term (3)	Dust will be generated the duration of the construction phase	Low (negative) – 21
Extent	Local (3)	Airborne dust may extend across the development site area.	
Intensity	Minimal (1)	Limited damage to minimal area is anticipated	
Probability	Unlikely (3)	There is a possibility that generated dust will impact ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			

Site Clearing for the development of the RTSF complex, CPP and pipelines and roads.			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Application of wetting agents or dust suppressant on the dirt roads and exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.			
Post- mitigation			
Duration	Short term (1)	Dust generation will be limited to the area disturbed and for a few days further	Low (negative) – 6
Extent	Very Limited (1)	After mitigation measures are implemented, It is expected that dust impacts will be limited to isolated parts of the site.	
Intensity	Minimal (1)	Generated dust will have limited damage to minimal area and social impact	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low.	
Nature	Negative		

10.1.2 Groundwater Impacts

No impacts are expected on groundwater during site clearing and potential blast excavation as the activities are likely to take place above the groundwater table. The interactions and impacts associated with the construction phase of the project are provided in Table 10-3.

Table 10-3: Interactions and Impacts on Groundwater during the Construction Phase

Interaction	Impact
Blast curtain excavation	Depleting of groundwater

10.1.2.1 RTSF Complex

10.1.2.1.1 Impact Description

No impacts on the groundwater are expected during the construction phase as all activities will occur above the water table.

10.1.3 Soil Impacts

The RTSF complex and CPP sites will be stripped of topsoil and the construction of the infrastructure will commence. The stripped soils will be stockpiled according to the rehabilitation plan recommendations. The major impacts to consider in above ground pipeline construction will be the loss of topsoil as a resource through compaction and erosion. Whilst the construction takes place, vehicles will drive on the soil surface resulting in soil compaction. This reduces infiltration rates as well as the ability for plant roots to penetrate the compacted soil. This then reduces vegetative cover and increases runoff potential. The increased runoff potential then leads to increased erosion hazards.

Table 10-4 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-4: Interactions and Impacts on Soil during the Construction Phase

Interaction	Impact
Site Clearing for the CPP, RTSF Complex and pipelines and roads	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability
Soil Stockpiling of soils from the CPP and RTSF Complex	Loss of topsoil as a resource – Erosion and Compaction
Use of vehicles and heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

10.1.3.1 CPP and RTSF Complex

10.1.3.1.1 Impact Description

Site clearing and stockpiling of soil will be undertaken for the CPP and RTSF complex, resulting in the susceptibility of soil erosion. The loss of topsoil as a resource will have a high negative impact as the natural regeneration of a few millimetres of topsoil takes hundreds of years. Cleared land increases the runoff potential over the area, which will increase the potential for erosion to occur.

The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result the risk of erosion will increase. When topsoil is compacted or eroded, the soil profile is compromised and its ability to function as a growth medium is restricted. Erosion and compaction of soil will result in the loss of topsoil as a resource.

The removal of topsoil, as well as the deterioration of the topsoil resources during stockpiling, will reduce the land capability. The RTSF complex and CPP land capability will reduce to non-usable areas as cultivated land will be replaced by mining land use. The RTSF will be a permanent structure, impacting on the footprint land capability indefinitely.

10.1.3.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the site clearing and stockpiling activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

Stripped soils are to be placed in the correct stockpile allocations (Plan 4) to reduce cross contamination of soils. These soils must be monitored and maintained in a reasonably fertile state; vegetation cover on all stockpiled soil is essential to eliminate erosion. Soils must be stripped by truck and shovel methods only.

There are no management objectives for the loss of land capability as the land use will change from agricultural to mining, permanently impacting on the land capability.

10.1.3.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the footprints of the CPP to an adequate end land use. To ensure that rehabilitation and eventual closure is effective and successful, the management of the soil resources is critical during the life of the project. The management of the soil throughout the project will directly influence the success of the rehabilitation activities. The soil will, thus, be stripped and stockpiled to prevent and minimise potential impacts with rehabilitation and long term use in mind. A Rehabilitation Plan (Appendix R) has been compiled and will detail the following:

- Following adequate stripping guidelines;
- The topsoil must be stripped by mechanical means, such as an excavator bucket, and loaded onto dump trucks;
- Topsoil stockpiles are to be kept to a maximum height of 4m (the practical tipping height of dump trucks);
- Topsoil is to be stripped when the soil is dry, so as to reduce compaction;
- The topsoil (0.3 m of the soil profile) should be stripped first and stockpiled separately;
- The subsoil (approximately 0.3 – 0.8 m thick) will then be stripped and stockpiled separately;
- Soils to be stripped according to the soil stripping ratios and stockpiled accordingly;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be used for their designated final purposes; and
- The stockpiles must be vegetated to reduce the risk of erosion, prevent weed growth and to reinstitute the ecological processes within the soil.

10.1.3.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-5.

Table 10-5: Potential Impacts on Soils due to the RTSF and CPP

<table>
<tr><th colspan="4">Site Clearing and stockpiling for the RTSF complex and CPP.</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Impact Description: Loss of topsoil as a resource due to compaction and erosion.</td></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Topsoil will be stripped and stockpiled if this is done without following the mitigation measures the impact will have a long term affect.</td><td rowspan="5">Medium-high (negative) – 91</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>Loss of topsoil will only occur within and immediately around the Project site.</td></tr>
<tr><td>Intensity</td><td>Very Serious (5)</td><td>Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.</td></tr>
<tr><td>Probability</td><td>Certain (7)</td><td>By excavating the soil it will certainly impact on the soil.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">

Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs;
Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure;
Ensure storm water management designs are in place; and
Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state and vegetated, as per the Rehabilitation plan.

</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Duration</td><td>Project Life (5)</td><td>Loss of topsoil makes land less productive. Effects will occur long after the project life.</td><td rowspan="5">Low (negative) – 30</td></tr>
<tr><td>Extent</td><td>Limited (2)</td><td>Loss of topsoil will only occur within and immediately around the Project infrastructure area.</td></tr>
<tr><td>Intensity</td><td>Moderate (3)</td><td>Loss of topsoil may result in loss of land capability and land use.</td></tr>
<tr><td>Probability</td><td>Unlikely (3)</td><td>If the mitigation is followed then it is unlikely that the impacts will occur.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
</table>

Loss of land capability due to site clearing and change of agriculture to mining at the RSTF and CPP.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Removal of soil layers will impact on the land capability because vegetation can no longer be supported. **The land use will also change from cultivation to mining**			
Prior to mitigation/ management			
Duration	Permanent (7)	The removal of soil from a profile reduces the land capability from a rateable index to non-existent; this impact is permanent if not mitigated.	Medium-high (negative) – 105
Extent	Limited (2)	The impact will only occur on the project infrastructure area.	
Intensity	Very Serious (6)	The land capability will be reduce from Class II, III, and IV to no capability.	
Probability	Certain (7)	By removing the topsoil the impact on land capability is certain.	
Nature	Negative		
Mitigation/ Management actions			
No land capability mitigation is possible during the construction phase because the land capability will be reduced to nothing and the land use is changed from agriculture/grazing to mining. As a result, there are no post mitigation measure impact ratings.			

10.1.3.2 Pipelines and Roads

10.1.3.2.1 Impact Description

The construction of the pipelines and roads may result in soil erosion due to exposed surfaces, as well as compacting soil resources due to the presence of vehicles and machinery. The loss of topsoil as a resource will have a high negative impact as the natural regeneration of a few millimetres of topsoil takes hundreds of years, although the impact will be limited to the linear footprints of the pipelines and roads.

10.1.3.2.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the site clearing and construction activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.1.3.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.1.3.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-6.

Table 10-6: Potential Impacts on Soils due to the Pipelines and Roads

Site Clearing and stockpiling for the pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Medium-low (negative) – 60
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	On-going (3)	Minimal loss of topsoil expected as pipelines will be constructed within existing servitudes and already impacted footprints.	
Probability	Almost certain (6)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ Ensure storm water management designs are in place.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (negative) – 30

Site Clearing and stockpiling for the pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Minor (2)	The impact will be reduced if mitigation is implemented.	
Probability	Almost certain (6)	Compaction and erosion will occur but can be managed through the mitigation measures listed.	
Nature	Negative		

10.1.4 Surface Water Impacts

Sedimentation of surface water resources due to potential soil erosion will impact on surface water quality. In addition, operational areas associated with the Kloof Mining Right area will be demarcated dirty water areas to ensure that potential contaminated water, due to water use and water runoff from operational areas, does not flow to clean water resources, thereby impacting on water quality. A SWMP will be implemented to manage and control clean and dirty water areas.

Table 10-7 details the project activities' interactions and the resultant impacts on surface water as a result of the proposed developments.

Table 10-7: Interactions and Impacts on Surface Water during the Construction Phase

Interaction	Impact
Site Clearing	Increased sedimentation on downstream watercourses due to exposed surfaces resulting in siltation of surface water resources.
	Mixing of upstream clean water runoff with dirty water runoff from cleared site areas.
Construction of infrastructure (CPP and RTSF complex).	Reduction in catchment yield

10.1.4.1 CPP and RTSF Complex

10.1.4.1.1 Impact Description

Site clearing activities increases the erosion potential of the soils due to the removal of vegetation and the compaction of the soil resources. Exposed surfaces are likely to result in increased sedimentation of surface water resources due to runoff from these areas which will be high in suspended solids. The areas cleared for the pipelines and roads are expected to be limited in extent, with the predominant impact resulting for the clearance of land for the CPP and RTSF complex.

The construction of the CPP and development of the RTSF complex will include the establishment of dirty water areas. The SWMP will result in the reduction of catchment yield and the RTSF complex and CPP footprint areas will no longer form part of the natural downstream catchment. The RTSF complex and CPP occupy 2% and 1% of the C23J quaternary catchment respectively; a reduction of catchment yield will be approximately 3% of the quaternary catchment. This impact will occur for beyond the project life.

10.1.4.1.2 Management Objectives

The management objectives adopted during the construction phase relate specifically to GN R704 of the NWA, which was established to provide regulations on the use of water for mining and related activities aimed at the protection of water resources.

The three main conditions of GN 704 applicable to this project are:

- *Condition 4* which defines the area in which mine workings or associated structures may be located, with reference to a watercourse and associated flooding. Any residue deposit, dam or reservoir together with any associated structure or any other facility should be situated outside the 1:100 year flood-line. The RTSF is located outside of the 1:100 year flood-line and 100 m buffer of the Leeuspruit;
- *Condition 6* which describes the capacity requirements of clean and dirty water systems. Clean and dirty water systems must be kept separate and must be designed, constructed, maintained and operated to ensure conveyance of flows of a 1:50 year recurrence event. Any dirty water dams must have a minimum freeboard of 0.8 m above full supply level; and
- *Condition 7* which describes the measures that must be taken to protect water resources. All dirty water or substances that may cause pollution must be prevented from entering a water resource (by spillage, seepage, erosion etc.) and ensure that water used in any process is recycled as far as practicable.

10.1.4.1.3 Management Actions and Targets

Temporary ditches must be constructed downstream of all cleared areas to capture and contain dirty water runoff until the storm water management facilities have been constructed. The temporary storage ditches and storm water management facilities must be sized based on the runoff volume generated from the cleared area for the 1:50 year storm event. The water contained in the temporary ditches must be used during the construction activities as far as possible. These ditches will aim to manage the impact of increased sedimentation on downstream watercourses due to exposed surfaces. The RWD will be constructed to manage the water runoff from the RTSF and will be sized appropriately.

The RTSF and CPP occupy 2% and 1 % of the C23J quaternary catchment respectively. The loss of catchment yield due to introduction of the proposed RTSF and other associated infrastructure will be compensated by the treated water discharge on the Leeuspruit during the operational phase.

All storm water management facilities will be constructed according to the GN R704 requirements.

10.1.4.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on surface water resources are provided in Table 10-8

Table 10-8: Potential Impacts on Surface Water due to the RTSF Complex and CPP

Site clearing for the Construction of the RTSF Complex and CPP.			
Dimension	**Rating**	**Motivation**	**Significance**
Mixing of upstream clean water runoff with dirty water runoff from cleared site areas, along with surface water sedimentation.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	May continue beyond the project life if not managed correctly	Medium-high (negative) – 80
Extent	Region (5)	May affect water quality on a regional basis	
Intensity	High (5)	May impact on highly sensitive environments such as the downstream Vaal Dam	
Probability	Likely (5)	Is likely to occur if not managed correctly	
Nature	Negative		
Mitigation/ Management actions			
▪ Temporary ditches must be constructed down-gradient of the cleared areas; ▪ The temporary ditches must be sized according to the 1:50 year rainfall event; ▪ The RTSF complex will be constructed outside of the 1:100 year floodline; ▪ Utilise water stored in the temporary ditches; ▪ Clean water upstream of the cleared and construction areas must be diverted around the site to nearby water courses. The diversion canals must be sized to accommodate a 1:50 year rainfall event; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas.			
Post- mitigation			
Duration	Short term (2)	Will only last for the duration of the construction phase	Low (negative)

Site clearing for the Construction of the RTSF Complex and CPP.			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Limited (2)	Limited to the project site if mitigation is applied correctly	– 28
Intensity	Moderate (3)	May impact already moderately impacted surface water resources	
Probability	Probable (4)	Probable, has occurred elsewhere and may occur here	
Nature	Negative		
Dimension	**Rating**	**Motivation**	**Significance**
Reduction in catchment yield.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	The RTSF and associated infrastructure will remain indefinitely and will result in a loss of catchment area	Medium-low (negative) – 66
Extent	Local (3)	Will affect the contribution of water from the regional catchment	
Intensity	Low (2)	May impact on already moderately impacted surface water resources	
Probability	Highly probable (6)	The RTSF and associated infrastructure have to be constructed for this project resulting in a reduction of catchment yield	
Nature	Negative		
Mitigation/ Management actions			
There is no mitigation for the loss of catchment and the impact is considered to be medium-low (negative).			

10.1.5 Fauna and Flora Impacts

Site clearing will take place in preparation for the construction of infrastructure. Site clearing includes the direct removal of vegetation prior to the stripping of topsoils and will be concentrated around the footprint areas. The interactions and resultant impacts on fauna and flora during the construction phase are provided in Table 10-9.

Table 10-9: Interactions and Impacts on Fauna and Flora

Interaction	Impact
Site clearing for infrastructure placement (CPP and RTSF complex)	Direct loss of floral species/vegetation types and biodiversity.
	Direct habitat loss and degradation, resulting in faunal species moving out of the area.
	Loss of species of special concern (protected species).
	Alien vegetation recruitment

10.1.5.1 RTSF, CPP and Pipelines and Roads

10.1.5.1.1 Impact Description

The construction of surface infrastructure within the Kloof Mining Right area will take place in various areas which will affect the current habitat and vegetation types present. There are three main types of habitat found on site, grassland areas (346 ha) (of which 3 differentiations were encountered), wetland areas (12.6 ha) and transformed areas which consist of agriculture or alien invasive vegetation (1 181.6 ha). The activities that have been rated as having the most significant impacts (medium-high (negative)) correspond to the grassland and wetland areas and include footprints of the CPP (55.6 ha of grassland and 10.7 ha of wetlands), RTSF (260 ha of grassland) and pipelines (2 ha of wetlands and 30.3 ha of grassland).

The CPP will impact heavily on grassland and wetland vegetation and habitat types present, with the RTSF impacting on the secondary grassland and agricultural fields; some of which have been fallow for a long period of time and have been taken over by alien invasive vegetation. Disturbance is also expected from the construction of pipeline from the CPP to the RTSF.

Site clearing and construction will constitute the complete removal of vegetation on the footprint of the CPP and RTSF and partial removal in areas where pipeline infrastructure will be placed. This will remove the remaining habitat that the existing vegetation types currently provide. The partial degradation of habitat for animal life has already taken place within the surrounding environment due to current land use practices, such as mining and agriculture and their associated impacts. This impact has and will continue to result in the permanent reduction of natural habitat for faunal species present within the Kloof Mining Right areas.

The Nationally protected plant *Boophone disticha* (Poison bulb) (nationally Declining) was encountered throughout the grassland, including the footprint of the CPP. The plant species *Hypoxis hemerocallidea* (Star Flower) (provincially protected, nationally Declining) was encountered in the grassland vegetation type in the region of the pipeline to the west of the CPP and the protected species listed in Table 9-20 are expected to occur within the grassland habitat type and must be managed appropriately. Mitigation measures should include obtaining permits and translocating these plants if encountered.

The clearing of vegetation will result in the emergence of open areas; indigenous vegetation is likely to be replaced by fast growing alien and weed vegetation. This impact can be greatly reduced with the correct implementation of Alien Invasive Management Plan. The significance of alien invasive vegetation infestation is considered to be medium-low (negative) and can be mitigated through the implementation of the Alien Invasive Management Plan and the eradication of alien invasive vegetation on site.

10.1.5.1.2 Management Objectives

Management objectives will be to prevent the loss of important/protected landscapes and species of plants and animals (such as those with Red Data Status, National and Provincial). This is achieved by avoiding destruction of areas where these species are located. If this is not possible in the case of plants, relocation permits will be required.

The destruction of the vegetative cover must be limited. This can be achieved by restricting the removal and disturbance of vegetation to those areas absolutely essential for the infrastructure placements.

The ecosystem present must be preserved; this includes areas not directly affected by project activities and can be achieved by limiting project activities to areas where they are essential. The risk of habitat fragmentation must be reduced through preservation of natural corridors. Rehabilitation plans must be initiated during construction to minimise disturbed areas. Habitat/vegetation degradation must be prevented through the implementation of an alien invasive plant management strategy.

10.1.5.1.3 Management Actions and Targets

Red Data plants located in areas of development (*Boophone disticha* (Poison bulb) and *Hypoxis hemerocallidea* (Star Flower)) should be marked prior to construction of any infrastructure and the necessary permits for relocations of these protected species must be obtained from the relevant government department. The relocation strategy must be approved by relevant authorities (GDARD) prior to relocation to a safe place to avoid destruction and stipulations made by GDARD must be followed. A nursery should be developed on site for this purpose. No protected plant species can be disturbed without authorisation.

Three basic rules of conservation apply to populations of Red Data plant species according to Red List Plant Guidelines (2012) and include:

- All populations of Near Threatened and Threatened plant taxa must be conserved *in situ*;
- All populations of Near Threatened and Threatened plant taxa must be protected with a buffer zone in accordance with guidelines; and
- An Ecological Management Plan must be compiled in respect of all actions that affect populations of Red Data plant species, and such Ecological Management Plans must conform with the Guidelines set out for buffer zone widths.

An Alien Invasive Management Plan has been developed and implemented as part of the Kloof Mine. The Alien Invasive Management Plan must be extended to include activities associated with the WRTRP and implemented to preserve natural habitat. Such a strategy will entail the identification and extent of areas where such infestation occurs. Thereafter, specific eradication measures can be prescribed for species present. The Alien Invasive Management Plan must reduce the number of these plant species that occur in the project area; this can be measured against the number of plants that were identified in this and previous studies. Currently there is approximately 60.7 ha of alien invasive vegetation that will form part of the infrastructure areas: the aim will be to reduce this infestation to 0 ha.

Waste dumping, including building waste and rubble, must be prohibited. Such illegal dumping sites are prone to alien invasive vegetation infestation. The environmental manager must ensure that after each building site is rehabilitated that there are no rubble piles remaining.

Training must be given to onsite staff detailing which plants and animals have Red Data status and how they may be identified. Thereafter the Environmental Officer must initiate the Red Data Management Plan. Records must be kept of any Red Data plant and animal species removal or death; this will ensure that management actions are adapted if they are not successful.

Destruction of vegetation must be limited to the areas essential for the development. Once construction activities are completed, any surrounding disturbed areas must be rehabilitated within one week and any potential areas of erosion must be marked and attended to before the following wet season starts. All exposed patches of soil must be vegetated with pioneer species which will colonise open and disturbed areas relatively quickly and prevent erosion and alien invasive vegetation from establishing.

10.1.5.1.4 Impact Rating

The impact ratings on fauna and flora during the construction phase are detailed in Table 10-10.

Table 10-10: Potential Impacts on Fauna and Flora during the Construction Phase

Site clearing for the Construction of the RTSF Complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Direct loss of floral species within the RTSF complex footprint. The removal of vegetation will result in the destruction of faunal habitats and a loss of biodiversity.			
Prior to mitigation/ management			
Duration	Permanent (7)	Total loss of 358 ha of floral species/vegetation will occur.	Medium-high (negative) – 84
Extent	Limited (2)	Species/habitat loss will only occur within and immediately around the project site.	

Site clearing for the Construction of the RTSF Complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Moderate (3)	The RTSF footprint covers disturbed grassland and agricultural areas.	
Probability	Definite (7)	It is likely that total destruction of vegetation types will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Limit degradation and destruction of the natural environment to the designated RTSF complex footprint and immediate surrounds; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Demarcate and avoid sensitive landscapes, such as riparian and wetland areas that were encountered to the east of the RTSF complex; ▪ Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation.			
Post- mitigation			
Duration	Permanent (7)	Total loss of 358 ha (the remaining footprint is agricultural) of floral species/vegetation will occur. The RTSF complex will be a permanent structure.	Medium-high (negative) – 77
Extent	Limited (2)	If contractors adhere to mitigation such as to limit the footprint of disturbance to only essential areas.	
Intensity	Moderate (2)	Dependent on sensitivity of the specific site.	
Probability	Definite (7)	This impact will occur	
Nature	Negative		
Site clearing for the Construction of the CPP and pipelines			
Dimension	**Rating**	**Motivation**	**Significance**
Direct loss of floral species within the CPP and pipeline footprints within medium and high sensitivity areas. The removal of vegetation will result in the destruction of faunal habitats and a loss of biodiversity.			
Prior to mitigation/ management			

Site clearing for the Construction of the RTSF Complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Project Life (5)	Loss vegetation due to site clearing for the pipeline (32 ha) and CPP (66 ha). The infrastructure will be present for the life of the project.	Medium-high (negative) – 84
Extent	Limited (2)	Habitat loss will only occur within and immediately adjacent to the project site.	
Intensity	High (5)	Sensitive sites occur throughout the pipeline route and CPP footprints, such as grasslands.	
Probability	Definite (7)	It is likely that destruction of vegetation types will occur without management measures.	
Nature	Negative		
Mitigation/ Management actions			
- Limit degradation and destruction of the natural environment to the designated RTSF complex footprint and immediate surrounds; - Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; - Demarcate and avoid sensitive landscapes, such as riparian and wetland areas, and areas containing fauna and flora SSC; - Permits must be applied for nationally protected plants. Should plant SSC be removed, these must be translocated to a similar habitat or relocated to a nursery; and - Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation.			
Post- mitigation			
Duration	Medium term (3)	Vegetation management (such as translocation) and rehabilitation, vegetation can recover in 1-5 years.	Low (negative) – 24
Extent	Limited (2)	Impacts will be limited if the area of disturbance is restricted to footprint areas.	
Intensity	Moderate (3)	Dependent on sensitivity of the specific site.	
Probability	Unlikely (3)	It is unlikely that species will be lost should SSC be identified and translocated.	

Site clearing for the Construction of the RTSF Complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		

10.1.6 Aquatics Impacts

Soil compaction and erosion may result in the sedimentation of surface water resources, deteriorating the quality of the water quality. The sedimentation and deterioration of surface water quality can have a significant impact on the aquatic habitats and biota.

It must be noted that the aquatic habitats are moderately to largely modified in its current states. The no-go option of not implementing the project will result in continued impacts on the aquatic habitats due to the surrounding land uses. The potential impacts associated with the no-go option are detailed in Appendix J.

Table 10-11 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-11: Interactions and Impacts on Aquatic Ecosystems during the Construction Phase

Interaction	Impact
Site clearing for pipelines, CPP and RTSF Complex:	Increased runoff as a result of cover loss could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.

10.1.6.1 RTSF, CPP and Pipelines and Roads

10.1.6.1.1 Impact Description

Runoff high in dissolved/suspended solids from cleared areas could result in water quality impacts. In addition, through contaminated runoff, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Increased runoff and erosion caused through construction activities as well as movement of suspended materials in runoff may produce habitat quality impacts which may include sedimentation, bed, channel and flow modification. This impact may result from the site clearing and construction activities for the RTSF, CPP and pipelines and roads.

10.1.6.1.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts.

10.1.6.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. The establishment of a buffer zone from the Loopspruit and Leeuspruit is likely to reduce aquatic habitat and water quality impacts of large developments. The removal of vegetative cover, as well as the construction of infrastructure, has been recognised as being responsible for increased runoff, sedimentation and subsequent water and habitat quality degradation in downstream portions of river systems (WRC, 2014). As such the careful management of vegetation removal and sedimentation control must be undertaken.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to maintain the PES of the river systems. The monitoring for the presence of *Barbus anoplus* and *Pseudocrenilabrus philander* species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 30% as a result of activities related to the proposed project.

10.1.6.1.4 Impact Rating

The impact ratings on aquatic ecology during the construction phase are detailed in Table 10-12.

Table 10-12: Potential Impacts on Aquatic Ecology during the Construction Phase

Site clearing for the Construction of the CPP and Pipelines.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact description: Water and habitat quality modification due to potential sedimentation			
Prior to mitigation/ management			
Duration	Medium term (3)	The site clearing and infrastructure placement will occur and potentially recover within a three-five year period	Medium-low (negative) – 48
Extent	Limited (2)	The impacts are anticipated to occur around the activities which are located in proximity to the Leeuspruit and Loopspruit.	
Intensity	Discernible change (3)	Water and habitat quality deterioration will be expected to occur downstream of the various activities.	

Site clearing for the Construction of the CPP and Pipelines.			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Almost certain (6)	Pollution from the proposed activities is almost certainly going to occur as the activities, especially without mitigation, are located within proximity to various river systems.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffers, where possible, up to 500m (minimum 100m) from the Leeuspruit and Loopspruit; ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive; slow deep/shallow habitats should be favoured; ▪ Pipelines that cross water courses should be incorporated into a bridge or culvert design if possible; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff; and ▪ Construction sequencing is proposed, where possible.			
Post- mitigation			
Duration	Medium term (3)	The construction will be short term and if mitigated so will the impacts be short term.	Low (negative) – 21
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a locally impacted extent.	
Intensity	Discernible change (2)	Impacts limited due to mitigation actions.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		
Site clearing for the Construction of the RTSF Complex.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact description: Water and habitat quality modification due to potential sedimentation			

<table>
<tr><th colspan="4">Site clearing for the Construction of the CPP and Pipelines.</th></tr>
<tr><th>Dimension</th><th>Rating</th><th>Motivation</th><th>Significance</th></tr>
<tr><td colspan="4">Prior to mitigation/ management</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>The site clearing and infrastructure placement will occur and potentially recover within a three-five year period</td><td rowspan="5">Medium-high (negative)
– 84</td></tr>
<tr><td>Extent</td><td>Local (3)</td><td>The impacts are anticipated to occur around the activities which are located in proximity to the Leeuspruit and Loopspruit.</td></tr>
<tr><td>Intensity</td><td>Discernible change (3)</td><td>Water and habitat quality deterioration is will be expected to occur downstream of the various activities.</td></tr>
<tr><td>Probability</td><td>Almost certain (6)</td><td>Pollution from the proposed activities is almost certainly going to occur as the activities, especially without mitigation, are located within proximity to various river systems.</td></tr>
<tr><td>Nature</td><td>Negative</td><td></td></tr>
<tr><td colspan="4">Mitigation/ Management actions</td></tr>
<tr><td colspan="4">
▪ Establish riparian buffers, where possible, up to 500m (minimum 100m) from the Leeuspruit and Loopspruit;
▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive; slow deep/shallow habitats should be favoured;
▪ Pipelines that cross water courses should be incorporated into a bridge or culvert design if possible;
▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation;
▪ Silt traps placed within clean water return channels;
▪ Re-vegetation of disturbed areas from construction activities as soon as possible;
▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary;
▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff; and
▪ Construction sequencing is proposed, where possible.
</td></tr>
<tr><td colspan="4">Post- mitigation</td></tr>
<tr><td>Duration</td><td>Medium term (3)</td><td>The construction will be short term and if mitigated so will the impacts be short term.</td><td>Low (negative)
– 24</td></tr>
</table>

Site clearing for the Construction of the CPP and Pipelines.			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Local (3)	The mitigation measures will allow the impacts to be kept to a locally impacted extent.	
Intensity	Discernible change (2)	Impacts limited due to mitigation actions.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		

10.1.7 Wetlands Impacts

There are wetlands within the proposed RTSF complex and CPP footprints. The construction of the RTSF and CPP will require the removal of the wetland vegetation and topsoil. The proposed pipelines and transmission lines will also be located within intermittent wetland areas, as illustrated in Plan 22. Wetlands are responsible for complex functions that include maintenance of water quality, toxicant assimilation, carbon storage, streamflow regulation and flood attenuation, as well as biodiversity maintenance.

Table 10-13 details the project activities' interactions and the resultant impacts on wetlands as a result of the proposed developments.

Table 10-13: Interactions and Impacts on Wetlands during the Construction Phase

Interaction	Impact
Site clearing for pipelines, CPP and RTSF Complex	Direct loss of 53.9 ha of wetland habitat
	Contamination of water in wetlands
	Loss of ecosystem services

10.1.7.1 RTSF Complex and CPP

10.1.7.1.1 Impact Description

The clearing of land for the RTSF complex will result in a loss 42.9 ha of wetlands, with the clearing of land for the CPP resulting in 11 ha of wetlands. The loss of wetlands will have potential downstream impacts as the wetland functioning is lost. The impacts on the wetlands due to the RTSF are considered permanent, while the CPP will be demolished and the footprints rehabilitated. In addition to the direct impact on the wetlands due to site clearing, the remaining adjacent wetlands will be indirectly impacted upon due to potential contaminated runoff from the cleared areas.

10.1.7.1.2 Management Objectives

Management objectives are to inform SGL where there are wetland interactions with the proposed activities during the construction of the RTSF complex and CPP. These objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.1.7.1.3 Management Actions and Targets

A Wetland Management Plan has been provided in Appendix K and must be used as a guide to inform management actions. However, specific management actions are briefly discussed below:

- A Wetland Offset Strategy will need to be compiled for lost wetlands due to the RTSF complex and CPP, as detailed in Appendix K;
- The edge of the wetlands and the 30m buffer must be clearly demarcated in the field that will last for the duration of the construction phase and access to these areas must be restricted. A 100 m buffer is recommended from all wetland areas that are not associated with the direct footprints of the RTSF complex and CPP;
- Minimise footprint area disturbed by construction activities; and
- Rehabilitation Plan for disturbed wetland must be in place.

10.1.7.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on Wetlands are provided in Table 10-14.

Table 10-14: Potential Impacts on Wetlands due to the RTSF Complex and CPP

Site clearing for the RTSF Complex in and adjacent to wetlands			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of 42.9 ha of wetland habitat.			
Prior to mitigation/ management			
Duration	Permanent (7)	Wetland habitat will be permanently impacted by the construction of the RTSF.	High (negative) -119
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Irreplaceable loss (6)	Loss of wetlands is a serious impact to sensitive environments.	

Site clearing for the RTSF Complex in and adjacent to wetlands			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		
Mitigation/ Management actions			
There is no mitigation for the loss of 42.9 ha of wetland habitat in the RTSF footprint. An offset strategy must be compiled to compensate for the wetlands that are lost to the proposed project prior to any development on site. This includes 4.4ha of VB wetland being lost and 38.5ha of pans being lost. There are no post mitigation ratings.			

Site Clearing for the CPP in and adjacent to wetlands			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct loss of 11 ha of wetland habitat (VB) and resultant indirect loss due to wetland disconnection from stream network.			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Wetland habitat will be impacted by the construction of the CPP, even after the project has ceased.	High (negative) -112
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Irreplaceable loss (6)	Loss of natural wetlands is a serious and irreplaceable impact to highly sensitive environments.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		
Mitigation/ Management actions			
▪ The CPP footprint must be rehabilitated as per the Rehabilitation Plan, following the conclusion of the Project. ▪ A wetland offset strategy must be compiled to compensate for the wetlands that are lost to the proposed project prior to any development on site.			
Post- mitigation			
Duration	Project Life (5)	Rehabilitation of the wetland will allow the impact to be mitigated and decreased; however the wetland will not be natural.	Medium-high (negative) -98

Site clearing for the RTSF Complex in and adjacent to wetlands			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted; mitigation will not decrease this.	
Intensity	Serious loss (5)	Loss of natural wetlands is a serious impact to highly sensitive environments.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		

10.1.8 Visual Impacts

The interaction and resultant impacts associated with the construction phase are detailed in Table 10-15.

Table 10-15: Interactions and Impacts associated with the Visual Environment during the Construction Phase

Interaction	Impact
Site clearing and construction will add infrastructure to the visual landscape	The construction of the pipelines and roads, CPP and RTSF complex will have a negative visual impact on the environment as the facilities will be visible to surrounding receptors.

10.1.8.1 Pipelines and Roads

10.1.8.1.1 Impact Description

The pipelines will be constructed close to ground level and are only expected to be visible in the immediate vicinity. Once constructed, the pipelines will remain *in situ* for the life of the project. Due to the limited viewshed of the pipelines, this impact is considered to be medium-low (negative).

10.1.8.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the construction of pipelines.

10.1.8.1.3 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts to the visual environment are provided in Table 10-16.

Table 10-16: Potential Impacts on the Visual Environment due to the Pipelines and Roads

Pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Pipelines will impact on the visual environment.			
Prior to mitigation/ management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Medium-low (negative) -63
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	The negligible height of the pipelines will restrict the viewshed.	
Probability	Definite (7)	Pipelines will be constructed.	
Nature	Negative		
Mitigation/ Management actions			
▪ Vegetation must only be removed from the pipeline routes or areas necessary for the construction of the pipeline; ▪ Establish vegetation on disturbed areas following construction; and ▪ Down lighting must be used should construction take place during night time.			
Post- mitigation			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Medium-low (negative) -42
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	The negligible height of the pipelines will restrict the viewshed.	
Probability	Almost Certain (6)	It is most likely that the impact will occur.	
Nature	Negative		

10.1.9 Noise Impacts

Noise will be generated from a variety of sources, such as equipment and machinery vehicles and pumps, throughout the project. Table 10-17 details the project activities' interactions and the resultant impacts due to the generation of noise as a result of the construction phase. Noise dispersion models were developed and indicated that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-17: Interactions and Impacts associated with Noise during the Construction Phase

Interaction	Impact
Site clearing and construction for pipelines and roads and CPP	Generation of noise may increase ambient noise

10.1.9.1 CPP and Pipelines and Roads

10.1.9.1.1 Impact Description

Noise will emanate from machinery and vehicles operating during the site clearing and construction activities. The noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts are considered to be low (negative).

10.1.9.1.2 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the generation of noise are provided in Table 10-18.

Table 10-18: Potential Impacts due to Noise Generation associated with the CPP and Pipelines and Roads

Site Clearing and construction of CPP and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of noise			
Prior to mitigation/ management			
Duration	Medium term (3)	Noise will be produced for the duration of the construction phase	Low (negative) – 21
Extent	Local (3)	It is expected that during construction noise will extend as far as development site area.	
Intensity	Minimal (1)	It is expected that during construction noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors.	

Site Clearing and construction of CPP and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		
Mitigation/ Management actions			
▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the construction phase	Low (negative) – 12
Extent	Local (3)	It is expected that during construction noise will be limited to site if mitigation measures are implemented.	
Intensity	Minimal (1)	It is expected that during construction noise will have a minimal social impact	
Probability	Rare (2)	It is improbable that noise will impact on the surrounding receptors.	
Nature	Negative		

10.1.10 Heritage Impacts

The potential impacts to heritage resources will only occur during construction phase. The identified heritage resources were assessed in terms of their cultural significance, as detailed in Appendix N. The identified burial grounds and graves are considered to have a very high cultural significance, with all identified structured considered to be negligible in terms of cultural significance. Table 10-19 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-19: Interactions and Impacts on Heritage Resources

Interaction	Impact
Site clearing	Destruction and damage to burial grounds and graves.
	Destruction and damage to structures older than 60 years.

10.1.10.1 RTSF Complex and Pipelines and CPP

10.1.10.1.1 Impact Description

Built structures older than 60 years were identified within the footprints of the RTSF complex and CPP. The identified structures older than 60 years were deemed to have a negligible cultural significance, although the structures are still protected under Section 34 of the NHRA. A Section 34 Permit Application must be applied for to the PHRA-G for any structures that may be altered or demolished.

Two burial grounds were identified (BGG-015 and BGG-022) within the footprint of the proposed RTSF. Several of the identified graves within site BGG-015 are associated with the Mkhwanazi families who still reside in the area, as well as another family residing in Lesotho. A further two burial grounds were associated with the pipeline route from the CPP to the RTSF and were associated with the Rapoo, Ntaopane and du Plessis families. The cultural significance of the burial grounds was determined to be highly significant to the communities in terms of social, cultural, religious and spiritual reasons.

The proposed RTSF and pipeline route will have a permanent and direct impact on these burial grounds should mitigation and management measures not be implemented.

10.1.10.1.2 Management Objectives

Management objectives are to prevent the permanent damage and destruction to heritage resources of significance, as well as to avoid international reputation damage to SGL should such impacts to heritage resources take place. SGL intends to manage the heritage resources in a responsible manner.

10.1.10.1.3 Management Actions and Targets

Burial grounds are protected under Section 36 of the NHRA. A Burial Ground and Graves Consultation (BGGC) process must be undertaken in accordance with Section 36 of the NHRA where the bona fide next of kin must be identified, where possible, and consulted to reach an agreement regarding the management of the burial grounds through a Conservation Management Plan (CMP). Where *in situ* conservation of the burial grounds is not feasible, a Grave Relocation Plan (GRP) must be developed through the BGGC process.

10.1.10.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on heritage resources of significance are provided in Table 10-20.

Table 10-20: Potential Impacts on Heritage Resources of Significance due to the RTSF Complex

Site clearing for the RTSF Complex and pipeline from the CPP to the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct Impact to Burial Grounds and Graves with Very High Cultural Significance			
Prior to mitigation/ management			
Duration	Permanent (7)	BGG-015 and BGG-022 are situated within the proposed development footprint of the RTSF. BGG-023 and BGG-027 are located within the pipeline route. Construction activities will permanently destroy the burial ground	High (negative) - 147
Extent	International (7)	Potential next of kin reside outside of South African borders. The destruction of burial grounds will have international reputation repercussions for SGL	
Intensity	Irreplaceable loss (7)	This is a major change to a resource with very high cultural significance	
Probability	Definite (7)	Without mitigation, it is certain that the burial grounds will be destroyed through the establishment of the RTSF in the proposed development footprint.	
Nature	Negative		
Mitigation/ Management actions			
▪ BGGC as regulated by Section 36 of the NHRA and Chapter XI of the Regulations to the Act must be implemented; ▪ Identify bona fide next of kin, as far as possible; ▪ Reach agreement with next of kin as to the appropriate management of the burial ground or grave either through a CMP or if required, GRP.			
Post- mitigation			
Duration	Immediate (1)	The impact from relocation will be transient, occurring specifically during the pre-construction phase of the WRTRP	Medium-low (negative) - 63
Extent	Limited (2)	The mitigation will impact graves within the burial grounds and the associated next of kin.	

Site clearing for the RTSF Complex and pipeline from the CPP to the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Serious loss (5)	The intensity of the mitigations will result in a moderate change to resources with very high Cultural significance.	
Probability	Definite (7)	Based on the current proposed development footprint, it is certain that a BGGC and GRP are required.	
Nature	Negative		

10.1.11 Socio-Economic Impacts

The potential socio-economic impacts are complex in nature as the potential impacts are multi-dimensional, interrelated and mutually reinforcing. In addition, the potential socio-economic impacts may not result from individual project activities, but due to the presence of the Ultimate Project as a whole; the driving factors behind potential socio-economic activities are not easily determined. For ease of reference throughout this report, the project activity "*Employment and Procurement*" will be used to refer to all potential socio-economic impacts and their related mitigation measures, although the potential impacts may result from a combination of activities. It should also be noted that majority of the socio-economic impacts are likely to occur throughout the project life, and have been rated as such, but are detailed during the construction phase only.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-21.

Table 10-21: Summary of the Potential Socio-Economic Impacts Resulting from the Construction Phase

Interaction	Impact
Employment and procurement for the construction and operation of the WRTRP.	Local employment and procurement of goods and services, as well as skills development, capacity building and economic development will have a positive impact. All these impacts will result in a positive contribution to the GDP.
	Disruption of movement and mobility for people and livestock.
	Displacement impacts for the development of the RTSF.
	Population influx may result as job seekers arrive in the area. Population influx may result in impacts such as pressure on services and resources and potential health, safety and security impacts.

10.1.11.1 Employment and Procurement

10.1.11.1.1 Impact Description: Job Creation, Economy Stimulation and Development

It is expected that a large portion of the workforce required during the construction and operational phases will be derived from within the borders of the affected local municipalities, although this number is not yet known. It is estimated that approximately 2 000 employees will be required for the construction phase and it is likely that construction activities will be undertaken through the appointment of contractors. The construction phase of the project will include activities such as engineering and design, infrastructure development, installation of machinery and equipment, civil engineering works, labour and capital and other construction related activities. It is anticipated that a total capital investment in excess of R 9 billion will be spent by SGL during the construction phase. This positive impact to local businesses and suppliers will have a further positive impact on the region through indirect and induced impacts on the economy.

In addition, SGL has a Social and Labour Plan with commitments that include skills development, basic education (literacy and numeracy) and capacity building of its employees, all of which contributes towards the improvement of the skills levels amongst the population in the region. It is anticipated that the Social and Labour Plan, and associated LED Plan, will provide benefits to the local economy by stimulating the growth of small businesses and contributing towards skills development.

10.1.11.1.2 Management Objectives

The communities in the vicinity of the project are likely to be affected the most by the project's activities. It is consistent with national legislation and international best practice standards that these host communities are given special consideration in terms of the project's benefits. To enhance the potential positive impacts associated with the project, the following enhancement measures have been proposed:

- Use labour-intensive construction methods, where feasible, to increase employment opportunities;
- Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities;
- Local labour, local construction contractors and local and small businesses should be prioritised;
- Where feasible, reserve a percentage of, and promote employment opportunities for woman and the youth;
- Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments;
- Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies;

- Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited;
- Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes;
- Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured;
- Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate;
- Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL; and
- Support housing development through the promoting of house ownership for employees.

10.1.11.1.3 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-22.

Table 10-22: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct, indirect and induced positive impacts as a result of local employment, procurement of local goods and services and skills and training development.			
Prior to enhancement/ management			
Duration	Project life (5)	The impacts will last for the life of the project.	Minor (positive) 60
Extent	Local (3)	Employment and procurement will target the local municipal areas.	
Intensity	Moderately high (4)	The economy's output will increase by R9.1 billion through employment and procurement.	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Likely (5)	Without the appropriate enhancement measures, potential for local recruitment and procurement will not be realised.	
Nature	Positive		
Enhancement/ Management actions			
▪ Use labour-intensive construction methods, where feasible, to increase employment opportunities; ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Where feasible, reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.			
Post- enhancement			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive) 96
Extent	National (6)	The resultant impacts will have a significant impact on a national scale.	
Intensity	High (5)	Enhancement will maximise local job creation and procurement which will result in significant multiplier affects.	
Probability	Highly probable (6)	Enhancement measures will ensure the local employment and procurement potential is realised.	
Nature	Positive		
Impact Description: Direct investment for goods and services will result in a multiplier effect on the local economy as a portion of these funds will stimulate regional economic growth.			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Prior to enhancement/ management			
Duration	Project life (5)	The LED will reach its peak during operation, but will commence during construction.	Minor (positive) 70
Extent	Municipal (4)	The local municipalities will benefit from the project, with the district municipality receiving benefits from taxes and royalties.	
Intensity	High (5)	The multiplier effect is likely to have a significant contribution to the region's economy.	
Probability	Likely (5)	Without the appropriate enhancement measures, benefits may be ad hoc and unsustainable	
Nature	Positive		
Enhancement/ Management actions			
▪ Where feasible, utilise existing SLP, LED and related stakeholder engagement processes to determine the need and viability for infrastructure and service-related projects; ▪ Supporting housing development through promoting house ownership for employees; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Identify students from local schools to participate in company bursaries and internship programmes; ▪ Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate; and ▪ Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL.			
Post- enhancement			
Duration	Beyond project life (6)	The impacts will last beyond the life of the project.	Major (positive) 119
Extent	Provincial (5)	The correct implementation of enhancement measures will result in benefits throughout the province.	
Intensity	Very high (6)	Living standards will be improved through the region.	
Probability	Certain (7)	The positive impact will definitely occur.	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Positive		

10.1.11.1.4 Impact Description: Disruption of Movement Patterns

The construction activities may impact on the daily movement patterns and mobility of people and livestock, both in terms of movement between farms and the use of existing access routes. Temporary disruption may extend to provincial and regional roads.

10.1.11.1.5 Management Objectives

Management objectives will be to minimise and manage the potential negative impacts associated with disruption of movement for people and livestock.

10.1.11.1.6 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-23.

Table 10-23: Pre-Mitigation and Post-Mitigation Potential Impacts on the Socio-Economic Environment

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Disruption of people and livestock daily movements			
Prior to mitigation/ management			
Duration	Medium term (3)	Mainly during construction phase with some disturbance during operation	Medium-low (negative) - 56
Extent	Local (3)	Project area and surrounding communities	
Intensity	Low (2)	Disruption may be intense for local farmers	
Probability	Certain (7)	Impact will definitely occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Inform and consult local communities regarding construction activities and potential road closures; ▪ Implement a grievance mechanism and procedures for surrounding communities to provide comments and issues relating to activities associated with the WRTRP; ▪ Erect suitable traffic and construction signage to raise awareness of construction and potential hazards; ▪ Implement cattle corridors and access points during construction activities to ensure grazing areas are uninterrupted.			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Post- mitigation			
Duration	Medium term (3)	Mainly during construction phase with some disturbance during operation	Medium-low (negative) - 42
Extent	Limited (2)	Project area and surrounding communities	
Intensity	Very low (1)	Nuisance factor for road users. Disruption may affect productivity of farming businesses	
Probability	Certain (7)	Mitigation will reduce disruption and provide alternative routes	
Nature	Negative		

10.1.11.1.7 Impact Description: Population Influx

Expectations regarding possible employment opportunities may arise once activities commence on site. Consequently, the area surrounding the CPP and RTSF complex may experience an influx of job seekers as this has already occurred in these areas since mining has expanded in the region. The magnitude of this impact may be influenced by the severity of poverty and unemployment, as people will be more inclined to travel in search of better livelihoods through employment.

The regional and local socio-economic profile indicates that poverty and unemployment are major challenges in the surrounding communities. It can therefore be anticipated that many job seekers (and sometimes whole families), as well as entrepreneurs and opportunists, will move to the broader Project area. In the event that a portion of the workforce is recruited from outside the local area, their presence will constitute an additional influx of people. Furthermore unsuccessful job seekers from outside the Project area may decide to settle in the Project area. This impact may commence prior to construction, and is likely to continue after construction has been completed.

The limited influx of construction workers, job-seekers and others is expected to have some social consequences. These include increased pressure on local services, resources and facilities, establishment and growth of informal settlements, conflict amongst communities and an increase in social pathologies and communicable diseases.

10.1.11.1.8 Management Objectives

Management objectives will be to minimise and manage the potential negative impacts associated with population influx.

10.1.11.1.9 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-24.

Table 10-24: Pre-Mitigation and Post-Mitigation Potential Impacts on the Socio-Economic Environment

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Resultant negative impacts associated with population influx.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	Influx may commence when information about the project becomes known. The impact will gain momentum during construction. Influx may seize during operation but some impacts will continue (e.g. HIV/Aids)	Medium high (negative) - 84
Extent	Municipal Area (4)	In vicinity of some project sites and at surrounding settlements	
Intensity	Moderately high (4)	Intensity will vary for different individuals and groups. Residents near project sites will be most severely impacted	
Probability	Highly Probable (5)	Pressure on services and growth of informal settlements is already a problem	
Nature	Negative		
Mitigation/ Management actions			
▪ Involve community structures to assist in communicating labour requirements and other mine related aspects to the communities; ▪ SGL must liaise with the municipalities to ensure expected population influx is taken into account for infrastructure development and planning; ▪ Promote development projects, such as low cost housing, by including such developments in the Social and Labour Plan and LED programmes; ▪ Implement an HIV/AIDS and alcohol abuse awareness campaigns in the communities and include such campaigns as a condition of contract for suppliers and sub-contractors; ▪ A voluntary counselling and testing (VCT) programme must be introduced for all employees for the WRTRP; ▪ Access control to operational areas must be implemented to prevent sex workers and petty traders from loitering near construction camps and operational areas; ▪ Construction and operational personnel must be dressed in uniform to clearly identify non-employed personnel from entering restricted areas; ▪ Liaison structures and forums that are already in place, such as the community police forum, must be strengthened with the local police to monitor social changes in crime patterns; and ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities.			
Post- mitigation			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Beyond project life (6)	Influx may commence when information about the project becomes known. The impact will gain momentum during construction. Influx may seize during operation but some impacts will continue (e.g. HIV/Aids)	Medium low (negative) - 55
Extent	Local (3)	In vicinity of some project sites and at surrounding settlements	
Intensity	Moderate (3)	Mitigation will reduce the scope and intensity of the impact, minimise construction camp impacts and assist local structures	
Probability	Likely (5)	The impact my still occur, even with mitigation	
Nature	Negative		

10.1.11.1.10 Impact Description: Displacement

The proposed RTSF complex requires a significant extent of land, which will inevitably result in a land acquisition process. One of the most significant socio-economic impacts resulting from such land acquisition is the displacement of persons residing on or making use of that land. Displacement impacts associated with the WRTRP encompass both physical displacement and economic displacement. The displacement impacts are predominantly centred around the proposed RTSF complex, which will result impact on agricultural activities and the livelihoods of farmers in the area. It is difficult to ascertain the total of production that will be lost due to the farmers' reluctance to disclose income information, however, it is estimated that an annual loss of production directly related to current activities will be R 25 million. The multiplier effects associated with the activities and possible losses from sterilised land could be R 50 million.

It should be noted that although farmers will be compensated for any displacement that may take place, the farm workers may not in turn receive compensation to enable them to establish an alternative livelihood.

10.1.11.1.11 Management Objectives

Management objectives will be to minimise the adverse impacts resulting from physical and economic displacement, as well as to determine the responsibilities for the relocation and/or compensation of farm workers or residents leasing the land.

10.1.11.1.12 Impact Description

The significance of the potential positive socio-economic impacts associated with the construction phase of the project are outlined in Table 10-25.

Table 10-25: Pre-Mitigation and Post-Mitigation Potential Impacts on the Socio-Economic Environment

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Physical and economic displacement impacts associated with the purchasing of land of the RTSF.			
Prior to mitigation/ management			
Duration	Permanent (7)	Displacement associated with the RTSF will be permanent.	High (negative) - 112
Extent	Limited (2)	The extent of the displacement will be for the RTSF site and its immediate surrounds.	
Intensity	Extremely high (7)	The impact will be intense for persons and households affected.	
Probability	Certain (7)	Displacement will take place.	
Nature	Negative		
Mitigation/ Management actions			
▪ The sales agreement must reflect the full value of the land and must consider the potential relocation cost of commercial farms and business operations; ▪ The responsibility for the resettlement of vulnerable households and compensation must be agreed upon prior to the finalisation of the sales agreement. Should SGL be responsible, a Resettlement Action Plan must be developed in consultation with the affected households; and ▪ An exclusion zone must be established from the RTSF where no households will be allowed.			
Post- mitigation			
Duration	Permanent (7)	Displacement associated with the RTSF will be permanent.	Medium high (negative) - 91
Extent	Very Limited (2)	The extent of the displacement will be for the RTSF site and its immediate surrounds.	
Intensity	Moderately high (4)	Mitigation will provide financial compensation and potential assistance.	
Probability	Certain (7)	Displacement will take place.	
Nature	Negative		

10.1.12 Traffic Impacts

The Traffic Impact Assessment (Appendix P) indicated that the analysed intersections were operating at an acceptable LOS, with the exception of the N12 and D671 intersection and the D671 and Kloof Mine access intersection. These road upgrades are the responsibility of the planning authorities as they will address existing traffic conditions. Potential impacts due to the increased vehicular activity are considered risks and are provided in Table 11-1.

Table 10-26 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-26: Interactions and Impacts on Traffic

Interaction	Impact
Construction activities at the CPP.	Increase in traffic volumes may result in vehicle delays.

10.1.12.1 CPP

10.1.12.1.1 Impact Description

Nuisance impacts may result due to increased delays at the N12 and D671 interaction and the D671 and Kloof Mine access intersection which are both currently experiencing unacceptable LOS. The increase in traffic volumes will result in increased vehicle delays due to the construction phase.

10.1.12.1.2 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on traffic are provided in Table 10-27.

Table 10-27: Potential Impacts Traffic due to the CPP

Operation of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Increased delays due to vehicle traffic			
Prior to mitigation/ management			
Duration	Medium Term, (3)	The construction phase in not expected to last more than 3 years	Medium-low (negative)

Operation of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Local (3)	Most of the impact will be on the local road network. Although the development traffic will make use of regional freight corridors, the number of vehicles assigned to any individual route will reduce as multiple route choices exist outside the study area.	– 50
Intensity	On-going serious social issues (4)	Increased traffic will result in minor increase in delays across most of the network.	
Probability	Likely (5)	It is likely that the additional development traffic could result in an increase in average vehicle delays and minor deterioration of service levels on the surrounding road network.	
Nature	Negative		
Mitigation/ Management actions			
▪ Make use of points-men at the N12 and D671 intersection and D671 and Kloof Mine access intersection; and ▪ Engage with the planning authorities concerning the maintenance and upgrading of public roads in proximity to the CPP.			
Post- mitigation			
Duration	Medium Term, (3)	The construction phase in not expected to last more than 3 years	Low (negative) – 32
Extent	Local (3)	Most of the impact will be on the local road network.	
Intensity	Medium social issues (2)	With mitigation, the impact of the additional development traffic will be minor.	
Probability	Probable (4)	It is probable for delays to occur on the local road network, mostly on days when points-men are not deployed.	
Nature	Negative		

10.2 Operational Phase

The operational phase includes the following activities associated with the Kloof Mining Right area:

- Abstraction of water from the K10 shaft;
- The CPP including:
  - The extraction of gold, uranium and sulfur from the reclaimed tailings at the CPP.
- The RTSF complex including:
  - The deposition of the residual tailings on the RTSF;
  - The operation of the RWD;
  - Treatment of water from the RWD at the AWTF; and
  - Discharge of treated water from the AWTF into the Leeuspruit.
- Pipelines, roads and transmission lines, including:
  - Pumping of residual tailings from the CPP to the RTSF; and
  - Use of roads for maintenance and monitoring of pipelines and transmission lines.
- Employment and Procurement.

10.2.1 Air Quality Impacts

Dispersion models were simulated to determine the predicted impacts of PM_{10}, $PM_{2.5}$, dust and certain gases during the operational phase of the CPP and RTSF associated with the Kloof Mining Right area. The dispersion model predictions were then used to determine and assess the significance of the potential impacts on the ambient air quality. The CPP and RTSF were modelled separately due to the different emission sources associated with the respective activities; the CPP emissions are predominantly gaseous in nature, with the RTSF emissions predominantly dust fallout.

The Initial Implementation (lower compartment) and Ultimate Project (lower and upper compartments) RTSF footprints were modelled. The lower compartment maximum predicted 24-hour daily PM_{10} concentration was 191 µg/m³, which exceeds the limit of 75 µg/m³. The annual PM_{10} concentration was 5 µg/m³ which is well below the annual limit of 40 µg/m³. The predicted maximum 24-hour daily PM_{10} concentrations for the Ultimate Project RTSF exceeded the NAAQS guidelines of 75 µg/m³, with a maximum concentration of 278 µg/m³. The predicted maximum daily PM_{10} concentration for the Ultimate Project RTSF is illustrated in Plan 26.

The maximum deposition rates for dust fallout from the lower compartment of the RTSF fell within the NDCR residential limits of 600mg/m²/day, with a deposition rate of 188 600mg/m²/day. Similarly, the maximum deposition rates for dust fallout for the Ultimate

Project RTSF was also within the NDCR residential limits, with a maximum concentration of 244 600mg/m^2/day; the dispersion model for the maximum dust fallout for the Ultimate Project RTSF is provided in Plan 27. The maximum concentrations for $PM_{2.5}$ did not exceed the NAAQS limits for both the Initial Implementation (lower compartment) and Ultimate Project (lower and upper compartments).

The gaseous emissions from the CPP include sulfur dioxide, nitrogen dioxide and carbon monoxide. The dispersion model maximum concentrations for sulfur dioxide and nitrogen dioxide exceeded the NAAQS standards for the predicted 1-hour models. The predicted maximum concentrations for carbon monoxide were within the NAAQS standards, as well as the annual sulfur dioxide and nitrogen dioxide concentrations.

All dispersion models for dust fallout, $PM_{2.5}$ and PM_{10}, for both the Initial Implementation (lower compartment) and Ultimate Project (lower and upper compartments) RTSF are provided in Appendix E. A summary of the predicted dispersion model results are provided in Table 10-28.

Table 10-28: Summary of Dispersion Modelling Results

Air Contaminant	Averaging Period	Ambient Air Quality Standard (µg/m^3)	Maximum Ground Level Concentration (µg/m^3)
Initial Implementation RTSF (Lower Compartment)			
Inhalable Particulates (PM_{10})	24 hour	75	123
	Annual	40	5.5
Fine Particulate ($PM_{2.5}$)	24 hour	65	33
	Annual	25	1.6
Dust fall (mg/m^2/day)			
Dust Deposition	monthly	600	274
Ultimate Project RTSF (Upper and Lower Compartments)			
Inhalable Particulates (PM_{10})	24 hour	75	278
	Annual	40	13
Fine Particulate ($PM_{2.5}$)	24 hour	65	58
	Annual	25	3
Dust fall (mg/m^2/day)			
Dust Deposition	monthly	600	244
CPP			
Inhalable Particulates	24 hour	75	15.5

Air Contaminant	**Averaging Period**	**Ambient Air Quality Standard (µg/m^3)**	**Maximum Ground Level Concentration**
(PM_{10})	Annual	40	1.4
Sulfur Dioxide (SO2)	1 hour	350	575
	24 hour	125	125
	Annual	50	16.4
Nitrogen Dioxide (all NO_x assumed to be NO_2)	1 hour	200	323
	Annual	40	9.4
CO (mg/m^3)			
Carbon Monoxide	1 hour	30	0.003
	8 hour	10	0.001

Plan 26: Maximum 24-Hour PM_{10} Concentrations

Plan 27: Maximum Dust Deposition (Not Mitigation)

Table 10-29 details the activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-29: Interactions and Impacts on Air Quality during the Operational Phase

Interaction	Impact
Operation of the CPP	Ambient pollutants loading due to stack emissions
	Reduction in the quality of ambient air due to increased pollutants loading
Operation of the RTSF	Reduction in air quality due to wind erosion of loose particulate matter from RTSF
	Soiling of surrounding surfaces due to fall out dust
	Health implications from inhalation of airborne dust

10.2.1.1 CPP

The operation of the CPP includes the extraction of gold, uranium and sulfur from the reclaimed tailings. The CPP will emit air pollutants into the surrounding atmosphere as part of the operational process.

10.2.1.1.1 Impact Description

The operation of the CPP, which includes the gold, uranium and acid plants, will be sources of gaseous emission that may lead to a reduction in air quality in the area. The dispersion model indicated 1-hour SO_2 and NO_2 maximum ground levels concentrations of 575 µg/m^3 and 323 µg/m^3, which exceed the NAAQS standards of 350 µg/m^3 and 200 µg/m^3 respectively. However, the 24-hour SO_2 concentrations for SO_2 and annual NO_2 concentrations were within the NAAQS standards, along with the PM_{10} and CO concentrations. The areas predominantly impacted upon due to the CPP occur to the north.

10.2.1.1.2 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the CPP comply with the NDCR standards for the protection of the environment, human health and wellbeing.

10.2.1.1.3 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NDCR standards. Stacks must be fitted with scrubbers and electrostatic precipitators to capture emissions (some of which record an 80% efficiency). Ambient pollutant monitoring should include gaseous and particulate emissions at upwind and downwind locations. Monitors must be place discretely at the nearest receptor area to assess public exposure. Concentrations of measured criteria pollutants must include PM_{10}, SO_2, NO_2.

10.2.1.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-30.

Table 10-30: Potential Impacts on Air Quality due to the CPP

Operation of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Pollution due to stack emissions from the CPP may impact on air quality			
Prior to mitigation/ management			
Duration	Project Life (5)	Emissions will be released to the atmosphere duration of life of the CPP	Medium-high (negative) – 91
Extent	Province (5)	Emissions will affect the entire province or region.	
Intensity	Moderate (3)	Emissions generated will have moderate impact during the operational phase	
Probability	Almost Certain (7)	Almost certain that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Installation of gas scrubbers; ▪ Installation of electrostatic precipitators; and ▪ Installation of fabric filters.			
Post- mitigation			
Duration	Project Life (5)	Emissions will be released to the atmosphere duration gold, uranium and sulfur extraction at the CPP for the project life.	Low (negative) – 18
Extent	Local (3)	Emissions will extend across the development site area.	
Intensity	Minimal - negative (-1)	Minimal impact on ambient air quality after mitigation measures are implemented	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low, due to design and implementation of adequate mitigation measures.	
Nature	Negative		

10.2.1.2 RTSF Complex

The operation of the RTSF includes the deposition of the residual tailings from the CPP into the RTSF. The side walls of the RTSF will be rehabilitated during the operational phase and vegetation will be established.

10.2.1.2.1 Impact Description

The RTSF will be a source of dust pollution, especially during windy episodes and in the dry months (April to September). This will result in fugitive dust emissions containing TSP, PM_{10} and $PM_{2.5}$; however model predictions have shown that TSP, PM_{10} and $PM_{2.5}$ emissions are within the NAAQS and NDCR standards.

The significance of the impacts associated with the fugitive dust emissions from the RTSF are considered to be medium-low (negative), reducing in significance to low (negative) following the implementation of mitigation measures. The mitigation measures include:

- Vegetation of side walls;
- Cladding of side walls with stone; and
- Application of wetting agents or dust suppressant on exposed surfaces.

10.2.1.2.2 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the RTSF comply with the NDCR standards for the protection of the environment, human health and wellbeing.

10.2.1.2.3 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NAAQS and NDCR standards. Ambient pollutant monitoring should include particulate emissions at upwind and downwind locations and monitors must be place discretely at the nearest receptor area to assess public exposure. Concentrations of measured criteria pollutants must include PM_{10} and dust fallout.

10.2.1.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-31.

Table 10-31: Potential Impacts on Air Quality due to the RTSF

Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of dust and reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Project Life (5)	Dust from tailings will take place for the life of mine	Low (negative) – 84
Extent	Local (3)	Airborne dust will extend across the development site area.	
Intensity	Serious Medium term (4)	Airborne dust will have serious medium term impact during the operational phase	
Probability	Almost Certain (7)	Almost certain that impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Vegetation of side walls; ▪ Cladding of side walls with stone; and ▪ Application of wetting agents or dust suppressant on exposed surfaces.			
Post- mitigation			
Duration	Project Life (5)	Dust will be generated from the RTSF for the duration of the operational	Low (negative) – 16
Extent	Limited (2)	Dust will be limited to the site and immediate surroundings with adequate mitigation measures.	
Intensity	Minimal (1)	Minimal impact on ambient air quality after mitigation measures are implemented	
Probability	Rare (2)	Possibility of impacting ambient air quality is very low, due to design and implementation of adequate mitigation measures.	
Nature	Negative		

10.2.2 Groundwater Impacts

Following the identification and characterisation of the aquifers, contaminant sources (Table 9-6) and groundwater receptors, a numerical model was developed to investigate the flow conditions and mass transport of contaminants associated with the RTSF. The maximum concentrations identified, sulfate and manganese, as well as the concentrations of arsenic and uranium (due to the perceived contaminants of concern associate with gold ore processing) were used as the contaminants for simulation. The model domain encompasses and areas following no flow boundaries approximately 24 km (east to west) by 21 km (north to south). The model domain and calibration is detailed in Appendix F.

The following scenarios were simulated for the RTSF:

- Scenario 1 assumes a base case with no mitigation whereby the RTSF does not contain a drain or liner to intercept any seepage. This will result in all seeped water from the RTSF infiltrating into the groundwater;
- Scenario 2 assumes a geomembrane liner will be implemented beneath the RTSF;
- Scenario 3 assumes a geomembrane and clay liner will be implemented beneath the RTSF;
- Scenario 4 assumes a Class C liner without underdrainage; and
- Scenario 5 is the same as Scenario 1 with the addition of a blast curtain to a depth of 30 mbgl to intercept any pollution plumes that may originate from the RTSF. A simplified design of the blast curtain is provided in Figure 10-1. The blast curtain will have an area of approximately 1 670 ha, which will have an area between the RTSF and blast curtain of 280 ha.

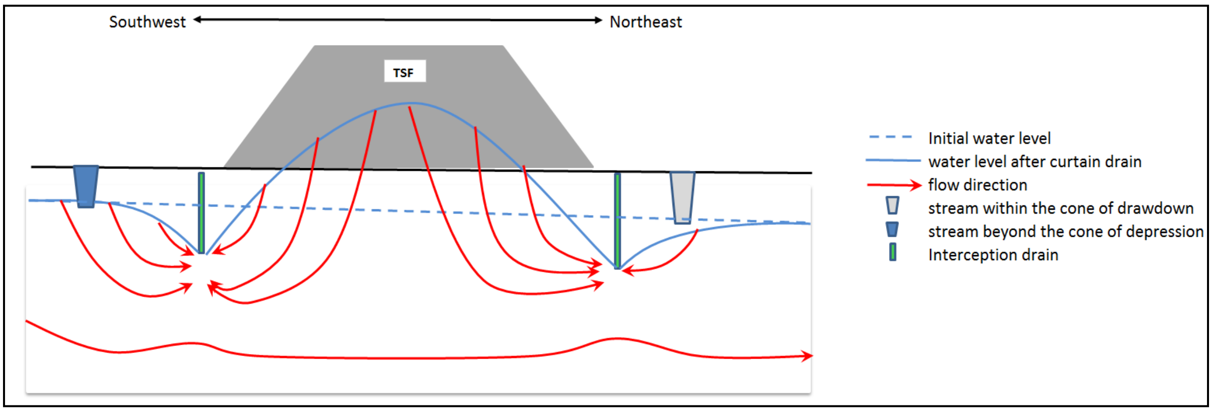


Figure 10-1: Conceptual Blast Curtain Design

The various scenarios were modelled and the effectiveness of the scenarios were compared by judging the extent of the contamination plumes from the RTSF. Both the life of the operation (50 years) and 100 years after closure were modelled, with the plume areas for each scenario provided in Table 10-32 and Table 10-33. The plume areas are only provided for concentrations that exceed the SANS 241:2011 drinking water standards for sulfates, manganese, arsenic and uranium.

Table 10-32: Plume Size for the Various Scenarios at the End of the Operational Phase (50 years)

Scenarios 50 years	Plume area (ha) that is above the SANS 241:2011 Recommended Limit			
	SO_4	Mn	As	U
Scenario 1	2 610	2 580	-	-
Scenario 2	-	-	-	-
Scenario 3	-	-	-	-
Scenario 4	-	-	-	-
Scenario 5	1 630	1 630	-	-

Table 10-33: Plume Size for the Various Scenarios 100 Years after Closure

Scenarios 100 years	Plume area (ha) that is above the SANS 241:2011 Recommended Limit			
	SO_4	Mn	As	U
Scenario 1	3 630	3 590	-	-
Scenario 2	1 390	1 350	-	-
Scenario 3	1 350	1 300	-	-
Scenario 4	1 340	1 290	-	-
Scenario 5	1 670	1 660	-	-

Both models (closure and 100 years after closure) for all scenarios indicated that the arsenic and uranium concentrations were within the SANS 241:2011 drinking water standard limits and, as a result, arsenic and uranium are not expected to have significant impacts. The remaining scenario results can be summarised as follows:

- Scenario 1 (base case) will have the most significant impact, with a sulfate and manganese contamination plume of approximately 2 610 ha and 3 630 ha for closure and 100 years after closure respectively;
- Scenarios 2, 3 and 4, which consist of various liners, will not result in a contamination plume exceeding the SANS 241:2011 recommended limits for sulfate and manganese and these scenarios are the most effective in preventing groundwater contamination. The contamination plumes from the RTSF with the various liners will be restricted to the RTSF footprint 100 years after closure; and
- Scenario 5 does not include a liner but utilises a blast curtain instead. Scenario 5 illustrated that the contamination plumes will be restricted to the blast curtain radius. Scenario 5 will result in the contamination plumes extending an additional 280 ha from the RTSF footprint, as opposed to being restricted to the RTSF footprint for

Scenarios 2, 3 and 4. The blast curtain will not require the capital expenditure associated with the liners however.

Due to the costs associated with the liners, SGL proposes to utilise a blast curtain. Although the use of a blast curtain will result in a contamination plume approximately 280 ha larger than the RTSF footprint, the cost of liner for the RTSF is anticipated to be approximately R 400 million which will result in the project becoming unfeasible. Should a liner be required, the WRTRP may not proceed which would result in the positive impacts associated with the Ultimate Project not being realised and continued impacts occurring throughout the West Rand due to the presence of the historical TSFs. For this reason, the potential impacts associated with the implementation of the blast curtain have been assessed.

The potential impacts below have assumed the base case scenario (scenario 1) and the implementation of a blast curtain (scenario 5) for the RTSF. The unmitigated sulfate contamination plume is displayed in Plan 28, with the sulfate contamination plume for scenario 5 illustrated in Plan 29. The interactions and resultant potential impacts that may affect groundwater during the operational phase are listed in Table 10-34.

Table 10-34: Interactions and Impacts on Groundwater during the Operational Phase

Interaction	Impact
Operation of the RTSF	Groundwater contamination may occur due to seepage from the RTSF.
	Groundwater contamination due to seepage from the RWD. The RWD will be lined and, as a result, no impact is expected.
Implementation of the blast curtain	Groundwater levels may be lowered due to dewatering of the blast curtain.

10.2.2.1 RTSF Complex

10.2.2.1.1 Impact Description

Should no mitigation measures, such as a liner or blast curtain, be implemented, seepage from the RTSF will negatively impact on groundwater with a sulfate and manganese plume of approximately 2 600 ha. The contamination plume will reach down-gradient private boreholes which will impact the groundwater users. In addition, the seepage from the RTSF will impact on streams once the contamination plume reached the streams. The contamination plume will migrate at a faster rate compared to the speed of the groundwater flow which will have a greater impact on the down-gradient riverine ecosystem and communities.

The implementation of a liner or blast curtain will be crucial to contain the contamination plume from the RTSF. The implementation of the blast curtain, however, will also impact on groundwater quantity as dewatering activities will take place at the blast curtain in an attempt to reduce groundwater quality impacts. The dewatering of the blast curtain will require a dewatering rate of 120% of the seeped water as water falling on the periphery of the RTSF will also need to be dewatered. The anticipated dewatering cone from the blast curtain is illustrated in Plan 30 and the drawdown may be more than 25 m is some localities. Such dewatering may also reduce the flow rate of the Leeuspruit and its tributaries. The water level is expected to be lowered by at least 10 m for an area of 2 370 ha.

Plan 28: End of Operation (50 years) Unmitigated (Scenario 1) Contamination Plume for the RTSF

Plan 29: End of Operation (50 years) Contamination Plume for Scenario 5 for the RTSF

Plan 30: Dewatering Cone of Depression associated with the Blast Curtain

10.2.2.1.2 Management Objectives

The management objectives are to prevent and minimise the potential contamination plumes as a result of the RTSF complex, as well as to manage the potential drawdown impacts associated with the blast curtain, should they be implemented.

10.2.2.1.3 Management Actions and Targets

The contamination plume must be limited as far as possible. Should a liner not be implemented, the contamination plume must be limited through the use of a blast curtain which will restrict the plume to approximately 1 600 ha.

10.2.2.1.4 Impact Ratings

The impact ratings, prior to and post mitigation measures, associated with groundwater during the operational phase are provided in Table 10-35.

Table 10-35: Potential Impacts on Groundwater due to the RTSF

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Seepage from the RTSF will contaminate groundwater resources and a contamination plume will migrate from the RTSF site.			
Prior to mitigation/ management			
Duration	Permanent (7)	Seepage of contaminated water will occur for an indeterminate period of time.	Medium-high (negative) – 105
Extent	Local (3)	The impact will be within 36 km of the RTSF footprint area	
Intensity	Serious (5)	Once contamination starts, it will be irreversible	
Probability	Definite (7)	Seepage from the RTSF will definitely impact the groundwater	
Nature	Negative		
Mitigation/ Management actions			
▪ Implementation of a blast curtain to restrict the migration of the contamination plume; ▪ Groundwater quality and water levels must be monitored on a quarterly basis; and ▪ Farmers must be compensated for impacted groundwater that extends beyond the blast curtain.			
Post- mitigation			
Duration	Permanent (7)	The contamination plume will be permanent	Low (negative)

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Limited (2)	The blast curtain with intercept any pollution plumes to within the immediate footprint area.	– 30
Intensity	Minimal (1)	Impact will be beneath and surrounding the RTSF only.	
Probability	Unlikely (3)	Impact to the groundwater outside the RTSF area is unlikely	
Nature	Negative		
Impact Description: Groundwater contamination due to seepage from the RWD.			
Prior to mitigation/ management			
Duration	Project life (5)	Seepage of contaminated water will occur during the operation of the RWD.	Medium-high (negative) – 77
Extent	Local (3)	The impact will be local and within 1.5 km of the RWD area	
Intensity	Minor (3)	Once contamination starts, it take time to rehabilitate naturally	
Probability	Definite (7)	Seepage from unmitigated (unlike) dams will definitely impact the groundwater	
Nature	Negative		
Mitigation/ Management actions			
▪ A liner must be implemented for the RWD; and ▪ Groundwater quality and water levels must be monitored on a quarterly basis;			
Post management			
Duration	Project life (5)	The seepage from the RWD will take place throughout the project life	Low (negative) – 21
Extent	Very limited (1)	With the application of a liner, the plume will be very limited	
Intensity	Minimal (1)	The intensity is minimal with the application of liners	
Probability	unlikely (3)	The impact is unlikely to occur	
Nature	negative		
Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Drawdown impact due to the dewatering of the blast curtain			
Prior to mitigation/ management			
Duration	Permanent (7)	The dewatering process and its impact will be permanent	Medium-Low (negative) – 72
Extent	Local (3)	The radius of influence will be of a local scale	
Intensity	Minor (2)	Drawdown in the nearby private boreholes will be less than 10 m	
Probability	Almost certain (6)	It is almost certain that there will be a linear drawdown of dewatering formed along the drain	
Nature	Negative		
Mitigation/ Management actions			
▪ Monitoring of groundwater levels as per the monitoring plan; and ▪ Farmers that are impacted due to the dewatering activities should be compensated.			
Post- mitigation			
Duration	Permanent (7)	The depression of the water table will persist throughout the life of operation	Medium-Low (negative) – 60
Extent	Limited (2)	With the re-introduction of the treated water into the Leeuspruit, the extent of impact will be limited	
Intensity	Minimal (1)	Once the abstracted water is treated and at the AWTF and introduced to the river, the environmental significance is rated as minimal	
Probability	Almost certain (6)	The lowering of the water table will almost certainly occur	
Nature	Negative		

10.2.3 Soil Impacts

During the operational phase, the pipelines will be monitored and maintained, resulting in site access along the pipeline route and use of the associated roads. The RTSF complex will be in operation and the footprint will not expand. Contaminants from the RTSF may impact on surrounding soil resources due to the mobilisation of the contaminants from wind and water. The use monitoring and maintenance of the pipelines may result in soil compaction due to vehicle and personnel movements.

Table 10-36 details the project activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-36: Interactions and Impacts on Soils during the Operational Phase

Interaction	Impact
Use of vehicles and heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
Operation of the RTSF	Contamination of surrounding soil resources due to mobilisation of contaminants.

10.2.3.1 Pipelines and Roads

10.2.3.1.1 Impact Description

The movement of personnel, vehicles and machinery during the monitoring and maintenance of the pipelines may result in soil compaction. Soil compaction prevents vegetation from being established and increases the velocity of water runoff which may result in soil erosion. The compaction and erosion of the soils leads to a loss of topsoil resources.

10.2.3.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the monitoring and maintenance activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.2.3.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.2.3.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-37.

Table 10-37: Potential Impacts on Soils due to Pipelines and Roads

Operation and maintenance of pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Medium-low (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The maintenance vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; and ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

10.2.3.2 RTSF Complex

10.2.3.2.1 Impact Description

Wind and water erosion of the RTSF may mobilise contaminants which could impact on surrounding soil resources. The contaminated soils will reduce the quality and land capability of the contaminated area.

10.2.3.2.2 Management Objectives

The management objectives are to limit the mobilisation and erosion of contaminants on the RTSF that could occur impact on surrounding soil resources around the RTSF. The rehabilitation of the side walls of the RTSF must be monitored for vegetation establishment and erosion potential. The implementation of storm water management facilities and wind barriers will reduce the mobilisation of contaminants from the RTSF.

10.2.3.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils.

10.2.3.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-38.

Table 10-38: Potential Impacts on Soils due to the RTSF

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Contaminated water or dust could settle on the surrounding soil resources. This will impact on the soil quality and the topsoil resource could be lost.			
Prior to mitigation/ management			
Duration	Project Life (5)	Contamination if unmitigated could last for many years.	Medium-high (negative) – 84
Extent	Local (3)	The impact will occur within and immediately around the Project site.	
Intensity	On-going serious (4)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	It is certain that this impact will occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Implement wind breaks surrounding the RTSF; ▪ Monitor the RTSF side walls for vegetation establishment and erosion potential; and			

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Ensure storm water management designs are in place.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	If mitigation measures are followed the impact area can be reduced	
Intensity	Minor (3)	If contamination occurs, it will still be a serious negative impact.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	
Nature	Negative		

10.2.4 Surface Water Impacts

Table 10-39 details the project activities' interactions and the resultant impacts on surface water as a result of the proposed developments.

Table 10-39: Interactions and Impacts on Surface Water during the Operational Phase

Interaction	Impact
Reduction of discharged water into the Wonderfonteinspruit	Decreased water discharged to the Wonderfonteinspruit River due to the abstraction of water from K10 shaft. This may result in inadequate water supply for the downstream users on the Wonderfonteinspruit.
Storage of water from the RTSF in the RWD.	Seepages of excess rainfall stored on the RTSF and the RWD to the Leeuspruit.
Discharges of water from the AWTP into the Leeuspruit.	Overflowing of small dams located on the Leeuspruit resulting in backing up of water upstream.
	Positive impact of dilution due to treated water being added to the current Leeuspruit flows.

10.2.4.1 Abstraction of Water from K10 Shaft

10.2.4.1.1 Impact Description

Currently approximately 30 Mℓ/day (30 000 m^3/day) of mine affected water from K10 shaft is being discharged into the Wonderfonteinspruit. During the operational phase of the project approximately 20 Mℓ/day (20 000 m^3/day) will be extracted and used as part of the reclamation process, along with an additional 12 m^3/day from Cooke 1 Shaft. This will result in a decrease in the current flow of 32 000 m^3/day in the Wonderfonteinspruit. Current flows for the Wonderfonteinspruit average 72 123 m^3/day; this would decrease by approximately 37% to 55% at the 1 m diameter pipeline outlet once discharges to the Wonderfonteinspruit decreases by 32 Mℓ/day.

The users identified along the Wonderfonteinspruit utilise water from the mentioned river for maize farming, cultivation of land and for cattle grazing, with total estimated usage being 3 500 m^3/day (based on 100 m^3/day for each of the 35 users identified). This water usage from the Wonderfonteinspruit in comparison to what is available based on the estimated flow data is sufficient, even after decrease in discharges occur.

Similarly, the reduction is discharge will result in decreased salt loads being discharged into the Wonderfonteinspruit; high salt loads are associated with poor water quality. The sulfate concentration in the Wonderfonteinspruit 1 m diameter pipeline outlet was 322 mg per litre, which exceeds the SANS 241: 2011 drinking water standards of 250 mg per litre, as well as the In-Stream Water Quality Guidelines for the Vaal Barrage unacceptable limit of 200 mg per litre. The reduction in salt loads in the Wonderfonteinspruit will decrease by 37% to 55%.

10.2.4.1.2 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on surface water resources are provided in Table 10-40.

Table 10-40: Potential Impacts on Surface Water due to the Abstraction of Mine Impacted Water from K10 Shaft

Abstraction and use of mine impacted water from K10 shaft.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: A decrease in water discharged into the Wonderfonteinspruit resulting in reduced water supply for downstream water uses.			
Prior to enhancement/ management			
Duration	Project Life (5)	32 Ml/d will be used during the operational life span within the RTSF	Medium-high (negative) - 78
Extent	Region (5)	May affect downstream water users beyond the project site	
Intensity	Moderate (3)	May impact already moderately impacted surface water resources	
Probability	Highly probable (6)	Water will need to be used within the RTSF and it is therefore most likely that the impact will occur	
Nature	Negative		
Enhancement/ Management actions			

Abstraction and use of mine impacted water from K10 shaft.			
Dimension	**Rating**	**Motivation**	**Significance**
There are no mitigation measures for the reduction in water quantity. It is estimated that the flows in the Wonderfonteinspruit will reduce by 37% to 55%, although there will still be sufficient flows to cater for the water supply demand.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: A decrease in water discharged into the Wonderfonteinspruit will result in decreased salt loads being discharged into the Wonderfonteinsruit.			
Prior to enhancement/ management			
Duration	Project Life (5)	Decrease of discharges to the Wonderfonteinspruit from 45 Ml/day to 13 Ml/day will occur during the operational phase.	Moderate (positive) 98
Extent	Region (5)	May affect downstream water users beyond the project site	
Intensity	Moderate high (4)	May impact already moderately impacted surface water resources	
Probability	Certain (7)	Water will need to be used within the RTSF and it is therefore the impact will occur	
Nature	Positive		
Enhancement/ Management actions			
The reduction in flows of approximately 32Ml/day will result in the corresponding reduction in salt loads of approximately 37% to 55%. This is a positive impact and there are no enhancement measures possible.			

10.2.4.2 RTSF Complex

10.2.4.2.1 Impact Description

During the operational phase of the project, water from the RTSF will be stored in the RWD before being pumped to the AWTF to be treated to potable water standards and discharged into the Leeuspruit. It is anticipated that 15 Mℓ/day (15 000 m^3/day) of treated water will be discharged into the Leeuspruit. This will result in an additional flow of 0.1 m^3 per second and an additional flow of approximately 35% in the Leeuspruit. Such increases may result in the overflowing of small farm dams downstream and a water backup in the river, although the floodlines for the Leeuspruit will not be impacted. This impact is considered to be medium-low (negative) and there are no possible mitigation measures.

The discharge of treated water is likely to have a positive impact on the water quality of the Leeuspruit and downstream Rietspruit as concentrations in the water will be diluted.

The operation of the RTSF and associated RWD has the potential to impact on the surrounding water quality should slurry or impacted water flow into the downstream environment. This is considered as a project risk and not an impact and has not been rated in terms of its significance as a result. As indicated in the groundwater impacts (Section 10.2.2.1), dewatering impacts will result in a drawdown effect and will lower the groundwater levels. The lowered groundwater levels extends to the Leeuspruit and its tributaries, however, water in the Leeuspruit flows much faster compared to the seepage rate through the stream floor and subsequently the stream flow will not be impacted significantly by the blast curtain dewatering activities.

10.2.4.2.2 Management Objectives

The objective is to treat the water from the RTSF complex to potable water standards.

10.2.4.2.3 Management Actions and Targets

The treated water being discharged will have a positive impact on the water quality of the Leeuspruit due to the additional dilution effect as well as the quality of the treated water falling within the SANS 241:2011 drinking water standards.

10.2.4.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on surface water resources are provided in Table 10-41.

Table 10-41: Potential Impacts on Surface Water due to the Discharge of Water associated with the RTSF Complex

Discharge of treated water from the AWTF into the Leeuspruit			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Positive impact on the water quality of the Leeuspruit and Rietspruit due to dilution of constituents from treated water discharges.			
Prior to enhancement/ management			
Duration	Project Life (5)	The discharge of water will occur for at least the life of the project.	Moderate (positive) 78
Extent	Municipal area (4)	The water quality downstream of the project will be positively impacted.	
Intensity	Moderately high (4)	The discharge of treated water will be a positive impact and will dilute the existing water quality of the Leeuspruit. The treated water will fall within SANS 241: 2011 drinking water standards.	
Probability	Highly probable	The dilution of the existing water quality	

Discharge of treated water from the AWTF into the Leeuspruit			
Dimension	**Rating**	**Motivation**	**Significance**
	(6)	will occur as long as the treated water is of a better quality than the Leeuspruit.	
Nature	Positive		
Enhancement/ Management actions			
The AWTF will treat water to SANS 241:2011 drinking water standards. It must be ensured that these standards are met prior to water discharge.			
Discharge of treated water from the AWTF into the Leeuspruit			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Potential overflowing of small dams downstream of the discharge point			
Prior to enhancement/ management			
Duration	Project Life (5)	The discharge of water will occur throughout the whole operational phase	Medium-low (negative) - 52
Extent	Municipal Area (4)	The Dams downstream of the project area, within the Leeuspruit catchment could be impacted	
Intensity	Moderately high (4)	On average 15 Ml/day will be discharged into the river with potential backing up of water upstream of the small Dams	
Probability	Probable (4)	Probability will increase, but will not be definite	
Nature	Negative		
Enhancement/ Management actions			
There are no mitigation measures proposed as the overflows of small dams will not result in significant backing up of flood waters.			

10.2.5 Fauna and Flora Impacts

Site clearing during the construction phase will have the most significant impacts on fauna and flora as vegetation and habitats are removed. The impacts associated with the operational phase are highlighted through the interactions in Table 10-42.

Table 10-42: Interactions and Impacts on Fauna and Flora during the Operational Phase

Interaction	Impact

Windblown tailings materials falling on surrounding areas.	Loss of vegetation and habitat due to degradation of vegetation quantity and quality. Loss of habitat will result in fauna moving away from the area.

10.2.5.1 RTSF Complex

10.2.5.1.1 Impact Description

The operational phase will include the deposition of tailings onto the RTSF. The RTSF may be susceptible to erosion from wind which may result in the tailings material being deposited in the areas surrounding the RTSF. The mobilisation of the tailings material can impact on vegetation which may result in vegetation and habitat loss. This impact is considered to be medium-low (negative) and can be mitigated to have a low (negative) impact. The mitigation measures include:

- Vegetate the side walls of the RTSF during its operation; and
- Monitor surrounding vegetation to assess potential impacts from windblown tailings material.

10.2.5.1.2 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-43.

Table 10-43: Potential Impacts on Fauna and Flora due to the RTSF

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of vegetation and habitat types due to windblown tailings particles degrading vegetation quality and quantity			
Prior to mitigation/ management			
Duration	Permanent (7)	The RTSF will not be removed and this impact has the potential to occur as long as the RTSF is operational	Medium-low (negative) – 48
Extent	Limited (2)	Species/habitat loss will only occur within and immediately around the RTSF site.	
Intensity	Moderate(3)	The vegetation surrounding the RTSF varies from disturbed (low sensitivity to wetlands with high sensitivity).	
Probability	Definite (4)	It is likely that certain plant species, downwind of the RTSF will be affected.	
Nature	Negative		

Mitigation/ Management actions			
▪ Vegetate the side walls of the RTSF during its operation; and ▪ Monitor surrounding vegetation to assess potential impacts from windblown tailings material.			
Post- mitigation			
Duration	Permanent (2)	With mitigation this impact can be greatly reduced.	Low (negative) - 8
Extent	Very Limited (1)	If well vegetated the impact will not disturb surrounding vegetation.	
Intensity	Minimal (-1)	Dependent on sensitivity of the specific site.	
Probability	Improbable (2)	This impact will occur	
Nature	Negative		

10.2.6 Aquatics Impacts

The operation of the RTSF and RWD may result in seepage of contaminants. All contaminated runoff from the RTSF will be channelled to the RWD and no contamination of surface water resources or aquatic habitats should take place from runoff. The water from the RWD will be treated at the AWTF and the treated water will be discharged into the Leeuspruit.

Table 10-44 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-44: Interactions and Impacts on Aquatic Ecosystems during the Operational Phase

Interaction	Impact
Abstraction of water from the K10 Shaft	The abstraction of mine affected water from the K10 Shaft for use in reclamation activities will result in reduced flow in the Wonderfonteinspruit. This may lead to aquatic habitat quality modification.
RTSF storage/operation	Seepage from the RTSF and RWD would result in potential persistent pollutant contamination with increased suspended and dissolved solids resulting in water and habitat quality modification and subsequent loss of sensitive aquatic biota and a reduction in overall aquatic biodiversity.

Interaction	Impact
Discharge of treated water into the Leeuspruit	Modification of instream aquatic habitat features including channel, flow and bed modification resulting in potential direct loss of aquatic biodiversity. This activity can also dilute pollutants and improve habitat diversity resulting in an increase biodiversity.

10.2.6.1 Abstraction of Water from K10 Shaft

10.2.6.1.1 Impact Description

Mine affected water from K10 Shaft is currently discharged into the Wonderfonteinspruit. Approximately 10 Mℓ/day of mine affected water from K10 Shaft will be used for the reclamation of the historical TSFs, this will result in a reduction of water within the Wonderfonteinspruit which may result in aquatic habitat modification.

10.2.6.1.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts.

10.2.6.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. Seepage of contaminated water from the RTSF and RWD can cause aquatic state degradation. To prevent this, the use of diversion and containment management is of importance. This can be achieved through effective ground and surface water management.

Although the discharge of treated water is likely to improve the downstream water quality (due to pollutant dilution), the management of the potential habitat impacts is important. At the point of discharge aquatic impacts may include the modification to the river bed and channel thus resulting in the alteration of aquatic habitat. Important management actions at this discharge point include energy dissipation, silt collection and discharge management.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to maintain the PES of the river systems. The monitoring for the presence of *Barbus anoplus* and *Pseudocrenilabrus philander* species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 30% as a result of activities related to the proposed project.

10.2.6.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic habitats are provided in Table 10-45.

Table 10-45: Potential Impacts on Aquatic Habitats due to the Abstraction from K10 Shaft

Abstraction of water from K10 Shaft.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately >15 years.	Medium-low (negative) - 60
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Minor (-2)	The removal of water from the Wonderfonteinspruit will likely reduce the overall available habitat. However, the flows at present are already artificial which has resulted in inundation of typically terrestrial regions. Therefore, the removal of water may result in a reduction of inundation.	
Probability	Almost certain (6)	The impact will almost certainly occur.	
Nature	Negative		
Mitigation/ Management actions			
There are no mitigation measures for the reduction in water quantity. It is estimated that the flows in the Wonderfonteinspruit will reduce by 37% to 55%, although there will still be sufficient flows to cater for the water supply demand.			

10.2.6.2 RTSF Complex

10.2.6.2.1 Impact Description

Contaminated seepage from the RTSF and RWD could result in water quality impacts and may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, through contaminated seepage, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances.

The discharge of treated water into the Leeuspruit may result in habitat quality impacts which may include bed, channel and flow modification. In addition, the discharge of treated water into the Leeuspruit will have a positive impact as the water quality of the river may improve due to the dilution of pollutants. This will result in increased biodiversity of aquatic biota.

10.2.6.2.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts.

10.2.6.2.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. Seepage of contaminated water from the RTSF and RWD can cause aquatic state degradation. To prevent this, the use of diversion and containment management is of importance. This can be achieved through effective ground and surface water management.

Although the discharge of treated water is likely to improve the downstream water quality (due to pollutant dilution), the management of the potential habitat impacts is important. At the point of discharge aquatic impacts may include the modification to the river bed and channel thus resulting in the alteration of aquatic habitat. Important management actions at this discharge point include energy dissipation, silt collection and discharge management.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must take place, with the primary target to maintain the PES of the river systems. The monitoring for the presence of *Barbus anoplus* and *Pseudocrenilabrus philander* species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 30% as a result of activities related to the proposed project.

10.2.6.2.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on aquatic habitats are provided in Table 10-46.

Table 10-46: Potential Impacts on Aquatic Habitats due to the RTSF Complex

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			
Prior to mitigation/ management			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately 15> years.	Medium-high (negative)

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	- 78
Intensity	Very serious (5)	Seepage and runoff from the RTSF will contain pollutants and will potentially negatively influence downstream water quality.	
Probability	Almost certain (6)	The impact will almost certainly occur if activities are to occur within proximity to the river systems without mitigation actions.	
Nature	Negative		
Mitigation/ Management actions			
▪ Silt traps placed within clean water return channels; ▪ The planting of indigenous trees around the RTSF and RWD; and ▪ Implementation of a blast curtain.			
Post- mitigation			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately 15> years.	Medium-low (negative) - 39
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	
Intensity	Very serious (-5)	Seepage and runoff from the RTSF will contain pollutants and will potentially negatively influence downstream water quality.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		
Discharge of treated water from the AWTF into the Leeuspruit			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Water and habitat quality modification			

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Prior to mitigation/ management			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately 15> years.	Medium-high (negative) - 78
Extent	Local (3)	The impacts, especially habitat impacts, will only occur within the local area. Water quality impacts will also most likely only impact a local area.	
Intensity	Very serious (5)	Habitat impacts attributed to erosion, flow and bed modification are serious impacts.	
Probability	Almost certain (6)	The impact will almost certainly occur if mitigation actions are not implemented.	
Nature	Negative		
Mitigation/ Management actions			
▪ Energy dissipation should occur at the site to slow water flow and control erosion; ▪ Silt collection should take place to avoid siltation in the river system; ▪ The discharge point should be stabilised and be able to withstand a 1:100 flood event; and ▪ Discharge should not allow for the creation of pools and should flow freely downstream.			
Post- mitigation			
Duration	Project life (5)	The impact will occur for the duration of the project which is approximately 15> years.	Negligible (positive) 33
Extent	Local (3)	The impacts, especially habitat impacts, will only occur within the local area. Water quality impacts will also most likely only impact a local area.	
Intensity	Average on going positive benefits (3)	If habitat impacts are mitigated, the treated discharge will likely improve water quality downstream. Furthermore, presently stream flow is modified. Improved streamflow will increase habitat diversity and subsequently aquatic biodiversity.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Positive		

10.2.7 Wetlands Impacts

There are limited interactions and impacts associated with wetlands during the operational phase, as majority of the impacts are likely to occur during the construction phase. The interactions and resultant impacts on wetlands during the operational phase are provided in Table 10-47.

Table 10-47: Interactions and Impacts on Wetlands during the Operational Phase

Interaction	Impact
Operation of RTSF.	This will include significantly increased general activity in the area. Wind and water spread sediments and pollutants have the potential to impact upon the surrounding wetlands, especially the Leeuspruit River.
	Water input from the catchment to the wetlands will be decreased due to the RTSF footprint being transformed and contained.
	Loss of groundwater input to wetlands due to the dewatering activities, with subsequent loss of wetland habitat, affecting the aquatic and wetland flora and fauna, and compromising the functioning of the wetlands from a hydrological point of view.
Abstraction of water from K10 shaft will reduce water discharged into the Wonderfonteinspruit	Desiccation and potential loss of wetland habitat may occur due to the reduction in water being released into the Wonderfonteinspruit from K10 shaft. This impact will obligate wetland species.
Discharge of treated water from the AWTF will increase flows in the Leeuspruit by approximately 35%.	Wetland habitat downstream of the discharge point in the Leeuspruit may have larger saturated or flooded areas. This is important as wetland habitat is affected by the level of saturation which in turn affects the wetland dependent fauna and flora.

10.2.7.1 Abstraction of Water from K10 Shaft

10.2.7.1.1 Impact Description

The reduction in water from K10 Shaft being discharged into the Wonderfonteinspruit will reduce water flows in the Wonderfonteinspruit, impacting on surrounding wetlands through desiccation. There are no mitigation measures for the reduction in water being discharged into the Wonderfonteinspruit.

10.2.7.1.2 Impact Rating

The impact significance ratings for the impacts on wetlands due to the abstraction of water from K10 Shaft are provided in Table 10-48.

Table 10-48: Potential Impacts on Wetlands due to the Abstraction of Water from K10 Shaft

Abstraction of water from K10 Shaft.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Desiccation of wetlands due to the reduction in water in the Wonderfonteinspruit.			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Impact will occur during the operation of the project but may remain for some time after.	Medium-high (negative) -78
Extent	Local (3)	Although the Wonderfonteinspruit is a major river eventually draining into the Vaal, the desiccation impact is likely to only be local.	
Intensity	Serious loss (4)	The loss of 32 Mℓ/day constitutes approximately 71% of the current volume of water being released into the wetland, which leads to a serious loss of wetland habitat and impacts wetland dependant flora and fauna.	
Probability	Highly probable (6)	The activity is definite; however the impact is highly probable.	
Nature	Negative		
Mitigation/ Management actions			
There are no mitigation measures for the loss of wetland habitat due to the reduction in flow I the Wonderfonteinspruit. It must be noted that water will be discharged from the SWTF into the Leeuspruit; both the Leeuspruit and Wonderfonteinspruit drain into the Vaal River.			

10.2.7.2 RTSF Complex

10.2.7.2.1 Impact Description

This phase will include the operation of the RTSF complex. The presence of the RTSF may result in erosion of the tailings material through wind and water erosion, which has the potential to result in sediments and pollutants reporting to the adjacent wetland systems. This will have a negative impact on the wetland integrity. This is of particular importance as the RTSF is located adjacent to wetland systems associated with the Leeuspruit. The footprint of the RTSF will also result in a significant loss of water input from the catchment of the wetlands.

Water from the RTSF will be treated at the AWTF and the treated water will be discharged into the Leeuspruit. The discharge of water will increase the flows in the Leeuspruit by up to 35% which will impact on wetlands by increasing the saturation or flood areas. The increased flows may also result in increased erosion along the banks of the Leeuspruit which may result in sedimentation of surrounding wetlands.

The blast curtain will require dewatering activities which will lower the groundwater levels surrounding the RTSF. The wetlands in proximity to the blast curtain will be impacted due to the loss of groundwater recharge into the wetlands, which will result in the loss of wetland habitat and compromise the functioning of the wetlands from a hydrological aspect.

10.2.7.2.2 Management Objectives

These objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.2.7.2.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.2.7.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on Wetlands are provided in Table 10-49.

Table 10-49: Potential Impacts on Wetlands due to the RTSF Complex

Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Sediment and pollution impacting the integrity of adjacent wetlands.			
Prior to mitigation/ management			
Duration	Project Life (5)	Impact will only occur during the operation of the CPP and RTSF.	Medium-high (negative) -84
Extent	Municipal (4)	The wetland catchments within the municipal boundaries will be impacted.	
Intensity	Serious (5)	This represents serious damage to highly sensitive environments.	
Probability	Highly probable (6)	This is highly probable due to the nature of the activity.	

Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		
Mitigation/ Management actions			
▪ The RTSF footprint must be fully contained and have no contact with the surrounding environment, especially the Leeuspruit River and tributaries. This is of particular relevance to storm water control; ▪ Vegetation of RTSF side walls; ▪ Application of wetting agents or dust suppressant on exposed surfaces; and ▪ Cladding of side walls with stone.			
Post- mitigation			
Duration	Project Life (5)	Mitigation will not decrease the duration of the operation of the CPP and RTSF.	Low (negative) -30
Extent	Local (3)	The mitigation measures will allow the impacts to be kept to a local extent.	
Intensity	Minor effects (2)	The wetlands will be subjected to minor impacts with mitigation measure employed.	
Probability	Unlikely (3)	Mitigation will decrease the likelihood of impacts significantly.	
Nature	Negative		
Impact Description: Loss of water input to wetlands from RTSF footprint.			
Prior to mitigation/ management			
Duration	Permanent (7)	Impact will be permanent as RTSF is to remain in perpetuity.	Medium-high (negative) -98
Extent	Local (3)	The local wetlands will be impacted.	
Intensity	Moderate loss (3)	This represents a moderate loss and impact to wetlands.	
Probability	Certain (7)	The loss of the area from the RTSF footprint is definite according to project plan	
Nature	Negative		
Mitigation/ Management actions			
There is no mitigation for the loss of water in the surrounding wetlands due to the presence of the RTSF. As a result, no post-mitigation ratings have been provided.			

Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Discharge from the AWTF will increase flows in the Leeuspruit by 35%. Increased flows will increase the saturation levels of the surrounding wetlands, as well as resulting in potential erosion which will cause sedimentation in the wetlands.			
Prior to mitigation/ management			
Duration	Beyond Project Life (6)	Impact will occur during the operation of the project and will remain for some time after. Impact is manageable and reversible.	Medium-high (negative) -96
Extent	Local (3)	The impacts are likely to only be localised to the Leeuspruit itself as the further away from the discharge point the lesser the flow rate impact will be. Therefore this is not seen as a municipal impact.	
Intensity	Irreplaceable damage to highly sensitive environment (7)	Erosion within wetland habitat will be a serious and irreplaceable impact to the sensitive wetland environment.	
Probability	Highly probable (6)	The activity is definite; however the impact is highly probable.	
Nature	Negative		
Mitigation/ Management actions			
▪ Energy dissipation designs must be designed and implemented at the discharge point of the treated water; ▪ Erosion hotspots must be identified along the Leeuspruit for up to 3 km downstream of the proposed discharge point. Erosion hotspots must be rehabilitated and erosion control implemented; and ▪ Erosion hotspots must be monitored on an annual basis.			
Post- mitigation			
Duration	Beyond Project Life (6)	Impact will still occur during the operation of the project and will remain for some time after. Impact is manageable and reversible.	Medium-low (negative) - 44
Extent	Local (3)	The impacts are still likely to only be localised to the Leeuspruit itself as the further away from the discharge point the lesser the flow rate impact will be.	
Intensity	Minor (2)	Erosion within wetland habitat will be a minor impact if prevented or rehabilitated.	

Operation of the RTSF.			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Probable (4)	The activity is definite; however the impact is only probable with mitigation.	
Nature	Negative		
Impact Description: Dewatering of water resources due to the blast curtain will have a negative impact on the wetland hydrological functioning. The wetlands downstream are not anticipated to be impacted upon however.			
Prior to mitigation/ management			
Duration	Permanent (7)	Wetland habitat within the dewatering cone will be permanently impacted by the dewatering as this will occur in perpetuity.	High (negative) -112
Extent	Local (3)	Despite the connectivity of water resources in a catchment, the impact to wetland is seen to be local; especially due to the water discharge downstream will mitigate downstream desiccation.	
Intensity	Irreplaceable loss (6)	Loss of natural wetlands is a serious and irreplaceable impact to highly sensitive environments.	
Probability	Definite (7)	This will occur according to the proposed mine plan and infrastructure layout.	
Nature	Negative		
There is no mitigation for the loss of wetlands; the blast curtain is critical to prevent further impacts.			

10.2.8 Visual Impacts

A viewshed model was developed using ArcGIS 3D Analyst Extension and illustrates the areas from which the proposed project will potentially be visible. The visibility of the project activities and infrastructure is based on the heights detailed in Table 10-50. The viewshed models are based on the topography only and do not take into account potential vegetation screening.

Table 10-50: Infrastructure Heights for Viewshed Modelling

Component	Infrastructure	Height
CPP	Uranium Processing Plant	36 m
CPP	Gold Processing Plant	25 m
CPP	Acid Plant	25 m
RTSF	RTSF	100 m

Component	Infrastructure	Height
RTSF	AWTF	5 m
RTSF	RWD	2 m

A practical viewshed model was developed for the CPP and RTSF and it was determined that the CPP is unlikely to be noticeable beyond a 4 km radius, with the RTSF having a much greater visibility of approximately 12 km. The viewshed area for the CPP and RTSF and the respective visual impact exposure is provided in Table 10-51, with the viewshed models for the CPP and RTSF illustrated in Plan 31 and Plan 32 respectively. It must be noted that the viewshed models have been based on the CPP and RTSF during the operation of the facilities but have been assessed during the construction phase as the impact will commence during this phase.

Table 10-51: Viewshed Area per Category

Category	Impact	Viewshed Area
CPP		
0 – 1.5 km	Potentially High Visual Exposure	11.13 km²
1.5 – 35 km	Potentially Moderate Visual Exposure	15.48 km²
3 – 4 km	Potentially Low Visual Exposure	11.22 km²
RTSF		
0 – 5 km	Potentially High Visual Exposure	172.20 km²
5 – 9 km	Potentially Moderate Visual Exposure	239.09 km²
9 – 12 km	Potentially Low Visual Exposure	233.19 km²

Plan 31: Practical Viewshed Model for the CPP

Plan 32: Practical Viewshed Model for the RTSF

Although the starter walls of the RTSF will have been started during the construction phase, the operational phase will comprise the depositing of tailings onto the RTSF.

The interactions and impacts associated with the operational phase are provided in Table 10-52

Table 10-52: Interactions and Impacts of the RTSF of the Visual Environment

Interaction	Impact
Operation of the CPP	The CPP will have a negative visual impact on the environment as the facilities will be visible to surrounding receptors.
Operation and depositing of tailings onto the RTSF	The operation of, and depositing of tailings on the RTSF will have a continued negative impact on the visual environment as the RTSF expands in height and footprint.

10.2.8.1 CPP

10.2.8.1.1 Impact Description

The CPP is expected to be visible for a maximum of 4 km and will have a visual impact on the surrounding receptors. The intensity of the impact is reduced, however, due to the adjacent existing mining activities to the south, east and north of the proposed CPP. Construction activities, as well as the presence of the CPP will impact on the visual environment; this impact will commence during the construction phase and will be present throughout the project life. A photomontage of the proposed CPP is provided in Figure 10-3, with Figure 10-2 indicating the current visual landscape. The viewpoint of the below figures was taken from the secondary road to the west of the proposed CPP and is approximately 1.3 km from the site. Figure 10-2 indicates the existing mining activities adjacent to the CPP, including a waste rock dump, shaft and associated infrastructure.

Figure 10-2: Current Visual Landscape of Proposed CPP

Figure 10-3: Potential Visual Landscape of Proposed CPP

10.2.8.1.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the development and presence of the CPP.

10.2.8.1.3 Management Actions and Targets

Potential visual impacts are subjective in nature which becomes difficult to provide management targets. The actions to be implemented involve reducing the visibility of the CPP to reduce the visual impact associated with the activity. Such actions include the establishment of vegetation screens, as well as establishing vegetation on disturbed areas, and the colour selection or finishing of the infrastructure.

10.2.8.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-53.

Table 10-53: Potential Impacts on the Visual Environment due to the CPP

Site clearing and development of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The presence of the CPP will have a negative impact on the visual environment.			
Prior to mitigation/ management			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Medium-high (negative) -77
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Moderate (3)	The CPP is adjacent to existing mining activities but will add additional infrastructure to the environment.	
Probability	Definite (7)	The CPP will be constructed and have an impact on the visual environment.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish vegetation screens adjacent to the CPP and, where permitted, along public roads from which the CPP is visible; ▪ Infrastructure must be painted natural hues to blend into the surrounding landscape; ▪ Pylons and metal structures must be galvanised to weather to a matt grey finish or painted with a matt finish; and			

Site clearing and development of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
▪ Down lighting must be used for activities undertaken at night.			
Post- mitigation			
Duration	Project Life (5)	The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Medium-low (negative) -66
Extent	Local (3)	The impact will extend only as far as the development site area.	
Intensity	Moderate (3)	The CPP's visibility will be reduced should the mitigation measures be implemented.	
Probability	Almost Certain / Highly Probable (6)	The likelihood of the impact occurring is almost certain.	
Nature	Negative		

10.2.8.2 RTSF Complex

10.2.8.2.1 Impact Description

The operation of the RTSF will involve the deposition of tailings material onto the RTSF which will result in the increase of the RTSF height. As the height increases the RTSF will become more visible and will begin to dominate the landscape for nearby receptors.

The RTSF and associated infrastructure is expected to be visible from a maximum distance of 12 km. The surrounding land use is predominantly agriculture; the establishment of the RTSF will have a significant impact as the sense of place will be altered from agricultural to mining. The RTSF will be approximately 100 m in height and cover an area of approximately 1 300 ha. The height and extent of the RTSF will have a significant visual impact which will commence during the construction phase and will be permanent.

10.2.8.2.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the RTSF due to the operation and deposition of tailings material.

10.2.8.2.3 Management Actions and Targets

Potential visual impacts are subjective in nature which makes it difficult to provide management targets. The actions to be implemented involve reducing the visibility of the RTSF although such actions are limited due to the size and extent of the facility.

10.2.8.2.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on the visual environment are provided in Table 10-54.

Table 10-54: Potential Impacts on the Visual Environment due to the RTSF

Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The operational will increase the RTSF's height which will result in the RTSF's visibility increasing.			
Prior to mitigation/ management			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	High (negative) -119
Extent	Municipal Area (4)	The RTSF will be visible for up to 12 km.	
Intensity	Moderate Irreplaceable Loss (6)	The visual landscape will be significantly altered.	
Probability	Definite (7)	The impact will occur.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish and maintain vegetation screens surrounding the RTSF and, where permitted, along public roads from which the RTSF is visible; and ▪ Concurrent rehabilitation of the side slopes of the RTSF must be undertaken and vegetation must be established.			
Post- mitigation			
Duration	Permanent (7)	The impact is irreversible, even with management, and will remain after the life of the project.	High (negative) -112
Extent	Municipal Area (4)	The RTSF will still be visible for up to 12 km.	
Intensity	Very Serious (5)	The intensity of the visual intrusion will still be significant.	
Probability	Definite (7)	The alteration to the sense of place will definitely occur.	
Nature	Negative		

10.2.9 Noise Impacts

Table 10-55 details the project activities' interactions and the resultant impacts due to noise generation as a result of the proposed developments. Noise dispersion models were developed and indicated that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-55: Interactions and Impacts associated with Noise during the Operational Phase

Interaction	Impact
Operation of the CPP, deposition of tailings on the RTSF and treating and pumping of water at the AWTF.	Generation of noise may increase ambient noise

10.2.9.1 Water Abstraction, RTSF Complex and CPP

10.2.9.1.1 Impact Description

Noise will emanate from machinery and equipment associated with the operation of the CPP, as well as the operation of the pump station at the RTSF complex (including AWTF operation). Based on the noise model (Appendix M), the noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts is considered to be low (negative).

10.2.9.1.2 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the generation of noise are provided in Table 10-56.

Table 10-56: Potential Impacts due to Noise Generation

Water Abstraction and the operation of the RTSF complex and CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of noise			
Prior to mitigation/ management			
Duration	Project Life (5)	Noise will be produced for the duration of life of mine	Low (negative) – 27
Extent	Local (3)	It is expected that during operation noise will not extend beyond the operational areas.	
Intensity	Minor (1)	It is expected that during operational phase noise will have a minor social impact	

Water Abstraction and the operation of the RTSF complex and CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding communities.	
Nature	Negative		
Mitigation/ Management actions			
▪ Pump stations to be housed in noise attenuating enclosures; ▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Project Life (5)	Noise will be produced for the duration of life of mine	Low (negative) – 18
Extent	Local (3)	It is expected that the disturbing noise will be limited to the site area.	
Intensity	Minimal (1)	It is expected that during operational phase noise will have a minor impact	
Probability	Unlikely (2)	It is unlikely that noise will impact on the surrounding receptors.	
Nature	Negative		

10.2.10 Socio-Economic Impacts

As detailed in Section 10.1.11, socio-economic impacts may arise from the construction phase and continue throughout the life of the project. As a result, although these impacts may continue to occur during the operational phase, these impacts have not been reassessed for the operational phase below. For ease of reference, all potential socio-economic impacts fall under the activity *Employment and Procurement*.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-57.

Table 10-57: Summary of the Potential Socio-Economic Impacts Resulting from the Operational Phase

Interaction	Impact
Employment and procurement during the operational phase of the WRTRP.	Local employment and procurement of goods specific to the operational phase of the WRTRP.
Production of gold and uranium.	Export of uranium and gold will contribute to South Africa's export earnings and allows the country to earn foreign exchange.

10.2.10.1 Employment and Procurement

10.2.10.1.1 Impact Description: Job Creation and Economy Stimulation

The Overall WRTRP will provide an estimated 500 permanent job positions over the life of the operation. The project will also result in indirect employment opportunities in the formal and informal sectors following project expenditure in the local areas and through the creation and expansion of local businesses that may serve the project's workforce.

In 2013, the export of gold contributed almost R 50 billion to South African exports, accounting for 19.5% of the country's total exports (DMR, 2015). The WRTRP will contribute an estimated R 4.5 billion of GDP-R per annum should the gold and uranium product be exported. Such exports will bring stability to the country through the earning of foreign exchange which in turns allows a greater purchasing capacity in the international market that can be used to acquire goods and services necessary for the development of other industries within the nation.

10.2.10.1.2 Management Objectives

It is consistent with national legislation and international best practice standards that host communities are given special consideration in terms of the project's benefits. To enhance the potential positive impacts associated with the project, the following enhancement measures have been proposed:

- Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities;
- Local labour and local and small businesses should be prioritised;
- Reserve a percentage of, and promote employment opportunities for woman and the youth;
- Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments;
- Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies;

- Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited;
- Identify students from local schools to participate in company bursaries and internship programmes;
- Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured;
- Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate;
- Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL; and
- Support housing development through the promoting of house ownership for employees.

10.2.10.1.3 Impact Description

The significance of the potential positive socio-economic impacts associated with the operational phase of the project are outlined in Table 10-58.

Table 10-58: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Direct, indirect and induced positive impacts as a result of local employment, procurement of local goods and services.			
Prior to enhancement/ management			
Duration	Project life (5)	The impacts will last for the life of the project.	Minor (positive) 60
Extent	Local (3)	Employment and procurement will target the local municipal areas.	
Intensity	Moderately high (4)	Approximately 500 jobs will be created during the operational phase, with additional indirect jobs created as a result.	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Probability	Likely (5)	Without the appropriate enhancement measures, potential for local recruitment and procurement will not be realised.	
Nature	Positive		
Enhancement/ Management actions			
▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour and local and small businesses should be prioritised; ▪ Where feasible, reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.			
Post- enhancement			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive) 96
Extent	National (6)	The resultant impacts will have a significant impact on a national scale.	
Intensity	High (5)	Enhancement will maximise local job creation and procurement which will result in significant multiplier affects.	
Probability	Highly probable (6)	Enhancement measures will ensure the local employment and procurement potential is realised.	
Nature	Positive		
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Exportation of uranium and gold product will contribute directly to the country's economy.			

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Prior to enhancement/ management			
Duration	Project life (5)	The impacts will last for the life of the project.	Moderate (positive) 96
Extent	National (7)	Exports will affect the balance of the national accounts.	
Intensity	Moderately high (4)	On-going positive benefits will be experienced.	
Probability	Highly probable (6)	It is expected that majority of the uranium and gold product will be exported.	
Nature	Positive		
Enhancement/ Management actions			
This is a positive impact and there are no enhancement measures associated with the export of the product.			

10.2.11 Traffic Impacts

No additional traffic impacts are anticipated during the operational phase. The risks associated with traffic are provided in Table 11-1 along with the appropriate mitigation measures.

10.2.12 Radiological Impacts

The interactions and impacts associated with radiological impacts during the operational phase, are provided in Table 10-59.

Table 10-59: Interactions and Impacts due to Radionuclides during the Operational Phase

Interaction	Impact
Operation of the CPP	The CPP will result in stack emissions which are likely to contain radionuclides. These radionuclides are inhaled by surrounding receptors which may result in radiation impacts.
Operation of RTSF Complex	The RTSF will contain radionuclides within the deposited tailings material. The potential for radiological impacts occur directly from the RTSF, as well as water runoff from the RTSF.

10.2.12.1 RTSF Complex and CPP

10.2.12.1.1 Impact Description

Nuclide specific activity concentrations for the TSFs associated with the WRTRP were obtained from worker safety assessments (Gold Fields, 2010), or analysed by SGS laboratories in France (Appendix Q). The tailings material from the reclaimed TSFs will result in the reduction in uranium concentrations and a possible enrichment of other radionuclides. To estimate activity concentrations of what might be disposed of at the RTSF, the average activity concentrations of the TSFs associated with the Driefontein, Cooke and Kloof Mining Right areas were used to derive an overall activity concentration.

In addition, there is potential for radionuclides to be discharged as part of the AWTF once the water from the RTSF has been treated, as well as radionuclide particles emitted from stacks at the CPP. The treatment objective of the AWTF will be to potable standards (SANS 241) which requires a uranium concentration below 15 µg per litre. The chemical quality of the water from the RTSF was predicted using the saturation chemistry model. In addition, the CPP will utilise an acid plant roaster and gold plant smelter. The gold plant smelter has a hydrometallurgical and electrochemical process and is assumed to contain very little radionuclides, if any, and was therefore considered irrelevant in terms of radiological impacts (Appendix Q). The acid plant roaster will process pyrite which is known to include radionuclides; the particulate emissions from the roaster process may also include radionuclides.

The CPP is located within an access restricted area which ensures that no direct exposure to the public will take place. Radiation exposure to the public may occur through PM emissions, however, as the PM emissions contain radionuclides from the stacks. The inhalation doses are considered low.

The RTSF is a potential radiation source to the public through atmospheric and groundwater pathways. Radon gas and dust particles containing naturally occurring radionuclides may be released into the atmosphere through wind erosion. The radon gas and PM may be inhaled directly or deposited in the environment that introduces secondary exposure pathways. Water runoff from the RTSF is likely to contain radionuclides and may leach into the underlying aquifer where it may migrate laterally along natural groundwater flow gradients. The blast curtain will dewater the aquifer in proximity to the RTSF, mitigating the potential contamination plume of the RTSF.

10.2.12.1.2 Impact Rating

10.2.12.1.3 Impact Rating

The impact ratings, prior to and post mitigation measures, associated with radiological impacts during the operational phase are provided in Table 10-60.

Table 10-60: Potential Impacts due to Radiological Impacts

Operation of the CPP			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Stack emissions from the CPP is likely to contain radionuclides which may be inhaled or report to the environment			
Prior to mitigation/ management			
Duration	Project Life (5)	The impact, although low, will occur for the during of the project	Low (negative) -14
Extent	Very limited (1)	The radiological impact is very limited, and mainly limited to the site itself	
Intensity	Minimal (1)	The only contribution is from dust inhalation, which is low due to low levels of PM_{10} that will be released from the CPP stacks	
Probability	Improbable (2)	It is improbable that a radiological impact above the compliance criteria will occur from releases from the CPP.	
Nature	Negative		
Mitigation/ Management actions			
No mitigation measures are required from a radiological perspective. The mitigation measures provided from an Air Quality perspective will have a direct influence in the potential radiological impacts.			
Operation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The RTSF may result in direct and indirect radiation impacts through atmospheric and groundwater pathways			
Prior to mitigation/ management			
Duration	Permanent (7)	Although moderate, the impact will continue to occur for as long as the RTSF remain as a source.	Medium-low (negative) -52
Extent	Local (3)	The impact is highest close to the RTSF, but then decrease significantly with distance away from the RTSF.	
Intensity	Moderate (3)	The intensity is rated is moderate, since the radiological impact through the atmospheric pathway resulted in moderate doses, especially in close proximity of the RTSF (with radon inhalation as the main contributor).	
Probability	Probable (4)	The probability that the radiological impact will occur during the operational period is good	
Nature	Negative		

Mitigation/ Management actions			
▪ The RTSF must be managed and operated within the Radiation Management Programme for CoR-70 and must be approved by the NNR.			
Post- mitigation			
Duration	Permanent (7)	Although moderate, the impact will continue to occur for as long as the RTSF remain as a source.	Medium-low (negative) -48
Extent	Local (3)	The impact is highest close to the RTSF, but then decrease significantly with distance away from the RTSF.	
Intensity	Minor (2)	The intensity is rated is minor, since the radiological impact through the atmospheric pathway resulted in minor doses, especially in close proximity of the RTSF (with radon inhalation as the main contributor).	
Probability	Probable (4)	The probability that the radiological impact will occur during the operational period is good	
Nature	Negative		

10.3 Decommissioning Phase

The decommissioning phase will entail the demolition of the CPP and potential demolition of the ancillary infrastructure, including the pipelines and roads, depending on the final land use and requirements. The footprints will be rehabilitated to a final land use. The RTSF will be rehabilitated and vegetation will be established on the side walls and top of the RTSF. The RWD will remain in place as water control. The AWTF will be demolished and the footprints rehabilitated, or left intact, depending on the requirements at closure.

10.3.1 Air Quality Impacts

Table 10-61 details the activities' interactions and the resultant impacts as a result of the proposed developments.

Table 10-61: Interactions and Impacts on Air Quality during the Decommissioning Phase

Interaction	Impact
Wind erosion	Generation of dust
	Reduction in the quality of ambient air due to increased dust loading from vehicle wheels and wind erosion

10.3.1.1 CPP, RTSF and Pipelines and Roads

10.3.1.2 Impact description

The dismantling of old infrastructure, including the CPP and potential ancillary infrastructure such as pipelines and roads involve the use of heavy machinery and vehicles similar to the construction phase. The final rehabilitation of the RTSF may use heavy machinery and vehicles similar to the construction phase. Wind erosion of the tailings materials may occur until the rehabilitation is complete and vegetation has been fully established, binding the tailings particles. The impacts on the atmospheric environment during this phase will result in the release of fugitive dust emissions containing TSP, PM_{10} and $PM_{2.5}$.

10.3.1.3 Management Objectives

The management objective is to ensure that emissions on-site and off-site from the demolition activities and subsequent rehabilitation, as well as rehabilitation of the RTSF, are not in exceedance of the NAAQS and NDCR standards for the protection of the environment, human health and wellbeing.

10.3.1.4 Management Actions and Targets

An emissions management programme must be developed to assess performance and compliance to the NDCR standards. Ambient pollutant monitoring should include particulate emissions at upwind and downwind locations and monitors must be place discretely at the nearest receptor area to assess public exposure. Ambient levels of dust will be assessed against the relevant standards.

10.3.1.4.1 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on air quality are provided in Table 10-62.

Table 10-62: Potential Impacts on Air Quality due to the RTSF Complex and CPP

Demolition of the CPP.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of dust and reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Medium term (3)	Dust will be generated during the dismantling process	Low (negative) – 21
Extent	Local (3)	Impact will extend across the development site area.	
Intensity	Minimal (1)	Minimal impact anticipated	
Probability	Unlikely (3)	It is unlikely that a dust impact will occur.	

Nature	Negative		
Mitigation/ Management actions			
▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading rubble should be minimised; ▪ Demolition activities should be avoided on days when the wind speed is greater than 5.4 m/s.			
Post- mitigation			
Duration	Short term (2)	Dust will be generated for the duration decommissioning phase	Low (negative) – 10
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minimal (1)	Minor impact on ambient air quality during construction phase	
Probability	Rare (2)	The possibility of dust generation is very low	
Nature	Negative		
Rehabilitation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of dust and reduction in ambient air quality			
Prior to mitigation/ management			
Duration	Short term (2)	Dust will be generated for the duration of this phase	Low (negative) – 18
Extent	Limited (2)	Dust generated will be limited to the site and it immediate surroundings	
Intensity	Minor (2)	The impact on ambient air quality will be minor because…	
Probability	Unlikely (3)	It is unlikely that the dust generated will impact on ambient air quality.	
Nature	Negative		
Mitigation/ Management actions			
▪ Application of wetting agents or dust suppressant on exposed areas; ▪ The area of disturbance must be kept to a minimum; and ▪ The RTSF must be capped and vegetated.			
Post- mitigation			
Duration	Short term (2)	Dust will be generated for the duration rehabilitation activities	Low (negative)

Extent	Limited (2)	Dust generated will be limited to the site and immediate surroundings	– 10
Intensity	Minimal (1)	Minor impact on ambient air quality	
Probability	Rare (2)	The possibility of dust generation is very low with mitigation	
Nature	Negative		

10.3.2 Soil Impacts

Table 10-63 details the activities' interactions and the resultant impacts as a result of the decommissioning activities associated with the proposed developments. It must be noted that the impacts to soils as a result of the RTSF have been discussed as part of the operational phase and no further impacts will occur during the decommissioning phase; the impacts during the operational phase as a result of the RTSF are considered to be permanent as the RTSF will remain in the landscape.

Table 10-63 Interactions and Impacts on Soils and Land Capability During the Decommissioning Phase

Interaction	Impact
Demolition of infrastructure and use of heavy machinery	Loss of topsoil as a resource – Erosion and Compaction
Soil Erosion through exposed soil surfaces	Loss of topsoil as a resource – Erosion and Compaction
	Loss of Land capability

10.3.2.1 Pipelines and Roads

10.3.2.1.1 Impact Description

The movement of personnel, vehicles and machinery during the demolition and removal of the pipelines and roads may result in soil compaction. Soil compaction prevents vegetation from being established and increases the velocity of water runoff which may result in soil erosion. The compaction and erosion of the soils leads to a loss of topsoil resources.

10.3.2.1.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur as a result of the monitoring and maintenance activities. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.3.2.1.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the disturbed areas associated with pipeline and road construction.

10.3.2.1.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-64.

Table 10-64: Potential Impacts on Soils due to Pipelines and Roads

Rehabilitation of pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Loss of topsoil as a resource due to compaction and erosion.			
Prior to mitigation/ management			
Duration	Project Life (5)	When the soil has eroded the impact will be permanent and is potentially irreversible even with management.	Medium-low (negative) – 36
Extent	Limited (2)	Compaction and erosion will occur on a limited scale and in the unmitigated situation the erosion will extend beyond the direct infrastructure.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Unlikely (3)	The rehabilitation vehicles will remain on existing access routes	
Nature	Negative		
Mitigation/ Management actions			
▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ The pipeline routes and roads must be rehabilitated and vegetation established.			
Post- mitigation			
Duration	Short term (2)	If the mitigation measures are implemented the impact will be for less than a year.	Low (negative) – 12
Extent	Very limited (1)	Compaction and erosion will occur on a very limited scale.	

Rehabilitation of pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Moderate (3)	The intensity of the impact will be reduced if mitigation is implemented.	
Probability	Rare (2)	If mitigation is followed the impact will rarely occur	
Nature	Negative		

10.3.2.2 CPP

10.3.2.2.1 Impact Description

The demolition of the CPP will require heavy vehicles and machinery on site. The movement of vehicles and machinery, as well as the presence of the CPP for the project life, will result in soil compaction, reducing the ability for vegetation establishment and resulting in soil erosion from the site. The loss of topsoil as a resource is a significant impact as the natural regeneration of a few millimetres of topsoil takes hundreds of years.

10.3.2.2.2 Management Objectives

The management objectives are to limit the loss of topsoil that could occur through compaction and erosion. Exposed areas must be assessed for compaction and erosion potential. Should compaction and erosion occur, these areas must be ripped and vegetated to prevent further impacts.

10.3.2.2.3 Management Actions and Targets

There are no regulated targets and requirements for the management of soils. SGL will rehabilitate the footprints of the CPP to an adequate end land use. To ensure that rehabilitation and eventual closure is effective and successful, the management of the soil resources is critical during the life of the project. The management of the soil throughout the project will directly influence the success of the rehabilitation activities. The soil will, thus, be stockpiled to prevent and minimise potential impacts with rehabilitation and long term use in mind. A Rehabilitation Plan (Appendix R) has been compiled and will detail the following:

- Topsoil stockpiles are to be kept to a maximum height of 4 m (the practical tipping height of dump trucks);
- Topsoil must be handled when it is dry to avoid compaction;
- The topsoil (0.3 m of the soil profile) and subsoil (approximately 0.3 – 0.8 m thick) must be stockpiled separately;
- Compaction of the removed topsoil must be avoided by prohibiting traffic on stockpiles;
- Stockpiles should only be used for their designated final purposes; and

- Vegetation establishment must be monitored on rehabilitated areas.

10.3.2.2.4 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the loss of topsoil are provided in Table 10-65.

Table 10-65: Potential Impacts on Soils due to the CPP

Demolition of the CPP and rehabilitation			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: The movement of heavy machinery on the soil surface causes compaction, which reduces the vegetation's ability to grow and as a result erosion could be caused.			
Prior to mitigation/ management			
Duration	Project Life (5)	Soils will be moved from the stockpiled locations to the infrastructure sites for rehabilitation. This could impact on the soils if not mitigated. These impacts could last for many years.	Medium-high (negative) – 91
Extent	Local (3)	The impact will occur at the stockpile and the replaced locations.	
Intensity	Very Serious (5)	Loss of topsoil may result in loss of land capability and land use. Soil regeneration takes a very long time.	
Probability	Certain (7)	By excavating the soil it will certainly impact on the soil.	
Nature	Negative		
Mitigation/ Management actions			
▪ Soil handling and rehabilitation must be undertaken as outlined in the Rehabilitation Plan.			
Post- mitigation			
Duration	Project Life (5)	Loss of topsoil makes land less productive. Effects will occur long after the project life.	Low (negative) – 30
Extent	Limited (2)	Loss of topsoil will only occur within and immediately around the Project infrastructure area.	
Intensity	Moderate (3)	Loss of topsoil may result in loss of land capability and land use.	
Probability	Unlikely (3)	If the mitigation is followed then it is unlikely that the impacts will occur.	

Demolition of the CPP and rehabilitation			
Dimension	**Rating**	**Motivation**	**Significance**
Nature	Negative		

10.3.3 Surface Water Impacts

The decommissioning phase of the project will include the demolition and removal of infrastructure. There are no direct anticipated impacts on surface water resources associated with the decommissioning phase, however, spillages of residual material may take place from the decommissioning of the CPP and pipelines. Should residual material report to the catchment, this will have an impact on the surface water quality. These are considered as project risks and have not been rated as a result.

10.3.4 Aquatics Impacts

The CPP, pipelines and roads will be demolished, depending on the final land use, and the footprints rehabilitated. The RTSF will be rehabilitated and the RWD will remain in place to manage runoff from the RTSF. No new impacts on aquatic habitats will result from the RTSF and RWD from the operational phase.

Table 10-66 details the project activities' interactions and the resultant impacts on aquatic habitats as a result of the proposed developments.

Table 10-66: Interactions and Impacts on Aquatic Ecosystems during the Decommissioning Phase

Interaction	Impact
Demolition and removal of CPP, Pipelines and Roads	Increased runoff as a result of exposed surfaces could result in instream and riparian habitat modification or destruction through erosion, flow, bed, channel and water quality modification. Water quality modification can be related to an increase in the amount of suspended/dissolved solids which can result in increased sedimentation and changes to the physical chemistry of the water in downstream regions. These physical impacts could lead to reduced aquatic biodiversity.

10.3.4.1 CPP and Pipelines and Roads

10.3.4.1.1 Impact Description

Contaminated runoff and from exposed footprints of the CPP and pipelines and roads could result in water quality impacts and may include increased dissolved/suspended solids as well as potential persistent pollutants. In addition, through contaminated runoff and seepage, general water chemistry modification may occur as a result of increased metals and nutrients as well as modified pH balances. Increased runoff and erosion caused through decommissioning activities as well as movement of suspended materials in runoff may produce habitat quality impacts which may include sedimentation, bed, channel and flow modification.

10.3.4.1.2 Management Objectives

The objective is to preserve the PES and prevent further degradation of local aquatic environments. This objective can be achieved through the management of potential water and habitat quality impacts.

10.3.4.1.3 Management Actions and Targets

Mitigation measures provided as part of the surface water and groundwater sections apply for aquatic ecosystems as well. During the decommissioning phase, vehicles and people will be in proximity to aquatic resources (Leeuspruit and Loopspruit). The disturbance of land may result in compaction of soils and increase the erosion potential.

Along with the implementation of the mitigation measures, bi-annual aquatic biomonitoring must continue to take place, with the primary target to maintain the PES of the river systems. The monitoring for the presence of *Barbus anoplus* and *Pseudocrenilabrus philander* species downstream must take place to determine potential habitat impacts as these species were found in abundance. The SASS5 and ASPT index monitoring should not reduce by more than 30% as a result of activities related to the proposed project.

10.3.4.1.4 Impact Rating

The impact ratings on aquatic ecology during the decommissioning phase are detailed in Table 10-67.

Table 10-67: Potential Impacts on Aquatic Ecology during the Decommissioning Phase

Site clearing for the Construction of the CPP and Pipelines.			
Dimension	**Rating**	**Motivation**	**Significance**
Impact description: Water and habitat quality modification due to potential sedimentation			
Prior to mitigation/ management			
Duration	Short term (2)	The impact will only occur during the decommissioning phase.	Medium-low (negative) – 60
Extent	Local (3)	The impacts will only occur within the local area. Even water quality impacts would only occur until dilution can occur within short distance downstream regions.	

Site clearing for the Construction of the CPP and Pipelines.			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Very serious (5)	The habitat and water quality within the local extent can be a very serious impact. Especially to aquatic habitat which is difficult to rehabilitate.	
Probability	Almost certain (6)	The impact will almost certainly occur if activities are to occur within proximity to the river systems without mitigation actions.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish riparian buffer up to 500m (minimum 100m); ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of CPP and pipelines and road footprints as soon as possible; ▪ Soils adjacent the river that has been compacted must be loosened to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.			
Post- mitigation			
Duration	Short term (2)	The impact will only occur during the construction and decommissioning phase.	Low (negative) – 30
Extent	Local (3)	The impacts will only occur within the local area.	
Intensity	Very serious (5)	The habitat and water quality within the local extent can be a very serious impact. Especially to aquatic habitat which is difficult to rehabilitate.	
Probability	Unlikely (3)	Probability reduced due to mitigation actions.	
Nature	Negative		

10.3.5 Wetlands Impacts

The decommissioning phase will have similar impacts compared to the construction phase, although the interactions of the activities will be different. The interactions and impacts associated with wetlands during the decommissioning phase are provided in Table 10-68.

Table 10-68: Interactions and Impacts on Wetlands during the Decommissioning Phase

Interaction	Impact
Decommissioning of the CPP infrastructure.	This may result in negative impacts to the wetland area remaining due to increased traffic to the site and water quality impacts may also occur from runoff emanating from exposed surfaces. The impact has already been quantified in the construction phase; however decommissioning without mitigation may lead to additional impacts due to heavy machinery being used.
Decommissioning of the pipeline and road from the CPP to the RTSF	This will have a negative impact on the identified wetlands as direct contact with wetlands may result in quality impacts, as well as sedimentation due to runoff from exposed areas.
Decommissioning and rehabilitation of the RTSF; this is to remain in perpetuity	Significant and permanent impact to the catchment of the wetlands due to potential contaminant mobilisation.
	Limited yet present pollution source to remain in perpetuity.

10.3.5.1 RTSF Complex, CPP and Pipelines

10.3.5.1.1 Impact Description

The potential impacts on wetlands associated with the decommissioning phase may include runoff high in dissolved and suspended solids from exposed surfaces, as well as contaminants mobilised by wind or water from the RTSF. These impacts may impact on the integrity of the surrounding wetlands. The impacts on wetlands during the decommissioning phase are considered to be medium-low (negative).

The impacts associated with the loss of wetland and wetland functioning due to the blast curtain will continue indefinitely. This impact has been rated as permanent during the operational phase and has not been reassessed as a result.

10.3.5.1.2 Management Objectives

Management objectives are to prevent the loss of or further damage to wetland ecosystems and their buffer areas. This is important as the wetlands play a major role in controlling the hydrology of the West Rand, which has national importance as the Vaal and Crocodile River systems are downstream, and support a range of ecological processes and biodiversity in the region (WRDM EMF, 2013).

10.3.5.1.3 Management Actions and Targets

The management actions and targets associated with the aquatic habitats, fauna and flora, surface water quality and groundwater quality will aid in the preservation and management of wetland areas.

10.3.5.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on wetlands are provided in Table 10-69.

Table 10-69: Potential Impacts on Wetlands due to the RTSF Complex and CPP

Demolition of infrastructure and rehabilitation of CPP and pipelines			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Sedimentation and pollutant run-off will impact the integrity and functioning of the surrounding wetlands			
Prior to mitigation/ management			
Duration	Medium term (3)	Impact will only occur during the short lived decommissioning phase.	Medium-low (negative) - 66
Extent	Local (3)	The local wetland could be impacted.	
Intensity	Serious (5)	This represents serious damage to sensitive environments.	
Probability	Highly probable (6)	This is highly probable due to the nature of the activity.	
Nature	Negative		
Mitigation/ Management actions			
▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The CPP and pipelines and roads footprints must be rehabilitated according to the Rehabilitation Plan; ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal;			
Post- mitigation			
Duration	Short Term (2)	Mitigation may decrease the potential impact	Low (negative) - 18
Extent	Limited (2)	The mitigation measures will allow the impacts to be kept to a limited extent.	
Intensity	Minor effects (2)	With mitigation measure employed, the wetlands will be subjected further to minor impacts.	

Probability	Unlikely (3)	Mitigation will decrease the likelihood of negative impacts.	
Nature	Negative		
Rehabilitation of the RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Sedimentation and pollutant run-off will impact the integrity and functioning of the surrounding wetlands			
Prior to mitigation/ management			
Duration	Permanent (7)	This will have long-lasting permanent negative impacts on the wetlands beyond the project life as this is to remain in perpetuity.	Medium-low (negative) - 68
Extent	Regional (5)	Water quality impacts are a highly significant impact to the greater catchment if it is not contained. The Leeuspruit River is an important river and wetland and flows to the Vaal, making this a potential regional impact.	
Intensity	Serious (5)	This represents serious damage to highly sensitive environments.	
Probability	Probable (4)	The wetlands will certainly be impacted if the RTSF is not designed and decommissioned responsibly as this represents a significant pollution source.	
Nature	Negative		
Mitigation/ Management actions			
▪ Storm water management must be put in place to prevent run-off of any pollutants; and ▪ The RTSF must be vegetated and capped, with the blast curtain operation continuing.			
Post- mitigation			
Duration	Permanent (7)	Mitigation will not decrease the permanence of the RTSF.	Medium-low (negative) -45
Extent	Local (3)	Sound mitigation measures can decrease the impact to extend only as far as the local development area.	
Intensity	Serious (5)	This still represents serious damage to highly sensitive environments.	

Probability	Unlikely (3)	The RTSF will unlikely impact on the surrounding wetlands with all mitigation measures employed.	
Nature	Negative		

10.3.6 Visual Impacts

The decommissioning phase will result in the demolition and removal of infrastructure associated with the project. The CPP and pipelines' footprints will be rehabilitated according to the Closure Plan for the project which will be compiled approximately 15 years prior to closure. The demolition and removal of the infrastructure will aim to restore the impacted areas to the pre-mining conditions.

The interactions and impacts associated with the decommissioning phase are provided in Table 10-70.

Table 10-70: Interactions and Impacts on the Visual Environment

Interaction	Impact
Demolition and removal of infrastructure.	Although the demolition and removal of the infrastructure, such as the CPP and pipeline, will reduce the visual impact of the area, there will still be a visual disturbance until rehabilitation activities have been complete.
Rehabilitation of the RTSF.	The RTSF will be rehabilitated and capped. The presence of the RTSF will still remain a prominent feature on the landscape.

10.3.6.1 CPP and Pipelines and Roads

10.3.6.1.1 Impact Description

The demolition and removal of the CPP infrastructure and pipelines will improve the visual environment in comparison to the operational phase of the project as the visual disturbances will be removed from the landscape. However, the demolition and rehabilitation activities will continue to impact on the visual environment until rehabilitation activities have concluded, although the significance of the visual impact will be greatly reduced.

10.3.6.1.2 Management Objectives

The management objectives are to reduce the visual impact of infrastructure by demolishing and removing infrastructure from site, as well as to minimise the short term visual impact of the decommissioning activities.

10.3.6.1.3 Management Actions and Targets

The rehabilitation of the footprints must ensure that the surfaces are free draining and no surface water pools on the surface.

10.3.6.1.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts to the visual environment are provided in Table 10-71.

Table 10-71: Potential Impacts on the Visual Environment due to the CPP and Pipelines and Roads

CPP and Pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation of disturbed areas will have a minor (negative) visual impact, with an overall neutral impact.			
Prior to mitigation/ management			
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Medium-low (negative) -49
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	The rehabilitation activities are limited in their intensity.	
Probability	Definite (7)	Rehabilitation activities will take place.	
Nature	Negative		
Mitigation/ Management actions			
▪ The CPP and pipelines and roads footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.			
Post- mitigation			

CPP and Pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Duration	Medium Term (3)	The impact will occur for 1-5 years and the impact can be reversed with minimal management.	Medium-low (negative) -42
Extent	Limited (2)	The impact is limited to the site and its immediate surroundings.	
Intensity	Minor (2)	The negligible height of the pipelines will restrict the viewshed.	
Probability	Almost Certain (6)	It is most likely that the impact will occur.	
Nature	Negative		

10.3.6.2 RTSF Complex

10.3.6.2.1 Impact Description

The RTSF will be a permanent visual impact on the landscape, as has been rated during the construction and operational phases. The decommissioning phase will result in the RTSF reaching its capacity and no more tailings will be deposited. The RTSF will be capped and rehabilitated during the decommissioning phase to limit potential long term impacts, which in turn will reduce the significance of the visual impacts on the environment.

10.3.6.2.2 Management Objectives

The management objectives are to minimise the negative visual impact caused by the RTSF.

10.3.6.2.3 Management Actions and Targets

Potential visual impacts are subjective in nature which becomes difficult to provide management targets. The actions to be implemented involve reducing the visibility of the RTSF although such actions are limited due to the size and extent of the facility.

10.3.6.2.4 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts to the visual environment are provided in Table 10-72.

Table 10-72: Potential Impacts on the Visual Environment due to the RTSF

Rehabilitation RTSF			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Rehabilitation activities will result in visual intrusion on the landscape			
Prior to mitigation/ management			
Duration	Medium Term (3)	Rehabilitation of the RTSF may take in excess of 1 year.	Medium-low (negative) -70
Extent	Municipal Area (4)	Will affect the whole municipal area.	
Intensity	Moderate (3)	Moderate loss and / or damage to biological or physical resources or low to moderately sensitive environments, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	
Probability	Definite (7)	Rehabilitation activities will take place.	
Nature	Negative		
Mitigation/ Management actions			
▪ Establish vegetation on the side walls of the RTSF; and ▪ Cap and establish vegetation on the top of the RTSF.			
Post- mitigation			
Duration	Medium Term (3)	Rehabilitation of the RTSF may take in excess of 1 year.	Medium-low (negative) -42
Extent	Municipal Area (4)	Will affect the whole municipal area.	
Intensity	Minor (2)	The rehabilitation of the RTSF will be visible to immediate areas only.	
Probability	Almost Certain (6)	It is most likely that the impact will occur. < 80% probability	
Nature	Negative		

10.3.7 Noise Impacts

Table 10-73 details the project activities' interactions and the resultant impacts due to noise generation as a result of the proposed developments. Noise dispersion models were developed and indicated that the expected noise for the project will not exceed the SANS 10103:2008 limits.

Table 10-73: Interactions and Impacts associated with Noise during the Decommissioning Phase

Interaction	Impact
Demolition and removal of infrastructure	Generation of noise may increase ambient noise

10.3.7.1 CPP and Pipelines and Roads

10.3.7.1.1 Impact Description

Noise will emanate from machinery and equipment associated with the decommissioning of the CPP and pipelines and roads. Based on the noise model (Appendix M), the noise levels will not exceed the SANS 10103:2008 limits and, thus, the significance of the impacts are considered to be negligible.

10.3.7.1.2 Impact Ratings

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts due to the generation of noise are provided in Table 10-74.

Table 10-74: Potential Impacts due to Noise Generation

Demolition of the CPP and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Generation of noise			
Prior to mitigation/ management			
Duration	Medium term (3)	Noise will be produced for the duration of the decommissioning phase	Low (negative) – 21
Extent	Local (3)	It is expected that during decommissioning noise will extend as far as development site area.	
Intensity	Minimal (1)	It is expected that during decommissioning noise will have a minimal impact	
Probability	Unlikely (3)	It is unlikely that noise will impact on the surrounding receptors.	
Nature	Negative		

Demolition of the CPP and pipelines and roads			
Dimension	**Rating**	**Motivation**	**Significance**
Mitigation/ Management actions			
▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.			
Post- mitigation			
Duration	Short term (2)	Noise will be produced for the duration of the decommissioning phase	Low (negative) – 12
Extent	Local (3)	It is expected that during decommissioning noise will be limited to site if mitigation measures are implemented.	
Intensity	Minimal (1)	It is expected that during decommissioning noise will have a minimal social impact	
Probability	Rare (2)	It is improbable that noise will impact on the surrounding receptors.	
Nature	Negative		

10.3.8 Socio-Economic Impacts

As detailed in Section 10.1.11 for ease of reference, all potential socio-economic impacts fall under the activity *Employment and Procurement*.

The summary of the potential socio-economic impacts as a result of the project is included in Table 10-75.

Table 10-75: Summary of the Potential Socio-Economic Impacts Resulting from the Decommissioning Phase

Interaction	Impact
Decommissioning of the WRTRP operations.	Retrenchments of mine employees will take place as operations close. The local economy will likely be dependent on the WRTRP to an extent which will be impacted once operations cease.

10.3.8.1 Employment and Procurement

10.3.8.1.1 Impact Description

Any impact predictions concerning the characteristics of the socio-economic environment at the time of eventual project decommissioning are subject to a large margin of error which will significantly reduce the accuracy of the impact assessment. Several socio-economic impacts may arise when the operation is decommissioned and should be investigated prior to decommissioning. The issues that may arise include psychological impacts on the workforce due to personal and family income issues, dependency from the local economy on the project through multiplier effects, tax and royalties and Social and Labour initiatives and impacts on land uses following closure.

The closure of the project will result in the reduction in the economic stimulus to maintain the current state of the local economy and for further growth. This impact will be cumulative with regard to job losses, the closing down of businesses and the decrease on local investment and spending, all resulting in an overall economic slow-down.

10.3.8.1.2 Management Objectives

An important approach to mitigating economic dependency on the Project is to develop alternative and sustainable livelihoods so that local communities and businesses are able to support themselves through other economic sectors at the time of project closure. SGL must collaborate with the local municipalities and relevant government agencies to support the diversification of the local economy to reduce the economies dependency on the project and mining in general.

The MPRDA requires that the Social and Labour Plan must provide strategies and measures that could prevent job loss; these include the establishment of Future Forums to manage downscaling and retrenchments. The alternatives to save jobs must be investigated before decommissioning.

In addition, a Closure Plan will be developed and must include socio-economic impacts and a stakeholder consultation process for the operations. The Closure Plan must be compiled 15 years prior to the expected closure, and reviewed every 5 years.

10.3.8.1.3 Impact Description

The significance of the potential positive socio-economic impacts associated with the decommissioning of the project are outlined in Table 10-76.

Table 10-76: Potential Impacts on the Socio-Economic Environment due to Employment and Procurement

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Decommissioning of the project will have a direct negative impact through the retrenchment of the mine workforce, as well as a cumulative impact on the local economy due to its dependency on mining.			
Prior to mitigation/ management			
Duration	Beyond project life (6)	Some impacts (e.g. retrenchments) may occur during operation. However, most impacts will be felt after closure	Medium-high (negative) - 84
Extent	Municipal Area (4)	Impact will affect workers as well as local municipalities and communities	
Intensity	Moderately high (4)	Without appropriate mitigation, impact will undermine many of benefits achieved under LED. Retrenched workers and their families will be severely impacted	
Probability	Highly probable (6)	The impact will most likely occur	
Nature	Negative		
Mitigation/ Management actions			
▪ Develop a Closure Plan 15 years prior to planned closure and review the Closure Plan every 5 years; ▪ Establish a Future Forum, should it not already be established, to promote on-going discussions between SGL and the mine's workforce; ▪ Liaise with the Department of Labour for the utilisation of its resources and support services once retrenchments take place; ▪ Provide financial life skills to employees and ensure employees are trained in alternative skills; and ▪ Inform affected areas, such as the local municipality and labour sending areas, of planned retrenchments.			
Post- mitigation			
Duration	Beyond project life (6)	Some impacts (e.g. retrenchments) may occur during operation. However, most impacts will be felt after closure	Medium-low (negative) - 60
Extent	Municipal Area (4)	Impact will affect workers as well as local municipalities and communities	

Employment and Procurement			
Dimension	**Rating**	**Motivation**	**Significance**
Intensity	Low (2)	Mitigation will soften impacts on individuals/households and will capacitate local municipalities to sustain benefits	
Probability	Likely (5)	The impact will most likely occur, albeit not all negative components	
Nature	Negative		

10.4 Post-Closure Phase

10.4.1 Groundwater Impacts

The potential contamination plumes were modelled 100 years following closure, as detailed in Section 10.1.2.1. The unmitigated contamination plume will increase from 2 600 ha to approximately 3 600 ha. To mitigate the extent of the contamination plume, a blast curtain has been proposed as a liner will result in the WRTRP becoming unfeasible. The interactions and resultant impacts associated with the RTSF following closure of the project are detailed in Table 10-77.

Table 10-77: Interactions and Impacts on Groundwater during Post-Closure due to the RTSF

Interaction	Impact
Presence of the RTSF following closure.	Seepage from the RTSF will result in groundwater contamination.
Dewatering from the blast curtain	Groundwater levels will reduce and a cone of depression will occur.

10.4.1.1 RTSF Complex

10.4.1.1.1 Impact Description

As detailed in Table 10-33, the potential contamination plume will increase from approximately 2 600 ha to 3 600 ha when comparing the end of the operation to 100 years after closure. The extension of the contamination plume is likely to impact on more private boreholes and impact on more receptors. The implementation of the blast curtain will still be required during post closure. The dewatering activities 100 years after closure indicate that the radius of influence is expected to grow due to the prolonged dewatering. The predicted cone of depression may impact on nearby boreholes, the Leeuspruit and its tributary, as provided in Plan 33. The discharge of treated water from the AWTF into the Leeuspruit will, in part, mitigate the potential impacts from the cone of depression of the Leeuspruit.

Although there will be no new deposition of tailings material, it will take approximately 100 years after closure before the seepage rate will be reduced naturally (SLR, 2015); the dewatering of the blast curtain will need to continue in parallel. The impacts and mitigation measures provided in the operational phase remain for the impacts associated post closure.

Plan 33: Dewatering Cone due to the Blast Curtain 100 years Post Closure

10.4.2 Surface Water Impacts

To mitigate the extent of the contamination plume associated with the groundwater, a blast curtain has been proposed as a liner will result in the WRTRP becoming unfeasible. The interactions and resultant impacts associated with the RTSF following closure of the project are detailed in Table 10-78.

Table 10-78: Interactions and Impacts on Surface Water during Post-Closure due to the RTSF

Interaction	Impact
Dewatering from the blast curtain	Groundwater levels will reduce and a cone of depression will occur which may impact on the Leeuspruit and its tributaries

10.4.2.1 RTSF Complex

10.4.2.1.1 Impact Description

The implementation of the blast curtain will still be required during post closure. The dewatering activities 100 years after closure indicate that the radius of influence is expected to grow due to the prolonged dewatering. The predicted cone of depression may impact on nearby boreholes, the Leeuspruit and its tributary, as provided in Plan 33. The discharge of treated water from the AWTF into the Leeuspruit will, in part, mitigate the potential impacts from the cone of depression of the Leeuspruit.

10.4.2.1.2 Impact Rating

The impact significance ratings prior to and post mitigation measures, as well as the mitigation measures, for the impacts on surface water resources are provided in Table 10-79.

Table 10-79: Potential Impacts on Surface Water due to the RTSF Complex

RTSF Complex			
Dimension	**Rating**	**Motivation**	**Significance**
Impact Description: Dewatering impacts on the Leeuspruit and its tributaries			
Prior to mitigation/ management			
Duration	Permanent (7)	The dewatering process and its impact will be permanent	Medium-low (negative) - 72
Extent	Local (3)	The section of the Leeuspruit that will be impacted by the blast curtain is expected to be local, along a section of approximately 7.5 km	

Intensity	Minor (2)	Considering the flow rate of the river and river bed permeability, the intensity is expected to be minor	
Probability	Almost certain (6)	It is almost certain that the dewatering will affect the surface water flow	
Nature	Negative		
Mitigation/ Management actions			
▪ Monitoring of the Leeuspruit flow rates up and down gradient of the RTSF; and ▪ Discharge treated water from the AWTF into the Leeuspruit, in accordance with the IWULA.			
Post- mitigation			
Duration	Permanent (7)	The depression of the water table will persist throughout the life of operation	Medium-low (negative) - 60
Extent	Limited (2)	With the re-introduction of the treated water into the Leeuspruit, the impact on the river will be limited	
Intensity	Minimal (1)	Once the abstracted water is treated and at the AWTF and introduced to the river, the environmental significance is rated as minimal	
Probability	Almost certain (6)	The lowering of the water table will almost certainly occur and is likely to result in the depletion of the river	
Nature	Negative		

10.5 Cumulative Impacts

Cumulative impacts are defined as impacts arising from the combined effects of two or more projects or actions. The importance of identifying and assessing cumulative impacts is that the whole is often greater than the sum of its parts, implying that the total effect of multiple stressors or change processes acting simultaneously on a system may be greater than the sum of their effects when acting in isolation. Cumulative impacts usually relate to large-scale rather than site-specific impacts and have a tendency to increase the intensity of impacts already predicted for the proposed project.

The potential cumulative impacts as a result of the WRTRP are discussed in Table 10-80.

Table 10-80: Potential Cumulative Impacts

Environmental Aspect	Cumulative Impacts
Air Quality	Air quality data from the existing dust monitoring network (Kloof, Driefontein, Cooke and Ezulwini) indicates deposition rates that are within the recommended residential limit (600 mg/m^2/day), with the Driefontein PM_{10} monitoring data for 2013 and 2014 being within the regulatory 75 µg/m^3 with occasional exceedances of these limits taking place. The Driefontein monitoring network recorded much higher deposition rates than the remaining Mining Right monitoring networks. The operational phase of the Project at the different Mining Right areas will exacerbate localised impacts in the immediate vicinities of the activities. However, due to the existing mining operations currently taking place, as well as the limited distances between the respective Mining Right areas, the cumulative regional air quality impact might be diluted to within regulatory requirements. It is not envisaged that the proposed project will exacerbate the current ambient air quality scenario in the area.
Groundwater	There are no industrial or mining activities in the vicinity of the proposed RTSF other than Goldfields' Doornpoort TSF. Sources of future groundwater impacts will therefore be from both of these facilities. The Goldfields TSF is approximately 1 km northeast of the proposed RTSF and the Leeuspruit flows between the two TSFs. The Leeuspruit is generally fed by the groundwater and, therefore, any pollution from the Goldfields TSF is expected to be intercepted by the river as baseflow. However, the closeness of the two sites means that if any local fractures exist (that were not identified during this study) connecting the two TSFs, pollution plumes from the Goldfields TSF can possibly migrate beyond the river towards the proposed RTSF. Groundwater monitoring along a set of boreholes on both sides of the river is recommended to detect the sources of any contamination plume reaching the river. The hydrocensus conducted by Digby Wells in the vicinity of the RTSF showed that irrigation (fertiliser) related, site-specific pollution exists in some boreholes which are usually manifested by the elevated nitrate or ammonia concentrations. The baseline groundwater is of good quality, with current highest sulfate concentration recorded as 32 mg per litre (note: sulfate concentration up to 400 mg per litre is considered to be of good quality). This could accordingly serve as the baseline for future monitoring.
Soils	The major impacts associated with mining are the disturbance of natural occurring soil profiles consisting of layers or soil horizons. Rehabilitation of disturbed areas aims to restore land capability but the South African experience is that post mining land capability usually decreases compared to pre-mining land capability. Soil formation is determined by a combination of five interacting main soil formation factors. These factors are time, climate, slope, organisms and parent material. Soil formation is an extremely slow process and soil can therefore be considered as a non-renewable resource. Soil quality deteriorates during stockpiling and replacement of these soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. Depth however can be imitated but the combined soil quality deterioration and resultant compaction by the machines used in rehabilitation, leads to a net loss of land capability. A change in land capability then forces a change in land use. The impact on soil is high because natural soil layers are stripped and stockpiled for later use in rehabilitation. In addition, soil fertility is impacted because stripped soil layers are usually thicker than the defined topsoil layer. The topsoil layer is the layer where most plant roots are found and is generally 0.30 m thick. Although a significant portion of arable land will be lost at the RTSF site. The reclaimed sites will have an increase in land use and land capability. This will not be at the same level of the land capability and land use of the RTSF site.
Surface Water	The baseline water quality data indicated elevated concentrations of sulfate, nitrate, fluoride, manganese and ammonia in a number of streams in the project area. This indicates that rivers within the region are already impacted. The area comprises of various land uses which includes mining, industrial areas, residential areas and agricultural activities. All these land uses could possibly have contributed to this water quality status. The reclamation of the gold dumps could mobilise and expose sulfide minerals, such a pyrite (FeS_2), that will oxidise when exposed to water and air and release large quantities of iron and sulfate into solution which is very acidic and thereby referred to as AMD. Therefore, without adequate and effective mitigation measures, the proposed project may further deteriorate the quality of water in the natural water courses during the operational phase of the project. It is anticipated in the long term, however, that the surface water environment will benefit by eliminating a permanent source of contaminants due to the presence of the TSFs. The reclamation of the historical TSFs and removal of sulfides from the tailings will have a positive impact on the environment .This project would therefore contribute to a regional closure strategy that talks to a sustainable solution for both water issues and management of a multitude of poorly sited historical TSFs.

Environmental Aspect	Cumulative Impacts
Fauna and Flora	The only construction and subsequent removal of vegetation that will occur is within the footprint of the CPP and the RTSF complex, with negligible (after mitigation) impacts occurring from the pipeline. These two pose the greatest cumulative impacts to the general area. It is expected that 346 ha of natural grassland and 12 ha of wetlands will be removed to facilitate construction. Total cumulative impact to loss of vegetation and habitat will be 358 ha.
Aquatics	The aquatic habitat PES of the Leeuspruit is currently largely modified as a result of poor water quality compounded by habitat modification. The proposed project, through the creation of the RTSF, would potentially contribute toward increasing the dissolved solid component of the downstream aquatic regions. Thus, the proposed project would potentially contribute toward further water quality degradation (should no mitigation be implemented) within the Leeuspruit over the long term. The Leeuspruit will also be traversed by pipelines in three separate regions. The placement of these pipelines could degrade marginal aquatic habitat. However, on a large scale the impacts would be negligible. The Loopspruit is also currently in a largely modified state due to critical water and large habitat modification. No reclamation activities will be taking place within he Loopspruit catchment area. However, several pipeline crossings will be constructed and therefore could degrade marginal aquatic habitat. This impact was assessed to be on a local scale and therefore would result in a negligible cumulative impact, specifically on the marginal aquatic habitat.
Wetlands	The activities associated with the Kloof Mining Right area will result in the loss of 11 ha of valley bottom wetlands within the CPP footprint and 38.5 ha of pans and 4.4 ha of valley bottom wetlands within the RTSF footprint. SGL will need to investigate an offset strategy for the loss of these wetlands. This will directly contribute to the cumulative loss of wetlands in the local area, municipality and province. This may result in reduced wetland functionality which is responsible for maintenance of water quality, toxicant assimilation, carbon storage, streamflow regulation and flood attenuation, as well as biodiversity maintenance
Visual	The proposed CPP is situated near the existing Kloof mining infrastructure. This existing infrastructure has impacts on the visual aesthetics / character of the receiving environment and the development of the proposed CPP will add to these existing visual impacts. The receiving environment of the proposed RTSF consists mainly of small holdings, agriculture and open land with some small residential areas. Only a small percentage of the receiving environment has been disturbed by mining and prior to the construction of the new Gold Fields Doornpoort TSF there was no mining activity within 3.5 km of the proposed RTSF site. The construction of the new Gold Fields Doornpoort TSF and the proposed RTSF will have significant negative visual impacts on the visual aesthetics / character of the receiving environment. The visibility of these large developments will alter the sense of place of the receiving environment from rural to industrial / mining and result in a loss of scenic character and increased visual disturbance. The proposed activities of the Driefontein, Cooke and Ezulwini MRAs will have a neutral visual impact on the receiving environment. The reclamation of the Driefontein 3, Driefontein 5, Cooke and Cooke 4 South TSFs will have a negative visual impact during the reclamation phase but ultimately after the rehabilitation phase there will be a neutral visual impact because the negative visual impact of mining created by the TSFs will be removed. This neutral visual impact will be increased as the number of reclaimed dumps increases.
Noise	Cumulative impacts should be considered for the overall improvement of ambient noise levels. The project is considered a causative source of noise pollution of negligible significance. The existing noise sources in the immediate surroundings of the project area are typical noise sources such as vehicle activity on the main roads (N12, R28, R500 and R501) as well as on surrounding gravel roads. The existing Driefontein, Kloof, Ezulwini and Cooke Mining Right area are already impacting on the noise levels of their immediate surroundings in the respective Mining Right areas but are too far apart from one another to cumulatively impact on the region. As a result, the WRTRP is not expected to have a cumulative impact or exacerbate current noise levels. This is primarily due to noise propagation not measuring above the rating levels of the surrounding suburban and rural receptors.

Environmental Aspect	Cumulative Impacts
Heritage	Cumulative impacts occur from in-combination effects of various impacts on heritage resources acting within a host of processes that result in an incremental effect. As detailed in the cultural heritage baseline in Section 9.1.11, the regional and local study area contribute to the historic mining landscape associated with the West Rand, and the mining history of Johannesburg at large. Visible tangible markers associated with this history are historic mining infrastructures, such as headgears, and more significantly, historical TSFs. The proposed WRTRP will have neutralising impact to the local and regional study area as the RTSF will replace the historical TSFs on the landscape. This will be manifested primarily through the alteration to the sense-of-place in so far as the historic mining landscape characterised by the numerous individual historical TSFs will be changed into a modernised mining landscape through the establishment of the proposed RTSF. The overall sense-of-place, however, will remain intrinsically associated with the mining landscape, which is a part of a living mining heritage and cannot therefore be "preserved" through keeping of the static *status quo*. The proposed reclamation activities associated with the Initial Implementation will result in an additive cumulative impact to the historic mining landscape, i.e. the sum of all the effects of the reclamation. Reclamation activities will decrease the number of remaining historical TSFs as tangible markers of historic mining activities on the West Rand. The removal of the historical TSF's will subsequently gradually increase the significance of *in situ* resources. Through time, the remaining historical TSFs associated with the mining heritage of the greater Johannesburg region will have a high cultural significance regardless of the integrity of the resource.
Socio-Economic	It is expected that the project will contribute towards improving environmental conditions in the project area and its surroundings due to the reclamation of historical TSFs. The cumulative contribution of this impact is, however, dependent on the impacts of other existing and future developments in the area, as well as the success of government programmes aimed at the protection of the environment, and the socio-economic development of historically disadvantaged local communities. Cooperating and partnering with government, mining companies and industries is therefore imperative. It is also expected that the project will contribute to employment, local procurement and the production of high value products; this will facilitate income growth, capacity development and national level economic benefits. The project may also contribute to infrastructure and service improvements in the affected districts, which will in themselves impact positively on the local and district socio-economic status. These positive impacts, in combination with those of other developments, could boost the overall development in the surrounding municipal districts. A highly significant cumulative impact relates to the fact that existing and new developments in the West Rand may accelerate population influx to the area with the associated increased pressure on land, resources and services, as well as the potential for informal settlement, encroachment and urban sprawl. The development of the project could exacerbate conditions such as the spread of HIV/AIDS and other communicable diseases following population influx, settlement densification and related factors (e.g. decreases in the quality and quantity of water). Health impacts must be addressed in the project's Community Health and Safety Management Plan. Moreover, the Project should collaborate with national, provincial and local government, as well as leading health-based NGOs to promote an integrated approach to combating HIV/AIDS.

10.6 Item 3(g)(vi): Methodology Used in Determining and Ranking the Nature, Significance, Consequence, Extent, Duration and Probability of Potential Environmental Impacts and Risks

Based on South African legislation and guidelines, the following criteria were taken into account when examining potentially significant impacts:

- Nature of impacts (induced/direct/indirect, positive/negative);
- Duration (short/medium/long-term, permanent(irreversible) / temporary (reversible), frequent/seldom);
- Extent (geographical area, size of affected population/habitat/species);
- Intensity (minimal, severe, replaceable/irreplaceable);
- Probability (high/medium/low probability); and
- Mitigation (as per mitigation hierarchy: avoid, mitigate or offset significant adverse impacts).

The significance rating process follows the established impact/risk assessment formula:

SIGNIFICANCE = CONSEQUENCE[8] x PROBABILITY[9] x NATURE[10]

The matrix (Table 10-82) calculates the rating out of 147 points, whereby intensity, extent, duration and probability are each rated out of seven as indicated in Table 10-81. The weight assigned to the various parameters is then multiplied by +1 for positive and -1 for negative impacts.

Impacts are rated prior to mitigation, and again after consideration of the mitigation has been applied; post-mitigation is referred to as the residual impact. The significance of an impact is determined and categorised into one of seven categories (The descriptions of the significance ratings are presented in Table 10-83).

It is important to note that the pre-mitigation rating takes into consideration the activity as proposed, (i.e., there may already be some mitigation included in the engineering design). If the specialist determines the potential impact is still too high, additional mitigation measures are proposed.

[8] Consequence = Intensity + Extent + Duration
[9] Probability = Likelihood of an impact occurring
[10] Nature = Positive (+1) or Negative (-1) impact

Table 10-81: Impact Assessment Parameter Ratings

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
7	Irreplaceable loss or damage to biological or physical resources or highly sensitive environments. Irreplaceable damage to highly sensitive cultural/social resources.	Noticeable, on-going natural and / or social benefits which have improved the overall conditions of the baseline.	International The effect will occur across international borders.	Permanent: The impact is irreversible, even with management, and will remain after the life of the project.	Definite: There are sound scientific reasons to expect that the impact will definitely occur. >80% probability.
6	Irreplaceable loss or damage to biological or physical resources or moderate to highly sensitive environments. Irreplaceable damage to cultural/social resources of moderate to highly sensitivity.	Great improvement to the overall conditions of a large percentage of the baseline.	National Will affect the entire country.	Beyond project life: The impact will remain for some time after the life of the project and is potentially irreversible even with management.	Almost certain / Highly probable: It is most likely that the impact will occur. <80% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
5	Serious loss and/or damage to physical or biological resources or highly sensitive environments, limiting ecosystem function. Very serious widespread social impacts. Irreparable damage to highly valued items.	On-going and widespread benefits to local communities and natural features of the landscape.	Province/ Region Will affect the entire province or region.	Project Life (>15 years): The impact will cease after the operational life span of the project and can be reversed with sufficient management.	Likely: The impact may occur. <65% probability.
4	Serious loss and/or damage to physical or biological resources or moderately sensitive environments, limiting ecosystem function. On-going serious social issues. Significant damage to structures / items of cultural significance.	Average to intense natural and / or social benefits to some elements of the baseline.	Municipal Area Will affect the whole municipal area.	Long term: 6-15 years and impact can be reversed with management.	Probable: Has occurred here or elsewhere and could therefore occur. <50% probability.

RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	Positive impacts			
3	Moderate loss and/or damage to biological or physical resources of low to moderately sensitive environments and, limiting ecosystem function. On-going social issues. Damage to items of cultural significance.	Average, on-going positive benefits, not widespread but felt by some elements of the baseline.	Local Local extending only as far as the development site area.	Medium term: 1-5 years and impact can be reversed with minimal management.	Unlikely: Has not happened yet but could happen once in the lifetime of the project, therefore there is a possibility that the impact will occur. <25% probability.
2	Minor loss and/or effects to biological or physical resources or low sensitive environments, not affecting ecosystem functioning. Minor medium-term social impacts on local population. Mostly repairable. Cultural functions and processes not affected.	Low positive impacts experience by a small percentage of the baseline.	Limited Limited to the site and its immediate surroundings.	Short term: Less than 1 year and is reversible.	Rare / improbable: Conceivable, but only in extreme circumstances. The possibility of the impact materialising is very low as a result of design, historic experience or implementation of adequate mitigation measures. <10% probability.

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RATING	INTENSITY/REPLACABILITY		EXTENT	DURATION/REVERSIBILITY	PROBABILITY
	Negative impacts	**Positive impacts**			
1	Minimal to no loss and/or effect to biological or physical resources, not affecting ecosystem functioning. Minimal social impacts, low-level repairable damage to commonplace structures.	Some low-level natural and / or social benefits felt by a very small percentage of the baseline.	<u>Very limited/Isolated</u> Limited to specific isolated parts of the site.	Immediate: Less than 1 month and is completely reversible without management.	Highly unlikely / None: Expected never to happen. <1% probability.

Table 10-82: Probability/Consequence Matrix

		Significance																																					
Probability	7	-147	-140	-133	-126	-119	-112	-105	-98	-91	-84	-77	-70	-63	-56	-49	-42	-35	-28	-21	21	28	35	42	49	56	63	70	77	84	91	98	105	112	119	126	133	140	147
	6	-126	-120	-114	-108	-102	-96	-90	-84	-78	-72	-66	-60	-54	-48	-42	-36	-30	-24	-18	18	24	30	36	42	48	54	60	66	72	78	84	90	96	102	108	114	120	126
	5	-105	-100	-95	-90	-85	-80	-75	-70	-65	-60	-55	-50	-45	-40	-35	-30	-25	-20	-15	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100	105
	4	-84	-80	-76	-72	-68	-64	-60	-56	-52	-48	-44	-40	-36	-32	-28	-24	-20	-16	-12	12	16	20	24	28	32	36	40	44	48	52	56	60	64	68	72	76	80	84
	3	-63	-60	-57	-54	-51	-48	-45	-42	-39	-36	-33	-30	-27	-24	-21	-18	-15	-12	-9	9	12	15	18	21	24	27	30	33	36	39	42	45	48	51	54	57	60	63
	2	-42	-40	-38	-36	-34	-32	-30	-28	-26	-24	-22	-20	-18	-16	-14	-12	-10	-8	-6	6	8	10	12	14	16	18	20	22	24	26	28	30	32	34	36	38	40	42
	1	-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		-21	-20	-19	-18	-17	-16	-15	-14	-13	-12	-11	-10	-9	-8	-7	-6	-5	-4	-3	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
		Consequence																																					

Table 10-83: Significance Rating Description

Score	Description	Rating
109 to 147	A very beneficial impact that may be sufficient by itself to justify implementation of the project. The impact may result in permanent positive change	Major (positive) (+)
73 to 108	A beneficial impact which may help to justify the implementation of the project. These impacts would be considered by society as constituting a major and usually a long-term positive change to the (natural and / or social) environment	Moderate (positive) (+)
36 to 72	An positive impact. These impacts will usually result in positive medium to long-term effect on the natural and / or social environment	Minor (positive) (+)
3 to 35	A small positive impact. The impact will result in medium to short term effects on the natural and / or social environment	Negligible (positive) (+)
-3 to -35	An acceptable negative impact for which mitigation is desirable. The impact by itself is insufficient even in combination with other low impacts to prevent the development being approved. These impacts will result in negative medium to short term effects on the natural and / or social environment	Low (negative) (-)
-36 to -72	A minor negative impact requires mitigation. The impact is insufficient by itself to prevent the implementation of the project but which in conjunction with other impacts may prevent its implementation. These impacts will usually result in negative medium to long-term effect on the natural and / or social environment	Medium-low (negative) (-)
-73 to -108	A moderate negative impact may prevent the implementation of the project. These impacts would be considered as constituting a major and usually a long-term change to the (natural and / or social) environment and result in severe changes.	Medium-high (negative) (-)
-109 to -147	A major negative impact may be sufficient by itself to prevent implementation of the project. The impact may result in permanent change. Very often these impacts are immitigable and usually result in very severe effects. The impacts are likely to be irreversible and/or irreplaceable.	High (negative) (-)

10.7 Item 3(g)(vii): The Positive and Negative Impacts that the Proposed Activity (in terms of the Initial Site Layout) and Alternatives will have on the Environment and the Community that may be Affected

The layout of the project has been designed to mitigate and prevent potential impacts as far as possible. The project activities associated with the Kloof Mining Right area are likely to result in negative impacts to the biophysical environment, while the reclamation activities associated with the remaining Mining Right areas, namely Driefontein, Ezulwini and Cooke, are likely to result in positive impacts to the biophysical environment as a result of the removal of historical TSFs that are sources of pollution and contamination. The proposed RTSF complex has undergone a thorough site selection process and, although it will impact on the environment, it will ensure that two separate TSFs aren’t required as proposed by the CUP and WWP projects, thus minimising the potential impact. The WRTRP aims to remedy these issues and concerns that have been raised previously by I&APs and stakeholders by ensuring that one RTSF is developed as opposed to two TSFs developed for the CUP and WWP projects.

The predominant impacts associated with the Kloof Mining Right area, as identified by specialist studies as well as concerns from I&APs is the development of the RTSF and, to a lesser extent, the CPP. The significant negative impacts that may result due to the RTSF complex and CPP include groundwater quality deterioration for the immediate RTSF footprint area, the loss of wetland habitat, a negative intrusion on the visual landscape and sense of place and a permanent impact to agricultural land use and land capability. The RTSF will be a permanent structure on the landscape and saturation of the RTSF will take up to 100 years after closure; monitoring of the groundwater quality and quantity will be required throughout this period. The development of the RTSF complex and CPP, however, will enable the historical TSFs within the West Rand to be completely reclaimed. This will result in the removal of permanent pollution sources, improving the quality of water resources, as well reducing the extent of land occupied by mining dumps throughout the West Rand; the resultant tailings to be deposited on the RTSF will be reduced in sulfate and uranium content, reducing the contamination potential. The RTSF and CPP will, therefore, have direct negative and indirect positive environmental impacts on the greater West Rand.

In addition, the AWTF will treat mine affected water that would otherwise be discharged into the Wonderfonteinspruit. The mine affected water, which will be used for the reclamation of the historical TSFs, will be treated to potable drinking standards (SANS 241: 2011) and discharged into the Leeuspruit, WUL permitting. The discharge of potable water quality will dilute the Leeuspruit, improving on the water quality. The reduction of discharged mine affected water into the Wonderfonteinspruit will also result in a reduction of contaminants in the Wonderfonteinspruit, although this will also result in the reduction in water flow within the river.

Further to the environmental impacts associated with the Kloof Mining Right area activities as part of the WRTRP, there will also be significant positive socio-economic impacts, although the development of the RTSF complex will result in the loss of agricultural land and, subsequently, physical and economic displacement. The development and investment into the infrastructure, production of gold and uranium, and labour requirements and skills and training initiatives will have a significant positive socio-economic impacts for the region. Such impacts will also have multiplier impacts which will cumulatively increase such positive impacts.

10.8 Item 3(g)(viii): The Possible Mitigation Measures that could be applied and the Level of Risk

This section refers to the potential mitigation measures proposed for impacts associated with the project, with specific relation to concerns that I&APs have raised. The mitigation measures proposed in this Draft EIA and EMP were made available for public review and comment. Any further comments or issues raised will be recorded and responded to before the EIA and EMP is updated and submitted to the DMR provided they are submitted within a reasonable time.

Section 10.7 outlines the positive and negative impacts associated with the project, as identified by I&APs, as well as identified by the specialist studies. The predominant issues raised by I&APs relate to groundwater contamination, both existing and future potential contamination, as well as issues relating to the socio-economic development of the region.

The historical TSFs present throughout the landscape are located on sensitive dolomitic aquifers and seepage from the TSFs results in the contamination of groundwater. The WRTRP aims to remove these historical TSFs through the reclamation activities and rehabilitate the TSFs' footprints which will remove a permanent pollution source from the landscape. In addition, present mining activities can result in the groundwater becoming contaminated as it reacts with ore that increases the water's sulfate concentrations and pH values. The WRTRP will utilise this mine affected water to reclaim the historical TSFs, prevent discharge into the environment as well as preventing the use of clean water for mining activities, and this water will eventually be treated at the AWTF to potable standards (SANS 241:2011). The WRTRP is likely to improve the water quality of the region by removing the permanent pollution sources from the environment, using mine affected water to minimise discharge into the environment and to treat mine affected water to potable standards.

The development and presence of the RTSF will be a permanent pollution source on the environment once established. The tailings material to be deposited on the RTSF will not have the pollution potential of the current historical TSFs as large quantities of sulfate and uranium will be removed during the processing at the CPP. In addition, the water contained in the RTSF will be diverted and flow to a lined RWD which will prevent contamination of the groundwater resources. Contamination plumes are still expected from the RTSF due to seepage, however, and this contamination plume will be restricted to an area of approximately 1 600 ha through the implementation of a blast curtain. The blast curtain will be located along the periphery of the RTSF footprint. Groundwater monitoring will be undertaken throughout the life of the project and beyond to ensure that potential impacts to the environment due to the contamination plume are monitored.

The RTSF will also result in economic and physical displacement, the loss of wetlands and a visual intrusion on the environment. An exclusion zone will be implemented whereby purchase agreements will be concluded with the land owners affected by the RTSF. The responsibility for farm workers and land occupiers will be agreed upon in the purchase agreement to ensure any physical or economic displacement is compensated adequately. A wetland offset strategy will be implemented to compensate for the loss of wetland habitat.

The WRTRP will contribute significantly to the socio-economic environment. It is expected that the project will have a total capital investment in excess of R 9 billion and will require 2 000 temporary employees during the construction phase and 500 permanent employees for the life of the operation over a period of 50 years. The WRTRP will contribute an estimated R4.1 billion per annum should the product be exported. To enhance the socio-economic impacts anticipated, enhancement and management measures have been provided to maximise the local benefits.

All mitigation measures and the significance ratings, prior to and post the implementation of the mitigation measures, have been provided in Sections10.1 to 10.4.

10.9 Item 3(g)(ix): Motivation where No Alternatives Sites were Considered

Alternatives sites were considered for the CPP and RTSF complex, as well as the pipeline routes. A comprehensive site selection process was undertaken for the CPP and RTSF complex, as detailed in Sections 8.1.1 and 8.1.2. The pipeline route alternatives were determined based on existing routes and servitudes, avoiding wetland and sensitive areas, crossing impacts and mine owned land and assessing operating costs pertaining to topographical considerations on pumping costs.

10.10 Item 3(g)(x): Statement Motivating the Alternative Development Location within the Overall Site

10.10.1 RTSF

A parallel and independent site selection process was undertaken in 2009 and 2010 by Metago and Golder Associates, respectively, which considered the social, environmental and economic aspects of potential sites. The preferred areas identified by Metago (sites B2/B3) overlaid preferred areas identified by Golder Associates (sites 33/34) during their selection process, confirming the suitability of the area now referred to as the RTSF. Subsequent intrusive investigations have confirmed the suitability of the site in relation to its size with respect to the proposed deposition rate (4Mt/m), and rate of rise and ultimate tonnage capacity (1.3Bt) to accommodate the region’s collective TSF resources. It is relevant to note that neither of the two sites ultimately adopted by Rand Uranium (Site 35) and Gold Fields (CTSF) are capable of meeting the required deposition rates and tonnage required by the WRTRP.

Therefore the recommendation is that the site now identified as the RTSF be the preferred site.

10.10.2 CPP

A site selection process was undertaken by Golder Associates (Golder, 2013) for the CPP. A total of 100 candidate site areas were identified, of which 25 candidate sites were in compliance with the site selection criteria and taken forward for further analysis. The Top Two sites were then identified as the preferred and alternative sites respectively. The sites were called Site T2 (Preferred Option) and Site T9 (Alternative). The preferred option Site "T2" will be assessed as part of this study.

10.10.3 AWTF

The position of the AWTF has been selected as the closest to the source of impacted water to be treated, adjacent to the RWD of the RTSF, as well as close to the proposed point of discharge.

10.10.4 Pipe routes

As outlined in section 8.1.3, the interconnecting pipeline routes shown in Plan 10 have been well considered and are the preferred pipeline routes for the project.

11 Item 3(h): Full Description of the Process undertaken to Identify, Assess and Rank the Impacts and Risks the Activity will impose on the Preferred Site (In respect of the final site layout plan) through the Life of the Activity

The proposed infrastructure layout for the Kloof Mining Right area was informed by various environmental, technical and engineering studies. This included independent specialist studies undertaken as part of the Scoping phase of the EIA process, as well as site selection processes for the CPP and RTSF. The Scoping phase of the project identified potential impacts that may arise as a result of the proposed project and detailed the plan of study for specialist studies to determine the sensitives and baseline environment of the project area.

Following the identification of potential impacts and detailed baseline environment, the impacts were assessed utilising the Digby Wells' methodology which assesses the nature of the impact, duration and extent, intensity including the aspects irreplaceability, and the probability of the impact occurring. The EIA methodology is detailed in Section 10.6. Following the assessment of the potential impacts, mitigation measures are provided and the potential impacts are assessed post-mitigation. The significance of the pre-mitigation impacts, the proposed mitigation measures and the post-mitigation significance ratings are detailed per environmental aspect per phase of the project in Section 10. The potential impacts assessed are based on the preferred site layout (Plan 4).

12 Item 3(i): Assessment of each Identified Potentially Significant Impact and Risk

The potential impacts per activity are detailed in Table 12-1. The discussion of the impacts are provided in Section 10, along with the impact ratings prior to and post the implementation of mitigation and management measures, as well as providing a list of the mitigation measures.

Table 12-1: Assessment of Each Identified Impact

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
Construction Phase						
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Loss of topsoil as a resource	Soils	Construction Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Loss of land capability	Soils and land capability	Construction Phase	Medium-high (negative)	N/A	Medium-high (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Medium-high (negative)	Manage through: ▪ Storm Water Management Plan.	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Medium-high (negative)	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-high (negative)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Medium-low (negative)	Manage through: ▪ Alien Invasive Management Plan	Medium-low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Medium-low (negative)	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	Low (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	High (negative)	Compensate through: ▪ Wetland offset strategy	High (negative)
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	High (negative)	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-high (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Construction Phase	High (negative)	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	Medium-low (negative)
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Low (negative)	Manage through: ▪ Section 34 destruction permit	Low (negative)
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	Low (negative)
	Loss of topsoil as a resource	Soils	Construction Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Loss of land capability	Soils and land capability	Construction Phase	High (negative)	N/A	High (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Medium-high (negative)	Manage through: ▪ Storm Water Management Plan.	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Medium-high (negative)	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-high (negative)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Medium-low (negative)	Manage through: ▪ Alien Invasive Management Plan	Medium-low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Medium-low (negative)	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	Low (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	High (negative)	Compensate through: ▪ Wetland offset strategy Remedy through: ▪ Rehabilitation Plan.	Medium-high (negative)
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Medium-high (negative)	Manage through: ▪ Vegetation screens. ▪ Infrastructure finishes.	Medium-low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Low (negative)	Manage through: ▪ Section 34 destruction permit	Low (negative)
	Increased delays due to vehicle traffic	Traffic	Construction Phase	Medium-low (negative)	Manage through: ▪ Planning authority consultation	Medium-low (negative)
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	Low (negative)
	Loss of topsoil as a resource	Soils	Construction Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Medium-low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Medium-high (negative)	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-high (negative)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Medium-low (negative)	Manage through: ▪ Alien Invasive Management Plan	Medium-low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Medium-low (negative)	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	Low (negative)
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Medium-low (negative)	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	Medium-low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	Low (negative)
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Construction Phase	High (negative)	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	Medium-low (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	Moderate (positive)
	Direct investment and multiplier effect.	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	Moderate (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Population influx and associated impacts	Socio-economic	Construction Phase Operational Phase	Medium high (negative)	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	Medium low (negative)
	Physical and economic displacement	Socio-economic	Construction Phase	High (negative)	Manage and remedy through: ▪ Sales agreement. ▪ Exclusion zones.	Medium high (negative)
Operational Phase						
Water Abstraction from K10 Shaft	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	▪ Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Reduction in water quantity in the Wonderfonteinspruit.	Surface water	Operational Phase	Medium-high (negative)	N/A	Medium-high (negative)
	Improvement of water quality in the Wonderfonteinspruit due to decreased salt loads.	Surface water	Operational Phase	Moderate (positive)	N/A	Moderate (positive)
	Reduction in water quantity in the Wonderfonteinspruit leading to aquatic habitat modification.	Aquatics	Operational Phase	Medium-low (negative)	N/A	Medium-low (negative)
	Desiccation of wetlands along the Wonderfonteinspruit	Wetlands	Operational Phase	Medium-high (negative)	N/A	Medium-high (negative)
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	Low (negative)
	Contamination of groundwater from RTSF seepage	Groundwater	Operational Phase Decommissioning Phase Post Closure	Medium-high (negative)	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	Medium-low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Contamination of groundwater from RWD seepage	Groundwater	Operational Phase	Medium-high (negative)	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	Medium-low (negative)
	Reduction in water levels associated with the establishment of the blast curtain.	Groundwater	Construction Phase	Medium-low (negative)	Monitor and manage through: ▪ Groundwater level monitoring. ▪ Compensation plan.	Medium-low (negative)
	Contamination and deterioration of soils	Soils	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	Low (negative)
	Improvement of water quality in the Leeuspruit and Rietspruit due to discharge of treated water.	Surface water	Operational Phase	Moderate (positive)	Monitor and manage through: ▪ Water quality from AWTF.	Moderate (positive)
	Loss of vegetation, habitat and biodiversity	Fauna and flora	Operational Phase	Medium-low (negative)	Monitor and manage through: ▪ Vegetation of side walls of RTSF.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	Medium-low (negative)
	Modification of instream habitat	Aquatic ecology	Operational Phase	Medium-high (negative)	Manage and enhance through: ▪ Energy dissipation and silt collection.	Negligible (positive)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Contamination and sedimentation of wetlands	Wetlands	Operational Phase	Medium-high (negative)	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	Low (negative)
	Loss of water quantity	Wetlands	Operational Phase	Medium-high (negative)	N/A	Medium-high (negative)
	Wetland sedimentation and increased saturation due to water discharge	Wetlands	Construction Phase Operational Phase	Medium-high (negative)	Manage and enhance through: ▪ Energy dissipation and erosion management.	Medium-low (negative)
	Loss of wetland and wetland functioning due to dewatering.	Wetlands	Operational Phase Decommissioning Phase Post Closure	High (negative)	N/A	High (negative)
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	High (negative)	Manage remedy through: ▪ Vegetation screens. ▪ Concurrent rehabilitation.	High (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Radiation impacts to environment and public	Radiological	Operational Phase Decommissioning Phase Post Closure	Medium-low (negative)	Manage through: ▪ Radiation Management Programme for CoR-70; and ▪ NNR approval.	Medium-low (negative)
CPP	Reduction in air quality due to stack emissions	Air quality	Operational Phase	Medium-high (negative)	Manage through: ▪ Installation and maintenance of scrubbers, precipitators and filters.	Low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
	Radiation impacts to environment and public	Radiological	Operational Phase	Low (negative)	Manage through: ▪ Air quality management.	Low (negative)
Pipelines and Roads	Soil compaction and erosion	Soils	Operational Phase	Medium-low (negative)	Manage through: ▪ Erosion control. ▪ Site access restriction.	Low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Construction Phase Operational Phase	Minor (positive)	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	Moderate (positive)
	Contribution to country's economy	Socio-economic	Operational Phase	Moderate (positive)	N/A	Moderate (positive)
Decommissioning Phase						
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Medium-low (negative)
	Visual intrusion on the landscape	Visual	Decommissioning Phase	High (negative)	Manage through: ▪ Rehabilitation Plan.	High (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
	Generation of noise	Noise	Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Medium-high (negative)	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	Low (negative)
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Visual intrusion on the landscape	Visual	Decommissioning Phase	Medium-low (negative)	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	Medium-low (negative)
	Generation of noise	Noise	Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Low (negative)	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	Low (negative)
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Medium-low (negative)	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. ▪ Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	Low (negative)
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Medium-low (negative)	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	Low (negative)
	Visual intrusion on the landscape	Visual	Decommissioning Phase	Medium-low (negative)	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	Medium-low (negative)
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Low (negative)	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	Low (negative)
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Decommissioning Phase	Medium-high (negative)	Manage through: ▪ Closure Plan. ▪ Future Forum.	Medium-low (negative)
Post-Closure						

Activity	Potential Impact	Aspects Affected	Phase	Significance prior to mitigation	Mitigation Type	Significance post mitigation
RTSF Complex	Contamination of groundwater from RTSF seepage	Groundwater	Post Closure	Medium-high (negative)	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan.	Medium-low (negative)
	Depletion of the Leeuspruit and its tributaries.	Surface Water	Post Closure	Medium-low (negative)	Manage and prevent through: ▪ Flow monitoring. ▪ Discharge of treated water	Medium-low (negative)

13 Item 3(j): Summary of Specialist Reports

The summary of the specialist impact assessment reports undertaken for the WRTRP is detailed in Table 13-1.

Table 13-1: Summary of Specialist Impact Assessments for the WRTRP

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Air Quality Impact Assessment	The operation of the CPP and RTSF will result in the reduction of ambient air quality due to the generation of stack emissions and dust fallout respectively. Dust scrubbers, electrostatic precipitators and fabric filters must be installed for the CPP, with concurrent rehabilitation undertaken on the RTSF. A dust monitoring programme is imperative.	All recommendations have been considered and included.	The Air Quality Impact Assessment has been included in Appendix E. All mitigation and management measures included in this report were recommended by the Air Quality Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B Sections 5, 6 and 7 and the monitoring provided in Section 9.
Groundwater Impact Assessment	The RTSF will result in a contamination plume that will deteriorate groundwater quality. The implementation of a liner will restrict the contamination plume to the RTSF footprint and is the recommended mitigation to be implemented. Should the liner result in the project becoming unfeasible, a blast curtain is considered an acceptable mitigation measure rather than the project being abandoned.	All recommendations have been considered and included.	The Groundwater Impact Assessment has been included in Appendix F. All mitigation and management measures included in this report were recommended by the Groundwater Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7 and the monitoring provided in Section 9.
Soil Impact Assessment	It is important that soils are stripped and stockpiled correctly to reduce soil compaction and erosion. Soils must be stripped according to the Rehabilitation Plan and utilised for rehabilitation purposes.	All recommendations have been considered and included.	The Soil Impact Assessment has been included in Appendix G. All mitigation and management measures included in this report were recommended by the Soil Specialist. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Surface Water Impact Assessment	Sedimentation of surface water resources will deteriorate the water quality. It is important to manage site clearing and construction activities to divert all contaminated runoff and prevent dirty water from reporting to clean water resources. The treated water from the AWTF must be monitored to ensure it is potable standards which will improve the water quality of the Leeuspruit.	All recommendations have been considered and included.	The Surface Water Impact Assessment has been included in Appendix H. All mitigation and management measures included in this report were recommended by the Surface Water Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7 and the monitoring provided in Section 9.
Fauna and Flora Impact Assessment	Alien invasive vegetation must be managed on all disturbed areas as alien invasive vegetation out-competes indigenous vegetation and results in the loss of available habitats and biodiversity. Concurrent rehabilitation must be undertaken on disturbed areas.	All recommendations have been considered and included.	The Fauna and Flora Impact Assessment has been included in Appendix I. All mitigation and management measures included in this report were recommended by the Fauna and Flora Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7 and the monitoring provided in Section 9.

List of studies undertaken	Recommendations of specialist reports	Specialist Recommendations that have been included in the EIA report	Reference to applicable section of report where specialist recommendations have been included
Aquatics Impact Assessment	The sedimentation of water resources is a significant threat to the quality of aquatic ecosystems. Sediment must be collected through silt traps and buffers implemented from all water resources where possible.	All recommendations have been considered and included.	The Aquatics Impact Assessment has been included in Appendix J. All mitigation and management measures included in this report were recommended by the Aquatics Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7 and the monitoring provided in Section 9.
Wetlands Impact Assessment	There is no mitigation for the loss of wetlands. A wetland offset strategy must be implemented to compensate for the loss of wetland habitat.	All recommendations have been considered and included.	The Wetlands Impact Assessment has been included in Appendix K. All mitigation and management measures included in this report were recommended by the Wetland Specialist, as well as the monitoring programmes. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Visual and Topography Impact Assessment	The visual impact associated with the RTSF complex and CPP is unavoidable should the project proceed. Vegetation screens and concurrent rehabilitation must be undertaken throughout the project.	All recommendations have been considered and included.	The Visual and Topography Impact Assessment has been included in Appendix L. All mitigation and management measures included in this report were recommended by the Visual Specialist. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Noise Impact Assessment	Noise impacts are considered to be low (negative) due to the baseline noise levels for the region. The impacts can be further mitigated through the maintenance of machinery and operating equipment and limiting activities to daylight hours.	All recommendations have been considered and included.	The Noise Impact Assessment has been included in Appendix M. All mitigation and management measures included in this report were recommended by the Noise Specialist. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Heritage Impact Assessment	The significant impact associated with the project is the potential impacts to graves identified within the RTSF footprint. A BGGC and GRP must be undertaken in accordance with Section 36 of the NHRA.	All recommendations have been considered and included.	The Heritage Impact Assessment has been included in Appendix N. All mitigation and management measures included in this report were recommended by the Heritage Specialist. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Social Impact Assessment	There are positive and negative socio-economic impacts associated with the project. The positive impacts can be enhanced and the negative impacts mitigated through the recommendations provided by the specialists and all positive impacts should be focused on the local municipalities and receiving communities.	All recommendations have been considered and included.	The Social Impact Assessment has been included in Appendix O. All mitigation and management measures included in this report were recommended by the Social Specialist. This includes the impact assessment and mitigation measures as discussed in Section 10, as well as the recommendations provided in Part B, Sections 5, 6 and 7.
Economic Impact Assessment		All recommendations have been considered and included.	The Economic Impact Assessment has been included in Appendix C. All mitigation and management measures included in this report were recommended by the Economic Specialist. This includes the impact assessment as discussed in Section 10.

14 Item 3(k): Environmental Impact Statement

14.1 Item 3(k)(i): Summary of the Key Findings of the Environmental Impact Assessment

The Environmental Impact Statement is utilised to summarise all of the potential significant environmental and social impacts identified during each phase of the proposed project. The significance of the significant impacts associated with the biophysical and social environment, pre-mitigation and post-mitigation, is summarised in Table 14-1.

Table 14-1: Summary of the Potential Impacts on the Biophysical and Social Environment

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
Construction Phase				
RTSF Complex	Loss of land capability	Soils and land capability	Medium-high (negative)	Medium-high (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	High (negative)
	Visual intrusion on the landscape	Visual	High (negative)	Medium-high (negative)
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	High (negative)	Medium-low (negative)
CPP	Loss of topsoil as a resource	Soils	Medium-high (negative)	Low (negative)
	Loss of land capability	Soils and land capability	High (negative)	High (negative)
	Sedimentation and deterioration of surface water quality	Surface water	Medium-high (negative)	Low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)
	Destruction of habitats and loss of ecosystem services	Wetlands	High (negative)	Medium-high (negative)

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
	Visual intrusion on the landscape	Visual	Medium-high (negative)	Medium-low (negative)
Pipelines and Roads	Loss of topsoil as a resource	Soils	Medium-high (negative)	Medium-low (negative)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Medium-high (negative)	Medium-high (negative)
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	High (negative)	Medium-low (negative)
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Minor (positive)	Moderate (positive)
	Direct investment and multiplier effect.	Socio-economic	Minor (positive)	Moderate (positive)
	Population influx and associated impacts	Socio-economic	Medium high (negative)	Medium low (negative)
	Physical and economic displacement	Socio-economic	High (negative)	Medium high (negative)
Operational Phase				
Water Abstraction from K10 Shaft	Reduction in water quantity in the Wonderfonteinspruit.	Surface water	Medium-high (negative)	Medium-high (negative)
	Improvement of water quality in the Wonderfonteinspruit due to decreased salt loads.	Surface water	Moderate (positive)	Moderate (positive)
	Desiccation of wetlands along the Wonderfonteinspruit	Wetlands	Medium-high (negative)	Medium-high (negative)

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Medium-high (negative)	Low (negative)
	Contamination of groundwater from RTSF seepage	Groundwater	Medium-high (negative)	Medium-low (negative)
	Contamination of groundwater from RWD seepage	Groundwater	Medium-high (negative)	Medium-low (negative)
	Contamination and deterioration of soils	Soils	Medium-high (negative)	Medium-low (negative)
	Improvement of water quality in the Leeuspruit and Rietspruit due to discharge of treated water.	Surface water	Moderate (positive)	Moderate (positive)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Medium-high (negative)	Medium-low (negative)
	Modification of instream habitat	Aquatic ecology	Medium-high (negative)	Negligible (positive)
	Contamination and sedimentation of wetlands	Wetlands	Medium-high (negative)	Low (negative)
	Loss of water quantity	Wetlands	Medium-high (negative)	Medium-high (negative)
	Wetland sedimentation and increased saturation due to water discharge	Wetlands	Medium-high (negative)	Medium-low (negative)
	Loss of wetland and wetland functioning due to dewatering.	Wetlands	High (negative)	High (negative)
	Visual intrusion on the landscape	Visual	High (negative)	High (negative)

Activity	Potential Impact	Aspects Affected	Significance prior to mitigation	Significance post mitigation
CPP	Reduction in air quality due to stack emissions	Air quality	Medium-high (negative)	Low (negative)
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Minor (positive)	Moderate (positive)
	Contribution to country's economy	Socio-economic	Moderate (positive)	Moderate (positive)
Decommissioning Phase				
RTSF Complex	Visual intrusion on the landscape	Visual	High (negative)	High (negative)
CPP	Loss of topsoil as a resource due to compaction and erosion	Soils	Medium-high (negative)	Low (negative)
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Medium-high (negative)	Medium-low (negative)
Post-Closure				
RTSF Complex	Contamination of groundwater from RTSF seepage	Groundwater	Medium-high (negative)	Medium-low (negative)

14.2 Item 3(k)(ii): Final Site Map

The infrastructure layout plan for the Kloof Mining Right area is illustrated in Plan 9 of this Report and in Appendix A. A composite plan is provided in Plan 34 and in Appendix A.

Plan 34: Composite Plan

14.3 Item 3(k)(iii): Summary of the Positive and Negative Implications and Risks of the Proposed Activity and Identified Alternatives

The predominant negative impacts include the alteration of the visual environment due to the establishment of the CPP and RTSF of the landscape, particularly as the RTSF is located within agricultural area, the contamination of the groundwater quality due to the contamination plume of the RTSF, potential destruction or damage to graves and the loss of land capability, wetlands and physical and economic displacement. The abovementioned impacts are regarded as high (negative) impacts. The groundwater contamination plume will impact groundwater and requires significant mitigation to prevent the contamination plume from impacting private boreholes and possibly surface water resources. The risk of such an impact from occurring is considered significant and adequate mitigation measures have been provided to restrict and contain the contamination plume.

Physical and economic displacement is inevitable as land is required for the development of the RTSF. It is imperative that purchase agreements are compiled to manage this risk as the WRTRP will not commence should the RTSF not be authorised. The footprint of the RTSF consists of graves and burial grounds, wetland areas and agricultural land. The development of the RTSF will, therefore, require a relocation of the graves and burial grounds, as well as the direct loss of agricultural and wetland areas. Although the impacts to graves and be mitigated, the loss of agricultural and wetland areas is permanent and unavoidable. A wetland offset strategy will be developed to compensate for wetland destruction.

The positive impacts associated with the project are predominantly occurring as part of the remaining Mining Right areas, Driefontein, Ezulwini and Cooke, as the historical TSFs will be reclaimed and removed from the landscape. This will result in the removal of permanent pollution sources from the environment, as well as resulting in the availability of occupied land. The Kloof Mining Right area will result in significant capital expenditure however, which will boost the local economy and have a multiplier effect. Job creation and skills development will also result from the project. In addition, mine affected water from K10 shaft will no longer be discharged into the Wonderfonteinspruit but will be used in the reclamation process of the historical TSFs. This water will eventually be treated to potable standards and discharged into the Leeuspruit, improving the water quality of the river.

15 Item 3(l): Proposed Impact Management Objectives and the Impact Management Outcomes for Inclusion in the EMPR

The EMP seeks to achieve a required end state and describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored.

The EMP will address the environmental impacts during the construction, operational, decommissioning and post-closure phases of the project. Due regard must be given to environmental protection during the entire project; a number of environmental recommendations are made to achieve environmental protection. These recommendations are aimed at ensuring that the contractor maintains adequate control over the project to:

- Minimise the extent of an impact during the life of the project;
- Ensure appropriate restoration of areas affected by the project; and
- Prevent long term environmental degradation.

The specific impact management objectives and outcomes for the WRTRP include the following:

- Maintain and minimise impacts to the ecosystems within the WRTRP area;
- Provide suitable end land capability and land use following the reclamation of the historical TSFs;
- Provide suitable vegetation establishment on the RTSF to prevent long term impacts;
- Implement concurrent rehabilitation measures where possible;
- Reduce dust contamination and generation of dust from historical TSFs;
- Prevent soil, surface water and groundwater contamination;
- Comply with local and national regulatory requirements; and
- Maintain and monitor operational and rehabilitated areas for impact identification.

16 Item 3(m): Final Proposed Alternatives

The layout for the WRTRP and Kloof Mining Right area infrastructure was informed by environmental and technical studies, as discussed in detail in Section 8.1 and Section 10.10. Where impacts cannot be avoided, mitigation and management measures have been provided. Although sensitive areas have been avoided as far as possible, sections of the CPP, RTSF and pipelines are located in wetland areas; the wetlands cannot be avoided. A wetland offset strategy has been proposed and developed to offset the loss of wetland areas for the CPP and RTSF area.

17 Item 3(n): Aspects for Inclusion as Conditions of Authorisation

The following aspects must be included as part of the conditions for authorisation:

- A wetland offset strategy must be implemented for the loss of wetland habitat associated with the WRTRP, particularly the RTSF complex. The wetland offset strategy must be implemented within 1 year of a wetland being impacted upon;
- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, SGL may

apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority;

- All historical TSFs as part of the WRTRP must be completely reclaimed and their footprints rehabilitated according to closure plans to be compiled;
- The treatment of mine affected water at the AWTF must continue beyond the operational phase. Liability of the AWTF may be transferred to a third party upon agreement;
- Environmental monitoring must take place as recommended;
- “Chance Find” Procedures must be developed for the construction phase in the event of accidental exposure of unidentified heritage resources;
- A BGGC process and possible GRP must be implemented for the RTSF;
- A performance assessment will be undertaken every two years by a suitably qualified person; and
- The closure cost assessment must be updated and submitted to the DMR as per the legislative requirements (annually).

18 Item 3(o): Description of any Assumptions, Uncertainties and Gaps in Knowledge

This section highlights the assumptions, uncertainties, limitations and knowledge gaps relevant to the various specialist studies undertaken.

18.1 Air Quality Impact Assessment

A potential knowledge gap associated with the Air Quality Impact Assessment is that it is possible that emissions from the CPP may have been underestimated due to limited data availability. The assumptions and limitations for the Air Quality Impact Assessment include:

- Modelled data was utilised for site-specific meteorological data; and
- Stack parameters and selected emission factors were adopted from previous reports where onsite stack emissions was not available.

18.2 Groundwater Impact Assessment

A numerical model was used to predict the potential impacts of the RTSF on the groundwater environment. Numerical models are commonly used to simulate and develop hydrogeological management solutions, i.e. the prediction of contaminant plume migration, groundwater inflow rate and groundwater level changes over time. However, groundwater systems are often complex and the data input requirements are beyond Digby Wells’ capability to evaluate in detail. A model, no matter how sophisticated, will never describe the investigated groundwater system without deviation of model simulations from the actual physical process (Spitz, 1996). Therefore, it is necessary to make some assumptions to simplify the complex, real world hydrogeological conditions into a simplified, manageable model.

All numerical modelling simulations require assumptions to be made during the translation of the numerical code into a site-specific model. These assumptions, which reflect data gaps in the conceptual model regarding the aquifer distribution and the aquifer parameters, can result in areas of uncertainty in the model output and predictions.

Based on the conceptual model a best approximation of the real world site conditions was simulated and calibrated with available information until a reasonable fit of simulated and measured data was obtained. A model sensitivity analysis was then carried out to give an indication of which assumptions in model input parameters were most likely to affect the model output.

The following assumptions have been made with regard to this numerical model:

- The life of the project is assumed to be 50 years;
- The Leeuspruit and its tributaries represent groundwater baseflow to the streams and were simulated as drains;
- It is assumed that the private boreholes, Leeuspruit and its tributaries are the main receptors of the potential contaminant plume in the project area;
- Based on the geological composition of the site, an effective porosity and specific yield of between 0.03 and 0.02 were applied over the entire model domain;
- Recharge has been estimated from model calibration and varies between 0.5% to 1.5% of the mean annual precipitation;
- The closure phase of the RTSF is estimated to occur after 50 years of operation. During the closure phase the RTSF will be decommissioned, the deposition of tailings material will terminate. SLR (2015) indicated that the RTSF will remain saturated for approximately 100 years, following the discontinuation of tailings deposition;
- Sulfate and manganese are expected to be the main contaminants of concern at the RTSF site (SLR, 2015) and have been simulated in the mass transport model. Sulfate is a conservative element and is expected to mobilise at the same rate of the groundwater flow. Manganese is however a non-conservative element and will retard in the aquifer materials resulting in a reduced migration rate. To simulate the transportation of manganese, the retardation factor (R_f) needs to be determined for various geological units. R_f is defined as the ratio of the migration distance of the non-conservative substance to the migration distance of the conservative distance and is always between 0 and 1:
  - This property is site specific and references from literature will not reflect the hydrogeochemical conditions in the project area. In this study the retardation factor of manganese has been assumed to be 0.04. Model sensitivity has been done to evaluate the effect of this uncertainty on the size of the pollution plume.

- Arsenic and uranium are generally perceived to be contaminants of concern in the West Rand gold mines, although the seepage test conducted by SLR (2015) did not identify them to seep at significant concentration. Regardless, both these elements have been simulated in this study and their results are given in Appendix F.

- The numerical model assumed that the blast curtain will be effective to intercept any plume that originates from the RTSF. For this to happen, the drain has to be at least 5 times more permeable than the aquifer. Otherwise, contaminants can migrate through more permeable weathered or fractures zones and will not be intercepted by the drain. The blast curtain will also need to be pumped continuously since any pooling in it can result in the migration of contaminants to the Leeuspruit.
- The implementation of the blast curtain will have a side effect as it can lower the water table. The water level in the area of the RTSF is shallow, ranging between 2.3 to 9.5 m below ground surface. The blast curtain will be excavated to a depth of 30 m below surface. The abstraction from the blast curtain is likely to create a cone of dewatering. In this study, the curtain is assumed to impact the groundwater if the drawdown is more than 10 m.

18.3 Soil Impact Assessment

The assumption and limitation associated with the Soil Impact Assessment includes:

- A field survey was undertaken for the RTSF complex only, with land type data and existing studies used for the remaining WRTRP area.

18.4 Surface Water Impact Assessment

Additional water quality data provided by the client was used in the baseline water quality description. The assumption and limitation applicable to the Surface Water Impact Assessment includes:

- No flow measuring equipment was installed on site. All flow data was obtained from existing DWS flow gauging stations.

18.5 Fauna and Flora Impact Assessment

A conservative assumption was made that all new pipelines will be above ground and within new servitudes. Furthermore, it was assumed that the pipeline servitudes will be 20 m wide. The vegetation or habitat types that will be disturbed due to the pipelines, and calculations on areas of disturbance, was based on these assumptions.

Avifaunal activity is reduced due to the lack of the summer migrants that generally start arriving in South Africa in October and early November. This also coincides with the breeding of most of the Southern African species.

The faunal sampling assessment was intended to document any faunal activity or evidence thereof on site. It is likely that some cryptic, nocturnal or migrant species may not have been recorded during the faunal survey.

Whilst every effort to document all plant species was made, it is possible that the emerging period (including flowering or seed-bearing phases of plant life-cycles) of some plants may not have coincided with the time of sampling. In this case, the absence of these plants from the species list does not imply that they do not occur on site at all.

18.6 Wetlands Impact Assessment

The assumptions and limitations associated with the Wetlands Impact Assessment include:

- Only areas that coincide directly with infrastructure and development were assessed. Given the linear nature of this project, as well as the large extent of the area, only wetlands within a 500 m study area from the infrastructure areas (250 m either side) were studied in detail; this included the pipelines, powerlines, historical TSFs and the footprints of the CPP and RTSF complex;
- It is important to note that not all wetland floral indicators or important species may have been identified as the sampling methodology aims to be representative of the project site and does not cover the entire surface area; and
- Whilst every effort was made to record all plant species, it is possible that the flowering period or seed-bearing phases of plant life-cycles of some plants may not have coincided with the time of sampling.

18.7 Visual Impact Assessment

A Visual Impact Assessment is open to subjectivity. This subjectivity is due to the different opinions receptors have of a proposed project. A receptor may be partial to the fact that the proposed project is occurring in an area, which becomes a source of economic upliftment for a community, whereas another receptor may view a proposed project as a negative factor which could hamper tourism or recreational activities.

Many factors can enhance or reduce the visual impact of the proposed project. It is, therefore, difficult to determine the visual impact of the proposed project from the viewpoint of each individual receptor. Consequently, this report focuses on the size of the viewshed area. Some infrastructure heights were not available for this study and assumptions were made. These assumptions were based on the heights of infrastructure from similar projects.

The 5 metre contour relief data from CD: NGI did not include contours for any of the mining activities (TSFs) for the project area and surrounds. These TSFs could potentially provide some screening of the proposed project. Lidar data (0.5 metre contours) from SGL was used where available to add the TSFs. For other areas, the contour data was edited and contours were added for these mining activities to produce a more representative topographical model.

18.8 Noise Impact Assessment

The assumptions and limitations associated with the Noise Impact Assessment include:

- Only daytime scenarios were modelled for the construction phase as it is assumed that construction activities will only be undertaken during daytime hours (06:00-22:00); and
- The resulting noise contours represent worst case (unmitigated), L_{Aeq} at any receiver located 360 degrees in the horizontal plane around the noise sources. The noise modelling software is limited to calculating the predominant wind direction (or downwind conditions of propagation) per single receptor only. Calm wind conditions have therefore been included in the model due to the number of surrounding receptors. Thus, the noise dispersion plots do not represent a typical seasonal scenario in the predominant wind direction but rather a yearly average of the area's meteorological conditions in all directions.

18.9 Social Impact Assessment

The assessment of potential socio-economic impacts expected to arise as a result of a proposed project is challenging for a number of reasons. Potential social impacts and the elements that combine to determine the socio-economic status of affected populations are generally multi-dimensional and interrelated.

For example, insufficient access to services such as water, sanitation and healthcare is both a cause and an effect of poverty. Hence, if a project increases the availability of services in an area, the ability of surrounding communities to take advantage of these services may, to some extent, depend on their current socio-economic status. In addition, the linkages between various potential project impacts are complex and can be mutually reinforcing and, lastly, many social impacts cascade. Although it is necessary to keep the complexity of social impacts in mind, it is also necessary to produce a Social Impact Assessment that will be accessible to a non-specialist audience and meet the requirements of the project.

19 Item 3(p): Reasoned Opinion as to whether the Proposed Activity should or should not be authorised

It must be noted that the Kloof Mining Right activities in isolation require authorisation in conjunction with the activities associated with the remaining Mining Right areas to incorporate the Ultimate WRTRP. Should one application or activity not be authorised, the entire WRTRP would be compromised and the significant positive impacts associated with the project will not be realised. As a result, the following section has been discussed taking into account the Ultimate WRTRP as well as the Kloof Mining Right area.

19.1 Item 3(p)(i): Reasons why the Activity should be Authorised or not

The WRTRP will bring significant socio-economic contributions to the West Rand; the West Rand economy has been growing at a Compounded Annual Growth Rate (CAGR) of 1.1% per year, with the Westonaria LM unemployment was recorded at 42.0%, while the Merafong City LM recorded an unemployment rate of 21.1%. The capital investment and contributions to the GDP associated with the WRTRP, along with the potential multiplier effects, are significant over the life of the operation (50 years), which will provide a sustained contribution to the local and national economy. In addition, the reclamation of historical TSFs, which are located on sensitive dolomitic aquifers, will result in positive impacts as permanent pollution sources are removed from the environment. Furthermore, mine affected water being discharged into the environment will be reduced and this water will eventually be treated to potable standards and discharged, having a positive impact on the environment and downstream users.

The WRTRP will also result in negative impacts on the environment, most notably the construction of the proposed RTSF. The development and presence of the RTSF will result in a contamination plume that will impact on groundwater quality. The RTSF will be approximately 1 300 ha in size and, should no mitigation be implemented, the resultant contamination plume will impact an area of approximately 3 600 ha 100 years after closure. The implementation of a liner beneath the RTSF will prevent a contamination plume for sulfate and manganese after 50 years of operation, with the contamination plume 100 years after closure being restricted to the RTSF footprint.

However, the implementation of a liner is likely to result in the WRTRP being financially unfeasible and all of the positive impacts associated with the project will not be realised. SGL proposes to implement a blast curtain which will restrict the contamination plume to an area of approximately 1 600 ha which is 1 900 ha greater than the RTSF footprint. Although the liner is preferred from a groundwater perspective, the implementation of a blast curtain will ensure the project is feasible and the larger positive impacts associated with the WRTRP are realised.

Based on the potential positive impacts associated with the project, the implementation of a blast curtain is considered to be an acceptable mitigation measure should the requirement of a liner result in the project becoming financially unfeasible; the implementation of a blast curtain is more suitable than the project not being undertaken at all.

19.2 Item 3(p)(ii): Conditions that must be Included in the Authorisation

19.2.1 Specific Conditions to be included into the Compilation and Approval of EMPR

The following aspects must be included as part of the conditions for authorisation:

- A wetland offset strategy must be implemented for the loss of wetland habitat associated with the WRTRP, particularly the RTSF complex. The wetland offset strategy must be implemented within 1 year of a wetland being impacted upon;

- All mitigation measures provided in this report must be implemented. Should the mitigation measures be deemed impractical, ineffective or cost prohibitive, SGL may apply to the DMR to alter such mitigation measures accordingly. Any change in mitigation measures must be approved by the competent authority;
- All historical TSFs as part of the WRTRP must be completely reclaimed and their footprints rehabilitated according to closure plans to be compiled;
- The treatment of mine affected water at the AWTF must continue beyond the operational phase. Liability of the AWTF may be transferred to a third party upon agreement;
- Environmental monitoring must take place as recommended;
- “Chance Find” Procedures must be developed for the construction phase in the event of accidental exposure of unidentified heritage resources;
- A BGGC process and possible GRP must be implemented for the RTSF;
- A performance assessment will be undertaken every two years by a suitably qualified person; and
- The closure cost assessment must be updated and submitted to the DMR as per the legislative requirements (annually).

19.2.2 Rehabilitation Requirements

A Rehabilitation Plan (Appendix R) has been compiled for the WRTRP, as required and detailed in the MPRDA. A Rehabilitation Plan is an important planning tool designed to assist in preventing, minimising or mitigating adverse long-term environmental and social impacts caused by the proposed project, as well as to create a self-sustaining ecosystem and to ensure the optimal management of rehabilitation issues that may arise.

The overall rehabilitation objectives, and requirements, for the WRTRP are as follows:

- Maintain and minimise impacts to the ecosystem within the study area;
- Provide practical rehabilitation measures for the rehabilitation of the Driefontein 3 and 5 TSFs, the Cooke TSF, Ezulwini South and the RTSF;
- Identification of suitable end post reclamation land capability and land use and potential identification of what the future land use could be for these areas;
- Provide suitable vegetation establishment techniques that can be adopted for the two dumps that will be reclaimed and for the RTSF;
- Implement progressive rehabilitation measures where possible;
- Reduction in dust contamination and generation of dust from historical TSFs through rehabilitation efforts and concurrent rehabilitation;
- Prevent soil, surface water and groundwater contamination by removing old tailings off dolomites and reducing the risk of sinkhole formation;
- Comply with the relevant local and national regulatory requirements; and
- Maintain and monitor the rehabilitated areas post reclamation and final capping of the RTSF.

20 Item 3(q): Period for which the Environmental Authorisation is required

To allow for the processing of all the dumps associated with the Ultimate WRTRP through the CPP and to promote the sustainability of the WRTRP, the environmental authorisation must be valid for a period of at least 30 years.

21 Item 3(r): Undertaking

It is confirmed that an undertaking is provided in Part B, Section 13 of the EMPr and is applicable to the EIA and EMPr sections of this report.

22 Item 3(s): Financial Provision

The Closure Cost Report is included in Appendix S. The financial provision for the Kloof Mining Right area is **R 286 009 667.16**, with the unplanned closure cost after one year **R 146 651 567.34**, as summarised in Table 22-1.

Table 22-1: Summary of the Closure Cost Liability for the Kloof Mining Right Area

Description	Planned Closure Cost		Unplanned Closure Cost after 10 years		Unplanned Closure Cost after 1 year	
Central Processing Plant	R	57,013,822.86	R	57,013,822.86	R	19,004,607.62
Dams	R	1,088,759.52	R	1,088,759.52	R	1,088,759.52
Linear Infrastructure	R	2,538,491.76	R	2,538,491.76	R	2,538,491.76
RTSF	R	172,308,394.02	R	172,308,394.02	R	77,172,014.32
Total	**R**	**232,949,468.17**	**R**	**232,949,468.17**	**R**	**99,803,873.23**
Monitoring Costs (groundwater)	R	809,750.00	R	809,750.00	R	809,750.00
Monitoring Costs (vegetation)	R	260,797.42	R	260,797.42	R	139,897.42
Maintenance Costs (vegetation)	R	12,055,263.66	R	12,055,263.66	R	6,256,591.14
Cyanide Decontamination	R	1,552,473.00	R	1,552,473.00	R	517,491.00
Radiation Clearance	R	1,110,000.00	R	1,110,000.00	R	1,110,000.00
Project Management (12%)	R	13,976,968.09	R	13,976,968.09	R	7,128,508.85
Contingency (10%)	R	23,294,946.82	R	23,294,946.82	R	11,880,848.08
GRAND TOTAL	**R**	**286,009,667.16**	**R**	**286,009,667.16**	**R**	**146,651,567.34**

22.1 Item 3(s)(i): Explain how the Aforesaid Amount was Derived

The "*Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*" will be used to assess the applicant's environmental liability. The DMR Guideline Document format makes use of a set template for which defined rates and multiplication factors are used.

The infrastructure areas and other areas affected by the mining activities were measured from plans provided by SGL. Measurements that were taken have been standardised to ensure that the costs calculated are easily updatable. The concrete and steel estimates associated with the plants are based on previous experience and assumptions.

The rates used were updated by quotes from demolition and civil contractors and professionals wherever possible. Rate formulation takes into consideration the total labour costs, plant costs, fuel costs and construction costs and provides an accurate, defendable rate.

The closure cost model was compiled in Microsoft Excel. The model consists of an input sheet, containing all measurements of each area of the infrastructure and activities, a standard rate sheet and a summary sheet which summarises the costs for closure. Each sheet is linked to the rate sheet, thereby, allowing the costs calculations to be updated easily from year to year.

22.2 Item 3(s)(ii): Confirm that this Amount can be Provided for from Operating Expenditure

SGL confirms that the amount detailed in Table 22-1 can be provided for from the operating expenditure of the WRTRP.

23 Item 3(t): Deviations from the Approved Scoping Report and Plan of Study

23.1 Item 3(t)(i): Deviations from the Methodology used in Determining the Significance of Potential Environmental Impacts and Risks

There were no deviations from the methodology proposed in the Scoping Report and plan of study.

23.2 Item 3(t)(ii): Motivation for the Deviation

No deviations were undertaken from the Scoping Report submitted to the DMR.

24 Item 3(u): Other Information required by the Competent Authority

To ensure compliance with the provisions of Sections 24(4)(a) and (b) read with Section 24 (3) (a) and (7) of the NEMA, the EIA report must include the information provided in the following chapters.

24.1 Item 3(u)(i)(1): Impact on the Socio-Economic Conditions of any Directly Affected Person

The potential socio-economic impacts were discussed in Sections 10.1.11 and 10.2.10. The predominant impact on directly affected persons results in the physical and economic displacement due to the proposed development of the RTSF. The RTSF will require the purchasing of land that is used for agricultural uses. The physical and economic displacement impacts are considered to be high (negative) for the land owner, land occupiers and farm workers. The significance of the impacts are considered to be medium-high (negative) following the implementation of the mitigation and management measures. It is essential that a purchase agreement is concluded between SGL and the landowners and that responsibility of the farm workers and any land occupiers are detailed in the purchase agreement. Should SGL be responsible, a Resettlement Action Plan must be developed in consultation with the affected households. SGL is in the process of negotiating and intend to buy the properties associated with the RTSF footprint, as well as investigating buy-outs for an exclusion zone.

The Social Impact Assessment is included in Appendix O and it is hereby confirmed that the mitigation measures are provided in Table 5-1 and Table 6-1, Part B of this report.

24.2 Item 3(u)(i)(2): Impact on any National Estate Referred to in Section 3(2) of the National Heritage Resources Act.

The potential impacts on heritage resources have been investigated and assessed in detail. The Heritage Impact Assessment is included in Appendix N to this report. In summary, the primary risk identified is the potential destruction or damage of burial grounds and graves within the RTSF complex footprint. These potential impacts can be mitigated through the BGGC process in terms of Section 36 of the NHRA where the bona fide next of kin must be identified where possible and consulted to reach agreement regarding the management of the burial grounds. A CMP must be compiled and, if required, a GRP developed through the BGGC process.

In addition to the burial grounds and graves identified, structures older than 60 years were identified throughout the project area. Structures older than 60 years require a destruction permit in accordance with Section 34 of the NHRA, even though the structures are deemed to have negligible cultural significance. The structures older than 60 years that may be impacted upon due to the Kloof Mining Right area activities, and may require a Section 34 destruction permit, are listed in Table 24-1 and displayed in Plan 24.

Table 24-1: Structures that may require a Section 34 Destruction Permit

Resource ID	Type	Description	Cultural Significance Motivation	Latitude	Longitude
Ste-001	Structure	Historic dwelling constructed with stone.	The structure is in a dilapidated state. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.4711°S	27.6186°E
Wf-002	Werf	Werf comprising of abandoned dilapidated residential structure, outbuildings, water tank and reservoir.	The werf is abandoned and in a state of ruin. The werf can be considered in particular dimensions against aesthetic and social criteria, but this type of resource is common and well represented throughout diverse cultural landscapes. The fabric of the resource is preserved and the meaning is evident.	26.4785°S	27.6170°E
Wf-003	Werf	Werf comprising of abandoned dilapidated residential structure and farmworker housing approximately 300m north-west of the main house.	The werf is abandoned and in a state of ruin. The werf can be considered in particular dimensions against aesthetic and social criteria, but this type of resource is common and well represented throughout diverse cultural landscapes. The fabric of the resource is preserved and the meaning is evident.	26.4751°S	27.6147°E
Ste-004	Structure	Historic dwelling constructed with stone.	The structure is in a dilapidated state. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.4804°S	27.6342°E

Resource ID	Type	Description	Cultural Significance Motivation	Latitude	Longitude
Wf-005	Werf	Werf comprising of three structures. One structure appears to be maintained, while the others are in a state of ruin.	The werf is abandoned and in a state of ruin, with the exception of one structure. The werf can be considered in particular dimensions against aesthetic and social criteria, but this type of resource is common and well represented throughout diverse cultural landscapes. Aesthetically, the werf does exhibit features not seen at other werfs, such as the pillars / columns that remain intact. The fabric of the resource is preserved and the meaning is evident.	26.4788°S	27.6288°E
Wf-008	Werf	Werf that is currently occupied. Werf comprises of residential structure and outbuildings.	The werf can be considered in particular dimensions against aesthetic and social criteria. This is a resource that is common and well represented throughout diverse cultural landscapes. The fabric of the resource is well preserved and the meaning is well established.	26.420°S	27.6214°E
Wf-014	Werf	Werf comprising of house, labourer quarters and mine singles quarters.	The werf can be considered in particular dimensions against aesthetic and social criteria. This is a resource that is common and well represented throughout diverse cultural landscapes. The fabric of the resource is well preserved and the meaning is well established.	26.4224°S	27.6122°E
Ste-016	Structure	Single structure constructed with brick and cement. Currently in dilapidated state.	The structure is in a dilapidated state. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.4887°S	27.5946°E

Resource ID	Type	Description	Cultural Significance Motivation	Latitude	Longitude
Ste-017	Structure	Foundations of structure constructed of brick and cement.	The structure is in a dilapidated state. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.5064°S	27.6200°E
Wf-018	Werf	Werf comprising of several structures in a state of disrepair.	The werf is abandoned and in a state of ruin. The werf can be considered in particular dimensions against aesthetic and social criteria, but this type of resource is common and well represented throughout diverse cultural landscapes. The fabric of the resource is preserved and the meaning is evident.	26.5135°S	27.6307°E
Ste-019	Structure	Concrete foundations.	The structure is in a dilapidated state. The structure can be considered in particular dimensions against aesthetic and social criteria, but the fabric of the structure is poorly preserved.	26.4224°S	27.6122°E
Wf-020	Werf	Werf comprising of main house, farm outbuildings and farm worker quarters. Currently vacant.	The werf is currently vacant. The werf can be considered in particular dimensions against aesthetic and social criteria, but this type of resource is common and well represented throughout diverse cultural landscapes. The fabric of the resource is preserved and the meaning is evident.	26.5054°S	27.6151°E
LFC-021	Site	Stone walled settlement complex.	The stone walled settlement can be considered on particular dimensions against aesthetic, historic and scientific criteria. The fabric of the site is preserved and there is potential for information, although the quality of information may be questionable	26.4319°S	27.6282°E

25 Item 3(v): Other Matters Required in Terms of Sections 24(4)(a) and (b) of the Act

This EIA report provides the competent authority with a detailed investigation of the activities to be undertaken a part of the project and their potential impacts. In addition, alternatives for the project have been discussed and assessed and no other matters are required in terms of Sections 24(4)(a) and (b) of the NEMA.

Part B: Environmental Management Programme Report

1 Item 1(a): Details of the EAP

It is confirmed that the details of the EAP have been provided in Part A, Section 2.1 of this report.

2 Item 1(b): Description of the Aspects of the Activity

It is confirmed that the baseline environment that may be impacted by the activities is detailed and discussed in Part A, Section 9.1 of this report.

3 Item 1(c): Composite Map

A composite plan for the Kloof Mining Right area is illustrated in Plan 34 above, as well as in Appendix A.

4 Item 1(d): Description of Impact Management Objectives including Management Statements

4.1 Item 1(d)(i): Determination of Closure Objectives

Mine closure aims to achieve long-term site stability and the establishment of a self-sustaining ecosystem which supports the final end land use. The overall rehabilitation and closure objective for the WRTRP is to:

- Remove mining infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements must be made to ensure their long term sustainable use;
- Any proposed post closure developments on old mining land will need to undergo extensive environmental and stability assessments before they can be permitted;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Conducting a radiological field survey to control or stop any action of radon emitting material;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Follow a process of closure that is progressive and integrated into the mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements; and

- To maintain and monitor all rehabilitated areas following re-vegetation and, if monitoring shows that the objectives have been met, making an application for closure.

4.2 Item 1(d)(ii): The Process for Managing any Environmental Damage, Pollution, Pumping and Treatment of Extraneous Water or Ecological Degradation as a Result of undertaking a Listed Activity

Listed and specified activities associated with the Kloof Mining Right area will result in ecological degradation and environmental damage and pollution. The potential impacts associated with such activities have been identified and assessed for each environmental aspect in Sections 10.1 to 10.4. Mitigation measures have been provided to mitigate the potential impacts associated with the project's activities to reduce the significance of such impacts. In addition, monitoring programmes have been provided in Section 9.5 to monitoring potential impacts which will allow alternative mitigation measures to be implemented if necessary.

The construction of the RTSF and CPP will result in the loss of agricultural land, wetlands and grasslands. The loss of wetlands will be compensated for through the wetland offset strategy. The loss of agricultural and grassland areas is unavoidable due to the permanent nature of the RTSF and significant life of the operation associated with the CPP. Compensation and buy-out associated with the economic and physical displacement will be undertaken by SGL. Further processes for managing environmental damage and ecological degradation is to ensure that water and sediment from the operational areas are contained and do not report to the catchment, which will prevent surface water quality deterioration and resultant impacts on the wetlands and aquatic ecosystems. This can be achieved by implementing a Storm Water Management Plan and installing silt traps. Similarly, erosion and generation of dust from exposed areas must be managed through dust suppression and limiting the areas cleared to operational areas only and rehabilitation disturbed areas.

Mine affected water will be abstracted from K10 shaft and utilised as part of the reclamation activities associated with the WRTRP. The resultant slurry will be pumped to the CPP where sulfate, uranium and gold will be extracted and the residual tailings deposited on the RTSF. The water from the residual tailings will flow to the RWD and will be treated at the AWTF. In addition, the contamination plume seeping from the RTSF will be abstracted at selected locations along the blast curtain. This water will also be treated to potable standards at the AWTF. All mine affected water from the RTSF will be treated to potable standards prior to being discharged into the Leeuspruit and will ensure that impacts to water resources are avoided; the discharge of treated water into the Leeuspruit is considered to have a positive impact as the Leeuspruit water quality will be diluted.

4.3 Item 1(d)(iii): Potential Risk of Acid Mine Drainage

To determine the potential for AMD associated with the project, a comprehensive sampling and testing campaign was undertaken by SLR Consulting (2015) to characterise the physical and geochemical properties of the tailings from the historical TSFs. Three typical composite samples were made up on which detailed and specialised geotechnical laboratory test work was undertaken. The composite samples included:

- Typical fine tailings: it is estimated that 95% of all tailings within historical TSFs will be coarser than this grading;
- Typical mean tailings: it is estimated to be a representative average tailings grading; and
- Typical coarse tailings: it is estimated that 80% to 90% of all tailings will be finer than this grading.

The CPP will aim to extract sulfur, uranium and gold from the reclaimed tailings. The unprocessed tailings samples underwent small scale SPLP leach tests and showed that there were nine contaminants likely to be of concern, namely, arsenic, iron, manganese, molybdenum, nickel, nitrate, sodium, sulfate and uranium. The removal of sulfur as sulfide will be undertaken to achieve a mass concentration of less than 0.3%; the re-processing of the tailings and removal of sulphide was seen to will play a positive role in reducing contaminant concentrations in the seepage and runoff from the RTSF (SLR Consulting, 2015). The sulfide mass concentrations of less than 0.3% will significantly reduce the AMD potential of the residual tailings. The concentration of concern, however, following processing at the CPP was manganese which has a concentration ratio of 110:1 for chemicals of concern.

4.4 Item 1(d)(iv): Steps taken to Investigate, Assess, and Evaluate the Impact of Acid Mine Drainage

SLR Consulting (2015) undertook and geochemical and geotechnical analysis of tailings samples from the historical TSFs associated with the WRTRP; the mineralogy and element content of the tailings composite samples were found to be similar. A small scale laboratory leach test was used to evaluate the effect of different metallurgical processes on the tailings leachability. The effect of sulfide flotation was concluded that sulfide removal during the reprocessing of the tailings plays a positive role in reducing contaminant concentrations in the seepage and runoff from the RTSF, although concentrations of manganese were a concern with a concentration ratio of 110:1.

4.5 Item i(d)(v): Engineering or Mine Design Solutions to be Implemented to Avoid or Remedy Acid Mine Drainage

The processing of the reclaimed tailings to a sulfide mass concentration of less than 0.3% will significantly reduce the AMD potential of the residual tailings, as well as play a positive role in reducing contaminant concentrations of other elements. Soregaroli and Lawrence (1998) showed that a sulfide-sulfur concentration of at least 0.3% is required for long term acid generation. In addition to the sulfide removal, a correlation to the concentration of other potential contaminants and the potential pH values were identified, such as concentrations of iron, uranium, manganese, aluminium, zinc lead and nickel among others. By controlling the pH of the residual tailings, the concentrations of potential contaminants can be reduced, as well as the potential of AMD generation. The following pH controls will be implemented and are expected to maintain the pH of the residual tailings between 6 and 9 in the long term (SLR Consulting, 2015):

- Sulfide removal and segregation through flotation to achieve a consistent mass concentration of 0.3%;
- Addition of lime to raise the pH of the process water going to the RTSF to around 10.5 initially;
- Construction of a concurrent cover to the RTSF side slopes to limit oxygen ingress and oxidation of any residual sulfide; and
- Control the rate of rise which maintains relatively low air permeability throughout the bulk of the volume of the RTSF.

4.6 Item 1(d)(vi): Measures that will be put in place to Remedy any Residual or Cumulative Impact that may Result from Acid Mine Drainage

Any water runoff from the RTSF will be drained into the lined RWD. In addition, seepage of water and the resultant contamination plume from the RTSF will be abstracted at locations along the blast curtain and this water, along with water in the RWD, will be pumped to the AWTF for treatment. The mine affected water will be treated to potable standards and discharged into the Leeuspruit, IWUL permitting. Thus, the likelihood of AMD formation is considered to be a negligible risk; the removal of sulfide to a mass concentration of 0.3% will reduce the AMD potential of the residual tailings, with any contaminated water emanating from the RTSF being treated to potable standards.

4.7 Item 1(d)(vii): Volumes and Rate of Water Use Required for the Mining, Trenching or Bulk Sampling Operation

Approximately 20 Mℓ of mine affected water will be abstracted from K10 shaft, with an additional 12 Mℓ of mine affected water abstracted from Cooke 1 shaft per day required for the reclamation activities. This will result in the requirement for 32 Mℓ of water required per day which is currently being discharged into the Wonderfonteinspruit and is considered to be significantly impacted upon. Following the reclamation activities, processing of the tailings and deposition of the residual tailings on the RTSF, the AWTF will treat runoff and seepage from the RTSF to potable standards prior to discharge, IWUL permitting, into the Leeuspruit. It is anticipated that approximately 15 Mℓ of potable treated water will be discharged per day.

4.8 Item 1(d)(viii): Has a Water Use Licence has been Applied for

An IWULA and IWWMP has been compiled and submitted to the DWS as the decision making authority. The water uses triggered under Section 21 of the NWA in relation to the proposed project are listed below:

- S21(c) – Impeding or diverting the flow of water in a watercourse;
- S21 (g) – Disposing of waste in a manner which may detrimentally impact on a water resource;
- S21 (i) – Altering the bed, banks, course or characteristics of a watercourse; and
- S21 (j) - Removing, discharging or disposing of water found underground if it is necessary for the efficient continuation of an activity or for the safety of people.

5 Item 1(d)(ix): Impacts to be Mitigated in their Respective Phases

The proposed mitigation measures and its compliance with the relevant standards are presented in Table 5-1.

Table 5-1: Impacts to be Mitigated

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Construction Phase						
RTSF Complex	Air quality	Construction Phase	Local	▪ Application of wetting agents or dust suppressant on exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to the commencement of the activity and for the duration of the project life.
	Groundwater	Construction Phase	Local	▪ Re-use abstracted water for dust suppression, vegetation or discharge (WUL permitting); and ▪ Groundwater level monitoring must be undertaken.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.
	Soils	Construction Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; ▪ Ensure storm water management designs are in place; and ▪ Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state and vegetated, as per the Rehabilitation Plan.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ During the construction phase
	Surface water	Construction Phase	Municipal Area	▪ Temporary ditches must be constructed down-gradient of the cleared areas; ▪ Utilise water stored in the temporary ditches; ▪ Clean water upstream of the cleared and construction areas must be diverted around the site to nearby water courses. The diversion canals must be sized to accommodate a 1:50 year rainfall event; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas.	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)	▪ During the construction phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Fauna and flora	Construction Phase	Site specific	▪ Limit degradation and destruction of the natural environment to the designated RTSF complex footprint and immediate surrounds; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Demarcate and avoid sensitive landscapes, such as riparian and wetland areas that were encountered to the east of the RTSF complex; ▪ Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ During the construction phase
		Construction Phase Operational Phase	Site specific	▪ Eradicate alien invasive vegetation and implement an Alien Invasive Management Plan.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ Prior to the commencement of the activity and for the duration of the project life.
	Aquatic ecology	Construction Phase	Footprint area	▪ Establish riparian buffers, where possible, up to 500m (minimum 100m) from the Leeuspruit; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff; and ▪ Construction sequencing is proposed, where possible.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase
	Wetlands	Construction	42.9 ha	▪ Implement a wetland offset strategy.	▪ SANBI in collaboration with the DWS Report on “Wetland offsets: a Best Practice Guideline for South Africa (Macfarlane, *et al*., 2014)	▪ Prior to and during construction phase.
	Visual	Construction Phase Operational Phase	Maximum visual disturbance of 12 km	▪ Only remove vegetation for the areas under immediate construction of the RTSF; and ▪ Establish vegetation screens surrounding the RTSF and, where permitted, along public roads from which the RTSF is visible.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During construction phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint area	▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
	Heritage resources	Construction Phase	Site specific	▪ BGGC as regulated by Section 36 of the NHRA and Chapter XI of the Regulations to the Act must be implemented; ▪ Identify bona fide next of kin, as far as possible; ▪ Reach agreement with next of kin as to the appropriate management of the burial ground or grave either through a CMP or if required, GRP.	▪ Burial grounds and graves are protected under Section 36 of the NHRA; and ▪ The BGGC process is regulated by Chapter XI of the Regulations to the NHRA.	▪ Prior to the site clearing activities associated with the construction phase.
	Heritage resources	Construction Phase	Site specific	▪ Apply for Section 34 destruction permits for structure older than 60 years.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).	▪ Prior to the site clearing activities associated with the construction phase.
CPP	Air quality	Construction Phase	Local	▪ Application of wetting agents or dust suppressant on exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to the commencement of the activity and for the duration of the project life.
	Soils	Construction Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; ▪ Ensure storm water management designs are in place; and ▪ Soils are to be stripped as per the stripping guidelines and stockpiles are to be maintained in an erosion free state and vegetated, as per the Rehabilitation plan.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ During the construction phase and stockpile management to be implemented throughout life of mine.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Surface water	Construction Phase	Municipal Area	▪ Temporary ditches must be constructed down-gradient of the cleared areas; ▪ Utilise water stored in the temporary ditches; ▪ Clean water upstream of the cleared and construction areas must be diverted around the site to nearby water courses. The diversion canals must be sized to accommodate a 1:50 year rainfall event; and ▪ All dirty water channels must be constructed and placed within the dirty water infrastructure areas.	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)	▪ During the construction phase
	Fauna and flora	Construction Phase	Site specific	▪ Limit degradation and destruction of the natural environment to the designated CPP footprint and immediate surrounds; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ During the construction phase
		Construction Phase Operational Phase	Site specific	▪ Eradicate alien invasive vegetation and implement an Alien Invasive Management Plan.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ Prior to the commencement of the activity and for the duration of the project life.
	Aquatic ecology	Construction Phase	Footprint area	▪ Establish riparian buffers, where possible, up to 500m (minimum 100m) from the Leeuspruit; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff; and ▪ Construction sequencing is proposed, where possible.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Wetlands	Construction	10.7 ha	▪ Implement a wetland offset strategy.	▪ SANBI in collaboration with the DWS Report on "Wetland offsets: a Best Practice Guideline for South Africa (Macfarlane, *et al*., 2014)	▪ Prior to and during construction phase.
	Visual	Construction Phase	Maximum visual disturbance of 4 km	▪ Establish vegetation screens adjacent to the CPP and, where permitted, along public roads from which the CPP is visible; ▪ Infrastructure must be painted natural hues to blend into the surrounding landscape; ▪ Pylons and metal structures must be galvanised to weather to a matt grey finish or painted with a matt finish; and ▪ Down lighting must be used for activities undertaken at night.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During construction phase
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint area	▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
	Heritage resources	Construction Phase	Site specific	▪ Apply for Section 34 destruction permits for structure older than 60 years.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).	▪ Prior to the site clearing activities associated with the construction phase.
	Traffic	Construction Phase	Local	▪ Make use of points-men at the N12 and D671 intersection and D671 and Kloof Mine access intersection; and ▪ Engage with the planning authorities concerning the maintenance and upgrading of public roads in proximity to the CPP.	▪ N/A	▪ Throughout the project life.
Pipelines and Roads	Air quality	Construction Phase	Local	▪ Application of wetting agents or dust suppressant on the dirt roads and exposed surfaces; ▪ The area of disturbance must be kept to a minimum; ▪ Minimise drop heights when loading and offloading construction materials; and ▪ Reduce vehicle travel speed and distances.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to the commencement of the activity and for the duration of the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Soils	Construction Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ Ensure storm water management designs are in place.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Surface water	Construction Phase	N/A	▪ Pipeline routes will be located above the 1:100 year modelled floodline elevation.	▪ GN R704 of the National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase
	Fauna and flora	Construction Phase	Site specific	▪ Limit degradation and destruction of the natural environment to the pipeline routes footprint and immediate surrounds; ▪ Re-vegetate open areas to limit erosion, which will also aid in water infiltration and flood attenuation; ▪ Demarcate and avoid sensitive landscapes, such as riparian and wetland areas; ▪ Manage nationally restricted alien invasive vegetation by ensuring disturbed areas are rehabilitated one week from the conclusion of construction activities to prevent the establishment of alien invasive vegetation.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ During the construction phase
		Construction Phase Operational Phase	Site specific	▪ Eradicate alien invasive vegetation and implement an Alien Invasive Management Plan.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ Prior to the commencement of the activity and for the duration of the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Aquatic ecology	Construction Phase	Footprint area	▪ Establish riparian buffers, where possible, up to 500m (minimum 100m) from the Leeuspruit and Loopspruit; ▪ No crossings should take place over riffle/rapid habitats as these are the most sensitive; slow deep/shallow habitats should be favoured; ▪ Pipelines that cross water courses should be incorporated into a bridge or culvert design if possible; ▪ Erosion prevention mechanisms must be employed to ensure the sustainability of all structures to prevent instream sedimentation; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of disturbed areas from construction activities as soon as possible; ▪ Minimise vegetation removal to infrastructure footprint. Clearing and grading should only occur where absolutely necessary; ▪ Diversion trenches and berms should convey dirty water to temporary ditches so as to contain runoff; and ▪ Construction sequencing is proposed, where possible.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During construction phase
	Visual	Construction Phase	Immediate surrounds	▪ Vegetation must only be removed from the pipeline routes or areas necessary for the construction of the pipeline; ▪ Establish vegetation on disturbed areas following construction; and ▪ Down lighting must be used should construction take place during night time.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During construction phase
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ As far as possible, restrict construction activities to daylight hours. Where construction activities extend beyond daylight hours, affected parties must be duly and timeously informed; ▪ Construction machinery and vehicles must be serviced to the designed requirements of the machinery/vehicles to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Heritage resources	Construction Phase	Site specific	▪ BGGC as regulated by Section 36 of the NHRA and Chapter XI of the Regulations to the Act must be implemented; ▪ Identify bona fide next of kin, as far as possible; ▪ Reach agreement with next of kin as to the appropriate management of the burial ground or grave either through a CMP or if required, GRP.	▪ Burial grounds and graves are protected under Section 36 of the NHRA; and ▪ The BGGC process is regulated by Chapter XI of the Regulations to the NHRA.	▪ Prior to the site clearing activities associated with the construction phase.
Employment and Procurement	Socio-economic	Construction Phase Operational Phase	Municipal	▪ Use labour-intensive construction methods, where feasible, to increase employment opportunities; ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Where feasible, reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be National Qualifications Framework (NQF) accredited; ▪ Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes ;and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Socio-economic	Construction Phase Operational Phase	Municipal	▪ Where feasible, utilise existing SLP, LED and related stakeholder engagement processes to determine the need and viability for infrastructure and service-related projects; ▪ Supporting housing development through promoting house ownership for employees; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Local labour, local construction contractors and local and small businesses should be prioritised; ▪ Identify students from local schools to participate in company bursaries and internship programmes; ▪ Continued assessment of projected IDP and LED initiatives of the local municipalities to ensure that the Social and Labour Plan commitments remain relevant and appropriate; and ▪ Communicate corporate social investment to the local communities to manage community expectations regarding infrastructure and services to be provided by SGL.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.
	Socio-economic	Construction Phase Operational Phase	Municipal	▪ Involve community structures to assist in communicating labour requirements and other mine related aspects to the communities; ▪ SGL must liaise with the municipalities to ensure expected population influx is taken into account for infrastructure development and planning; ▪ Promote development projects, such as low cost housing, by including such developments in the Social and Labour Plan and LED programmes; ▪ Implement an HIV/AIDS and alcohol abuse awareness campaigns in the communities and include such campaigns as a condition of contract for suppliers and sub-contractors; ▪ A VCT programme must be introduced for all employees for the WRTRP; ▪ Access control to operational areas must be implemented to prevent sex workers and petty traders from loitering near construction camps and operational areas; ▪ Construction and operational personnel must be dressed in uniform to clearly identify non-employed personnel from entering restricted areas; ▪ Liaison structures and forums that are already in	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ SPLUMA, 2013 (Act No. 16 of 2013).	▪ Prior to construction and through operation.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
				place, such as the community police forum, must be strengthened with the local police to monitor social changes in crime patterns; and ▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities.		
	Socio-economic	Construction Phase	Municipal	▪ The sales agreement must reflect the full value of the land and must consider the potential relocation cost of commercial farms and business operations; ▪ The responsibility for the resettlement of vulnerable households and compensation must be agreed upon prior to the finalisation of the sales agreement. Should SGL be responsible, a Resettlement Action Plan must be developed in consultation with the affected households; and ▪ An exclusion zone must be established from the RTSF where no households will be allowed.	▪ Constitution of South Africa; and ▪ King Report on Corporate Governance for South Africa, 2009.	▪ Prior to construction.
Operational Phase						
Water Abstraction from K10 Shaft	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ Pump stations to be housed in noise attenuating enclosures; ▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
RTSF Complex	Air quality	Operational Phase	Local and immediate surroundings	▪ Vegetation of side walls; ▪ Cladding of side walls with stone; and ▪ Application of wetting agents or dust suppressant on exposed surfaces.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); and ▪ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005.	▪ Prior to the commencement of the activity and for the duration of the project life.
	Groundwater	Operational Phase Decommissioning Phase Post Closure	1.5 km radius from the blast curtain	▪ Monitoring of groundwater levels as per the monitoring plan; and ▪ Farmers that are impacted due to dewatering activities should be compensated.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Groundwater	Operational Phase Decommissioning Phase Post Closure	1 600 ha	▪ Implementation of a blast curtain to restrict the migration of the contamination plume; ▪ Groundwater quality and water levels must be monitored on a quarterly basis; and ▪ Farmers must be compensated for impacted groundwater that extends beyond the blast curtain.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.
	Groundwater	Operational Phase	Immediate surroundings	▪ A liner must be implemented for the RWD; and ▪ Groundwater quality and water levels must be monitored on a quarterly basis;	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.
	Soils	Operational Phase	Immediate surroundings	▪ Implement wind breaks surrounding the RTSF; ▪ Monitor the RTSF side walls for vegetation establishment and erosion potential; and ▪ Ensure storm water management designs are in place.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Fauna and flora	Operational Phase	Immediate surroundings	▪ Vegetate the side walls of the RTSF during its operation; and ▪ Monitor surrounding vegetation to assess potential impacts from windblown tailings material.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.	▪ Throughout operational phase
	Aquatic ecology	Operational Phase	Local municipal area	▪ Silt traps placed within clean water return channels; ▪ The planting of indigenous trees around the RTSF and RWD; and ▪ The implantation of mitigation measures provided for surface water and groundwater for the operation of the RTSF.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ Throughout operational phase
	Aquatic ecology	Operational Phase	Local municipal area	▪ Energy dissipation should occur at the site to slow water flow and control erosion; ▪ Silt collection should take place to avoid siltation in the river system; ▪ The discharge point should be stabilised and be able to withstand a 1:100 flood event; and ▪ Discharge should not allow for the creation of pools and should flow freely downstream.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ Throughout operational phase
	Wetlands	Operational Phase	Footprint area and immediate surroundings	▪ The RTSF footprint must be fully contained and have no contact with the surrounding environment, especially the Leeuspruit River and tributaries. This is of particular relevance to storm water control; ▪ Vegetation of RTSF side walls; ▪ Application of wetting agents or dust suppressant on exposed surfaces; and ▪ Cladding of side walls with stone.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Throughout operational phase

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
		Operational Phase	Downstream of the Leeuspruit	▪ Energy dissipation designs must be designed and implemented at the discharge point of the treated water; ▪ Erosion hotspots must be identified along the Leeuspruit for up to 3 km downstream of the proposed discharge point. Erosion hotspots must be rehabilitated and erosion control implemented; and ▪ Erosion hotspots must be monitored on an annual basis.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ Prior to discharge and annually throughout operation.
	Visual	Construction Phase Operational Phase	Maximum visual disturbance of 12 km	▪ Establish and maintain vegetation screens surrounding the RTSF and, where permitted, along public roads from which the RTSF is visible; and ▪ Concurrent rehabilitation of the side slopes of the RTSF must be undertaken and vegetation must be established.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ Throughout the project life.
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ Pump stations to be housed in noise attenuating enclosures; ▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
	Radiological	Operational Phase Decommissioning Phase Post Closure	Local	▪ The RTSF must be managed and operated within the Radiation Management Programme for CoR-70 and must be approved by the NNR.	▪ National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).	▪ Throughout the project life.
CPP	Air quality	Operational Phase	Provincial	▪ Installation of gas scrubbers; ▪ Installation of electrostatic precipitators; and ▪ Installation of fabric filters.	▪ Listed Activities and Associated Minimum Emission Standard (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); ▪ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005; and	▪ Prior to the commencement of the activity and for the duration of the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ Pump stations to be housed in noise attenuating enclosures; ▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry; ▪ Equipment and machinery must be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
Pipelines and Roads	Soils	Operational Phase	Immediate surroundings	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; and ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint Area	▪ Regular service maintenance on the pipelines to mitigate water hammer noise as well as maintaining a constant flow rate during pumping of water and slurry.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Employment and Procurement	Socio-economic	Construction Phase Operational Phase	Municipal Area	▪ Clearly define and publicise recruitment policies and the nature and number of available jobs with specific focus on the local communities; ▪ Local labour and local and small businesses should be prioritised; ▪ Where feasible, reserve a percentage of, and promote employment opportunities for woman and the youth; ▪ Ensure that contractors comply with SGL's employment policies and Social and Labour Plan commitments; ▪ Coordinate recruitment through the Department of Labour and/or bona fide recruitment agencies; ▪ Undertake a skills survey and establish a database to identify core skills required and suitable candidates. Skills development and training programmes must be structured around the findings of the skills survey. Training should aim to be NQF accredited; ▪ Utilise existing SGL programmes and initiatives to identify students from local schools to participate in company bursaries and internship programmes; and ▪ Include local procurement targets in the WRTRP procurement policy and contractor agreements. Preferential procurement in accordance with Broad-Based Black Economic Empowerment and the Mining Charter must be ensured.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).	▪ Prior to construction and through operation.
Decommissioning Phase						
RTSF Complex	Air quality	Decommissioning Phase	Local and immediate surroundings	▪ Application of wetting agents or dust suppressant on exposed areas; ▪ The area of disturbance must be kept to a minimum; and ▪ The RTSF must be capped and vegetated.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to, and for one quarter following, decommissioning.
	Visual	Decommissioning Phase	Maximum visual disturbance of 12 km	▪ Establish vegetation on the side walls of the RTSF; and ▪ Cap and establish vegetation on the top of the RTSF.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning.
	Noise	Decommissioning Phase	Footprint Areas	▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
CPP	Air quality	Decommissioning Phase	Local	▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading rubble should be minimised; and ▪ Demolition activities must not be conducted on days when the wind speed is greater than 5.4 m/s.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to, and for one quarter following, decommissioning.
	Soils	Decommissioning Phase	Site specific	▪ Soil handling and rehabilitation must be undertaken as outlined in the Rehabilitation Plan.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Aquatic ecology	Decommissioning Phase	Footprint area	▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of CPP footprint as soon as possible; ▪ Soils adjacent the river that has been compacted must be ripped to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase
	Wetlands	Decommissioning Phase	Downstream wetlands	▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The CPP footprint must be rehabilitated according to the Rehabilitation Plan; and ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ During decommissioning phase
	Visual	Decommissioning Phase	Immediate surrounds	▪ The CPP and pipelines and roads footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning phase
	Noise	Decommissioning Phase	Footprint area	▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.
Pipelines and Roads	Air quality	Decommissioning Phase	Local	▪ The area of disturbance must be kept to a minimum; ▪ Drop heights when loading rubble should be minimised; and ▪ Demolition activities must not be conducted on days when the wind speed is greater than 5.4 m/s.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).	▪ Prior to, and for one quarter following, decommissioning.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
	Soils	Decommissioning Phase	Site specific	▪ Corrective actions, such as erosion berms and sourcing and replacement of topsoil, must be undertaken if any erosion occurs; ▪ Only the designated access routes must be utilised to reduce any unnecessary compaction, and compacted areas must be ripped to loosen the soil structure; and ▪ The pipeline routes and roads must be rehabilitated and vegetation established.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.	▪ Throughout project life.
	Aquatic ecology	Decommissioning Phase	Footprint area	▪ Establish riparian buffers, where possible; ▪ Silt traps placed within clean water return channels; ▪ Re-vegetation of pipelines and road footprints as soon as possible; ▪ Soils adjacent the river that has been compacted must be ripped to allow for vegetation establishment; and ▪ Vegetation establishment must be monitored.	▪ National Water Act, 1998 (Act No. 36 of 1998)	▪ During decommissioning phase
	Wetlands	Decommissioning Phase	Surrounding and downstream wetlands	▪ Storm water management must be put in place to prevent run-off of any pollutants; ▪ The pipelines and roads footprints must be rehabilitated according to the Rehabilitation Plan; and ▪ Pipelines must be flushed clean and rendered safe before decommissioning and removal.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.	▪ During decommissioning phase
	Visual	Decommissioning Phase	Immediate surrounds	▪ The CPP and pipelines and roads footprints must be rehabilitated according to the Rehabilitation and Closure Plans; ▪ Ensure that the footprints are contoured and profiled to ensure a free-draining topography; and ▪ Remove all infrastructure and rubble from site.	▪ N/A. There are no legal requirements for visual impacts in South Africa.	▪ During decommissioning phase
	Noise	Construction Phase Operational Phase Decommissioning Phase	Footprint area	▪ Restricting decommissioning activities to daylight hours; ▪ Decommissioning related machines and vehicles to be serviced to the designed requirements to ensure noise suppression mechanisms are effective e.g. installed exhaust mufflers; and ▪ Switching off equipment when not in use.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.	▪ Throughout the project life.

Activities	Aspects Affected	Phase	Size and scale of disturbance	Mitigation Measures	Compliance with standards	Time period for implementation
Employment and Procurement	Socio-economic	Decommissioning Phase	Municipal area	▪ Develop a Closure Plan 15 years prior to planned closure and review the Closure Plan every 5 years; ▪ Establish a Future Forum, should it not already be established, to promote on-going discussions between SGL and the mine's workforce; ▪ Liaise with the Department of Labour for the utilisation of its resources and support services once retrenchments take place; ▪ Provide financial life skills to employees and ensure employees are trained in alternative skills; and ▪ Inform affected areas, such as the local municipality and labour sending areas, of planned retrenchments.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002).	▪ 15 years prior to decommissioning.
Post Closure						
RTSF Complex	Groundwater	Operational Phase Decommissioning Phase Post Closure	Dewatering cone (Plan 33)	▪ Monitoring of groundwater levels as per the monitoring plan; and ▪ Farmers that are impacted due to dewatering activities should be compensated.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.
	Groundwater	Operational Phase Decommissioning Phase Post Closure	1 600 ha	▪ Implementation of a blast curtain to restrict the migration of the contamination plume; ▪ Groundwater quality and water levels must be monitored on a quarterly basis; and ▪ Farmers must be compensated for impacted groundwater that extends beyond the blast curtain.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.
	Surface Water	Operational Phase Decommissioning Phase Post Closure	Local	▪ Monitoring of the Leeuspruit flow rates, up and down gradient of the RTSF; ▪ Re-introduce treated water from the AWTF into the Leeuspruit.	▪ National Water Act, 1998 (act No. 36 of 1998)	▪ Prior to the commencement of the activity and for the duration of the project life.

6 Item 1(e): Impact Management Outcomes

A description of the objectives and outcomes of the EMP is outlined in Table 6-1, taking into account the impact and mitigation type.

Table 6-1: Impact Management Outcomes

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
Construction Phase					
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Reduction in water levels associated with the establishment of the blast curtain.	Groundwater	Construction Phase	Monitor and manage through: ▪ Groundwater level monitoring.	To manage the cone of depression due to dewatering activities.
	Loss of topsoil as a resource	Soils	Construction Phase	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Loss of land capability	Soils and land capability	Construction Phase	N/A	N/A
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Manage through: ▪ Storm Water Management Plan.	To prevent the sedimentation of water resources and ensure compliance with GN R704 and BRG 1 of the National Water Act, 1998 (Act No. 36 of 1998)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To limit the loss of vegetation and faunal habitat according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Manage through: ▪ Alien Invasive Management Plan	To prevent the establishment and manage alien invasive vegetation according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	Compensate through: ▪ Wetland offset strategy	To compensate for the destruction and loss of wetlands in the catchment.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To minimise the visual impact on the landscape.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Construction Phase	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	To ensure compliance with Section 36 of the NHRA and avoid damage to graves.
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Manage through: ▪ Section 34 destruction permit	To ensure compliance with Section 34 of the NHRA.
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource	Soils	Construction Phase	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Loss of land capability	Soils and land capability	Construction Phase	N/A	To prevent the loss of topsoil resources.
	Sedimentation and deterioration of surface water quality	Surface water	Construction Phase	Manage through: ▪ Storm Water Management Plan.	To prevent the sedimentation of water resources and ensure compliance with GN R704 and BRG 1 of the National Water Act, 1998 (Act No. 36 of 1998)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To limit the loss of vegetation and faunal habitat according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Manage through: ▪ Alien Invasive Management Plan	To prevent the establishment and manage alien invasive vegetation according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Destruction of habitats and loss of ecosystem services	Wetlands	Construction Phase	Compensate through: ▪ Wetland offset strategy Remedy through: ▪ Rehabilitation Plan.	To compensate for the loss and destruction of wetlands.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Manage through: ▪ Vegetation screens. ▪ Infrastructure finishes.	To minimise the visual impact on the landscape.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Construction Phase	Manage through: ▪ Section 34 destruction permit	To ensure compliance with Section 34 of the NHRA.
	Increased delays due to vehicle traffic	Traffic	Construction Phase	Manage through: ▪ Planning authority consultation	To minimise potential vehicle delays at utilised intersections.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Construction Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource	Soils	Construction Phase	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Construction Phase	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To limit the loss of vegetation and faunal habitat according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Establishment of alien invasive vegetation	Fauna and Flora	Construction Phase Operational Phase	Manage through: ▪ Alien Invasive Management Plan	To prevent the establishment and manage alien invasive vegetation according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Construction Phase	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	To maintain the PES of the aquatic ecosystems and habitats.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	To minimise the visual impact on the landscape.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Construction Phase	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	To ensure compliance with Section 36 of the NHRA and avoid damage to graves.
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Direct investment and multiplier effect.	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Population influx and associated impacts	Socio-economic	Construction Phase Operational Phase	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	To manage potential impacts associated with population influx.
	Physical and economic displacement	Socio-economic	Construction Phase	Manage and remedy through: ▪ Sales agreement. ▪ Exclusion zones.	To ensure that compensation is received for physical and economic displacement impacts.
Operational Phase					
Water Abstraction from K10 Shaft	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
	Desiccation of wetlands along the Wonderfonteinspruit	Wetlands	Operational Phase	N/A	N/A
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Operational Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Contamination of groundwater from RTSF seepage	Groundwater	Operational Phase Decommissioning Phase Post Closure	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	Ensure compliance with the SANS 241:2011 drinking water standards and limitation of the contamination plume to 1 600 ha.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Contamination of groundwater from RWD seepage	Groundwater	Operational Phase	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	Ensure compliance with the SANS 241:2011 drinking water standards and limitation of the contamination plume to 1 600 ha.
	Reduction in water levels associated with the establishment of the blast curtain.	Groundwater	Construction Phase	Monitor and manage through: ▪ Groundwater level monitoring. ▪ Compensation plan.	Limit the dewatering cone and provide compensation to affected landowners.
	Contamination and deterioration of soils	Soils	Operational Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	To prevent the loss of topsoil resources.
	Improvement of water quality in the Leeuspruit due to discharge of treated water.	Surface water	Operational Phase	Monitor and manage through: ▪ Water quality from AWTF.	To improve the water quality and ensure compliance with GN R704 and BRG 1 of the National Water Act, 1998 (Act No. 36 of 1998)
	Loss of vegetation, habitat and biodiversity	Fauna and flora	Operational Phase	Monitor and manage through: ▪ Vegetation of side walls of RTSF.	To limit the loss of vegetation and faunal habitat according to the National Environmental Management Biodiversity Act, 2004 (Act No. 10 of 2004)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Operational Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	To maintain the PES of the aquatic ecosystems and habitats.
	Modification of instream habitat	Aquatic ecology	Operational Phase	Manage and enhance through: ▪ Energy dissipation and silt collection.	To maintain the PES of the aquatic ecosystems and habitats.
	Contamination and sedimentation of wetlands	Wetlands	Operational Phase	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	To maintain the PES and EIS of the wetland habitats.
	Loss of water quantity	Wetlands	Operational Phase	N/A	N/A
	Wetland sedimentation and increased saturation due to water discharge	Wetlands	Construction Phase Operational Phase	Manage and enhance through: ▪ Energy dissipation and erosion management.	To maintain the PES and EIS of the wetland habitats.
	Visual intrusion on the landscape	Visual	Construction Phase Operational Phase	▪ Manage remedy through: ▪ Vegetation screens. ▪ Concurrent rehabilitation.	To prevent the loss of topsoil resources.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Radiation impacts to environment and public	Radiological	Operational Phase Decommissioning Phase Post Closure	Manage through: ▪ Radiation Management Programme for CoR-70; and ▪ NNR approval.	To comply with the NNRA and prevent radiological impacts.
CPP	Reduction in air quality due to stack emissions	Air quality	Operational Phase	Manage through: ▪ Installation and maintenance of scrubbers, precipitators and filters.	To minimise stack emissions and to ensure compliance with Listed Activities and Associated Minimum Emission Standard, 2013.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Pipelines and Roads	Soil compaction and erosion	Soils	Operational Phase	Manage through: ▪ Erosion control. ▪ Site access restriction.	To prevent the loss of topsoil resources.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Construction Phase Operational Phase	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	To enhance the positive impacts associated with the project to benefit the local communities and economy.
	Contribution to country's economy	Socio-economic	Operational Phase	N/A	To enhance the positive impacts associated with the project to benefit the local communities and economy.
Decommissioning Phase					
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To maintain the PES and EIS of the surrounding wetlands.
	Visual intrusion on the landscape	Visual	Decommissioning Phase	Manage through: ▪ Rehabilitation Plan.	To minimise the visual impact on the landscape.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Generation of noise	Noise	Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	To maintain the PES of the aquatic ecosystems and habitats.
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To maintain the PES and EIS of the wetland habitats.
	Visual intrusion on the landscape	Visual	Decommissioning Phase	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	To minimise the visual impact on the landscape.
	Generation of noise	Noise	Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Decommissioning Phase	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	To minimise dust emissions and to ensure compliance with National Dust Control Regulations (2013).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Decommissioning Phase	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	To prevent the loss of topsoil resources.

Activities	Potential impacts	Aspects affected	Phase	Mitigation type	Standard to be achieved
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Decommissioning Phase	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	To maintain the PES of the aquatic ecosystems and habitats.
	Degradation of habitats and loss of ecosystem services	Wetlands	Decommissioning Phase	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	To maintain the PES and EIS of the wetland habitats.
	Visual intrusion on the landscape	Visual	Decommissioning Phase	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	To minimise the visual impact on the landscape.
	Generation of noise	Noise	Construction Phase Operational Phase Decommissioning Phase	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	To limit noise generation to comply with the Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989) and SANS 10103:2008.
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Decommissioning Phase	Manage through: ▪ Closure Plan. ▪ Future Forum.	Ensure retrenchment is undertaken in accordance with the Social and Labour Plan and the requirements of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002).
Post-Closure					
RTSF Complex	Contamination of groundwater from RTSF seepage	Groundwater	Post Closure	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan.	Ensure compliance with the SANS 241:2011 drinking water standards and limitation of the contamination plume to 1 600 ha.
	Depletion of the Leeuspruit and its tributaries.	Surface Water	Post Closure	Manage and prevent through: ▪ Flow monitoring. ▪ Discharge of treated water	To ensure potential impacts to the Leeuspruit and its tributaries are offset through the discharge of treated water from the AWTF.

7 Item 1(f): Impact Management Actions

A description of impact management actions, identifying the manner in which the impact management objectives and outcomes referenced in Sections 5 and 6 will be achieved, is provided in Table 7-1.

Table 7-1: Impact Management Actions

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
			Construction Phase		
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Reduction in water levels associated with the establishment of the blast curtain.	Groundwater	Monitor and manage through: ▪ Groundwater level monitoring.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)
	Loss of topsoil as a resource	Soils	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ During the construction phase	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Loss of land capability	Soils and land capability	N/A	N/A	N/A
	Sedimentation and deterioration of surface water quality	Surface water	Manage through: ▪ Storm Water Management Plan.	▪ During the construction phase	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During the construction phase	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Establishment of alien invasive vegetation	Fauna and Flora	Manage through: ▪ Alien Invasive Management Plan	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	▪ During construction phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Destruction of habitats and loss of ecosystem services	Wetlands	Compensate through: ▪ Wetland offset strategy	▪ Prior to and during construction phase.	▪ SANBI in collaboration with the DWS Report on "Wetland offsets: a Best Practice Guideline for South Africa (Macfarlane, et al., 2014)
	Visual intrusion on the landscape	Visual	Manage through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During construction phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	▪ Prior to the site clearing activities associated with the construction phase.	▪ Burial grounds and graves are protected under Section 36 of the NHRA; and ▪ The BGGC process is regulated by Chapter XI of the Regulations to the NHRA.
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Manage through: ▪ Section 34 destruction permit	▪ Prior to the site clearing activities associated with the construction phase.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Loss of topsoil as a resource	Soils	Manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ During the construction phase and stockpile management to be implemented throughout life of mine.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Loss of land capability	Soils and land capability	N/A	▪ During the construction phase	▪ GN R704 of the National Water Act, 1998 (act No. 36 of 1998)
	Sedimentation and deterioration of surface water quality	Surface water	Manage through: ▪ Storm Water Management Plan.	▪ During the construction phase	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Establishment of alien invasive vegetation	Fauna and Flora	Manage through: ▪ Alien Invasive Management Plan	▪ During construction phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	▪ Prior to and during construction phase.	▪ SANBI in collaboration with the DWS Report on “Wetland offsets: a Best Practice Guideline for South Africa (Macfarlane, et al., 2014)

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Destruction of habitats and loss of ecosystem services	Wetlands	Compensate through: ▪ Wetland offset strategy Remedy through: ▪ Rehabilitation Plan.	▪ During construction phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Visual intrusion on the landscape	Visual	Manage through: ▪ Vegetation screens. ▪ Infrastructure finishes.	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Prior to the site clearing activities associated with the construction phase.	▪ Structures older than 60 years are protected under section 34 of the NHRA. Section 34 Permit Applications are regulated under Chapter III of the Regulations to the Act (GNR 548).
	Destruction and damage to structures older than 60 years of negligible cultural significance	Heritage resources	Manage through: ▪ Section 34 destruction permit	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Increased delays due to vehicle traffic	Traffic	Manage through: ▪ Planning authority consultation	▪ Throughout project life.	▪ N/A
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Loss of topsoil as a resource	Soils	Manage through: ▪ Erosion control and storm water management. ▪ Remedy through: ▪ Rehabilitation Plan.	▪ During construction phase	▪ GN R704 of the National Water Act, 1998 (Act No. 36 of 1998)

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Direct loss of vegetation, habitat and biodiversity	Fauna and Flora	Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During the construction phase	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Establishment of alien invasive vegetation	Fauna and Flora	Manage through: ▪ Alien Invasive Management Plan	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Manage through: ▪ Implementation of buffer zones. ▪ Erosion control and storm water management.	▪ During construction phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Visual intrusion on the landscape	Visual	▪ Manage remedy through: ▪ Footprint reduction and limitation. ▪ Vegetation establishment.	▪ During construction phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Destruction and damage to burial grounds and graves of very high cultural significance	Heritage resources	Manage and remedy through: ▪ Conservation Management Plan. ▪ Grave Relocation Plan.	▪ Prior to the site clearing activities associated with the construction phase.	▪ Burial grounds and graves are protected under Section 36 of the NHRA; and ▪ The BGGC process is regulated by Chapter XI of the Regulations to the NHRA.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
Employment and Procurement	Job creation, procurement of goods and services and skills upliftment	Socio-economic	Enhance through: ▪ Labour intensive methods. ▪ Skills survey and training programmes. ▪ Procurement policy	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Direct investment and multiplier effect.	Socio-economic	Enhance through: ▪ LED initiatives. ▪ Social and Labour Plan.	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Population influx and associated impacts	Socio-economic	Manage and prevent through: ▪ Awareness campaigns. ▪ Social and Labour Plan and LED Programmes. ▪ VCT Campaigns.	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ SPLUMA, 2013 (Act No. 16 of 2013).
	Physical and economic displacement	Socio-economic	Manage and remedy through: ▪ Sales agreement. ▪ Exclusion zones.	▪ Prior to construction.	▪ Constitution of South Africa; and ▪ King Report on Corporate Governance for South Africa, 2009.
Operational Phase					
Water Abstraction from K10 Shaft	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Desiccation of wetlands along the Wonderfonteinspruit	Wetlands	N/A	N/A	N/A
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); and ▪ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Contamination of groundwater from RTSF seepage	Groundwater	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)
	Contamination of groundwater from RWD seepage	Groundwater	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan..	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)
	Reduction in water levels associated with the establishment of the blast curtain.	Groundwater	Monitor and manage through: ▪ Groundwater level monitoring. ▪ Compensation plan.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)
	Contamination and deterioration of soils	Soils	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Improvement of water quality in the Leeuspruit due to discharge of treated water.	Surface water	Monitor and manage through: ▪ Water quality from AWTF.	▪ Throughout project life.	▪ SANS 241:2011 Drinking Water Standards
	Loss of vegetation, habitat and biodiversity	Fauna and flora	Monitor and manage through: ▪ Vegetation of side walls of RTSF.	▪ Throughout operational phase	▪ South African National Biodiversity Institute Red List of South African Plants, 2012.1; ▪ National Environmental Management: Biodiversity Act, 2004 (Act No. 10 of 2004) listed species; ▪ National Forests Act, 1998 (Act No. 84 of 1998) Protected Trees; and ▪ Gauteng Protected Plants.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Vegetation establishment.	▪ Throughout operational phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Modification of instream habitat	Aquatic ecology	Manage and enhance through: ▪ Energy dissipation and silt collection.	▪ Throughout operational phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Contamination and sedimentation of wetlands	Wetlands	Monitor and manage through: ▪ Erosion control and storm water management. ▪ Dust Management Plan. ▪ Dust monitoring programme. ▪ Concurrent rehabilitation.	▪ Throughout operational phase	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Loss of water quantity	Wetlands	N/A	N/A	N/A
	Wetland sedimentation and increased saturation due to water discharge	Wetlands	Manage and enhance through: ▪ Energy dissipation and erosion management.	▪ Prior to discharge and annually throughout operation.	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Manage remedy through: ▪ Vegetation screens. ▪ Concurrent rehabilitation.	▪ Throughout the project life.	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
	Radiation impacts to environment and public	Radiological	Manage through: ▪ Radiation Management Programme for CoR-70; and ▪ NNR approval.	▪ Throughout the project life.	▪ National Nuclear Regulator Act, 1999 (Act No. 47 of 1999).
CPP	Reduction in air quality due to stack emissions	Air quality	Manage through: ▪ Installation and maintenance of scrubbers, precipitators and filters.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ Listed Activities and Associated Minimum Emission Standard (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004); ▪ Ambient Air Quality – Limits for common pollutants, SANS 1929:2005; and
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Pipelines and Roads	Soil compaction and erosion	Soils	Manage through: ▪ Erosion control. ▪ Site access restriction.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Employment and Procurement	Job creation, procurement of goods and services.	Socio-economic	Enhance through: ▪ Skills survey and training programmes. ▪ Procurement policy	▪ Prior to construction and through operation.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002); ▪ Employment Equity Act, 1997 (Act No. 75 of 1997); ▪ Labour Relations Act 1995 (Act No. 66 of 1995); and ▪ Skills Development Act, 1998 (Act No. 97 of 1998).
	Contribution to country's economy	Socio-economic	N/A	N/A	N/A
Decommissioning Phase					
RTSF Complex	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Prior to, and for one quarter following, decommissioning.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Visual intrusion on the landscape	Visual	Manage through: ▪ Rehabilitation Plan.	▪ During decommissioning.	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
CPP	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Prior to, and for one quarter following, decommissioning.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Loss of topsoil as a resource due to compaction and erosion	Soils	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Degradation of habitats and loss of ecosystem services	Wetlands	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.
	Visual intrusion on the landscape	Visual	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	▪ During decommissioning phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Pipelines and Roads	Generation of dust, including TSP, PM_{10} and $PM_{2.5}$, reducing air quality	Air quality	Monitor and manage through: ▪ Dust Management Plan. ▪ Dust monitoring programme.	▪ Prior to, and for one quarter following, decommissioning.	▪ National Dust Control Regulations (2013) of the National Environmental Management: Air Quality Act, 2004 (Act No.39 of 2004).
	Loss of topsoil as a resource due to compaction and erosion	Soils	Manage through: ▪ Erosion control and storm water management. ▪ Site access restriction. Remedy through: ▪ Rehabilitation Plan.	▪ Throughout project life.	▪ Chamber of Mines – Guidelines for the rehabilitation of mined land.
	Reduced aquatic biodiversity and habitat	Aquatic ecology	Monitor and manage through: ▪ Implementation of buffer zone. ▪ Vegetation establishment.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998)
	Degradation of habitats and loss of ecosystem services	Wetlands	Monitor and manage through: ▪ Erosion control and storm water management. Remedy through: ▪ Rehabilitation Plan.	▪ During decommissioning phase	▪ National Water Act, 1998 (Act No. 36 of 1998) ▪ South African National Biodiversity Index.

Activities	Potential impacts	Aspects affected	Mitigation type	Time period for implementation	Compliance with standards
	Visual intrusion on the landscape	Visual	Remedy through: ▪ Rehabilitation Plan. ▪ Contouring of topography.	▪ During decommissioning phase	▪ N/A. There are no legal requirements for visual impacts in South Africa.
	Generation of noise	Noise	Prevent through: ▪ Regular equipment, vehicles and machinery inspections and maintenance	▪ Throughout the project life.	▪ Gauteng Noise Control Regulations (GN R5479:1999) in terms of the Environmental Conservation Act 1989 (Act No. 73 of 1989); and ▪ SANS 10103:2008.
Employment and Procurement	Retrenchment of mine workforce and cumulative impact on local economy	Socio-economic	Manage through: ▪ Closure Plan. ▪ Future Forum.	▪ 15 years prior to decommissioning.	▪ Mineral and Petroleum Resources Development Act, 2002 (Act No. 2002).
Post-Closure					
RTSF Complex	Contamination of groundwater from RTSF seepage	Groundwater	Manage and prevent through: ▪ Implementation of blast curtain ▪ Groundwater quality and quantity monitoring. ▪ Compensation plan.	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)
	Depletion of the Leeuspruit and its tributaries.	Surface Water	Manage and prevent through: ▪ Flow monitoring. ▪ Discharge of treated water	▪ Prior to the commencement of the activity and for the duration of the project life.	▪ National Water Act, 1998 (act No. 36 of 1998)

8 Financial provision

8.1 Item (i)(1): Determination of the Amount of Financial Provision

8.1.1 Item (i)(1)(a): Describe the Closure Objectives and the Extent to which they have been Aligned to the Baseline Environment described under Regulation 22 (2) (d) as described in 2.4 herein

Mine closure aims to achieve long-term site stability and the establishment of a self-sustaining ecosystem which supports the final end land use. The overall rehabilitation and closure objective for the WRTRP is to:

- Remove mining infrastructure that cannot be used by a subsequent land owner or a third party. Where buildings can be used by a third party, arrangements must be made to ensure their long term sustainable use;
- Any proposed post closure developments on old mining land will need to undergo extensive environmental and stability assessments before they can be permitted;
- Implement progressive rehabilitation measures, beginning during the construction phase wherever possible;
- Conducting a radiological field survey to control or stop any action of radon emitting material;
- Leave a safe and stable environment for both humans and animals and make their condition sustainable;
- Follow a process of closure that is progressive and integrated into the mine plans and that will assess the closure impacts proactively at regular intervals throughout project life;
- To prevent any soil and surface/groundwater contamination by managing all water on site;
- Comply with local and national regulatory requirements; and
- To maintain and monitor all rehabilitated areas following re-vegetation and, if monitoring shows that the objectives have been met, making an application for closure.

8.1.2 Item (i)(1)(b): Confirm specifically that the Environmental Objectives in relation to Closure have been consulted with Landowner and Interested and Affected Parties

As part of the PPP, the closure objectives and Rehabilitation Plan have been made available for public review. In addition, consultation with landowners and I&APs was undertaken as part of the Social Impact Assessment and input was requested regarding the environmental objectives in relation to closure.

8.1.3 Item (i)(1)(c): Provide a Rehabilitation Plan that describes and shows the Scale and Aerial Extent of the Main Mining Activities, including the Anticipated Mining Area at the time of Closure

A Rehabilitation Plan has been compiled for the Kloof Mining Right area and the WRTRP and is provided in Appendix R.

8.1.4 Item (i)(1)(d): Explain why it can be Confirmed that the Rehabilitation Plan is compatible with the Closure Objectives

The Rehabilitation Plan has been compiled in support of the primary closure objectives which are to remove unwanted infrastructure and rehabilitate the land to a suitable post-mining land use which provides a safe and stable environment for surrounding receptors and faunal species.

8.1.5 Item (i)(1)(e): Calculate and State the Quantum of the Financial Provision required to Manage and Rehabilitate the Environment in accordance with the Applicable Guideline

The "*Guideline Document for the Evaluation of the Quantum of Closure-Related Financial Provision Provided by a Mine*" was used to assess SGL's environmental liability. The DMR Guideline Document format makes use of a set template for which defined rates and multiplication factors are used.

The infrastructure areas and other areas affected by the mining activities were measured from plans provided by SGL. Measurements that were taken have been standardised to ensure that the costs calculated are easily updatable. The concrete and steel estimates associated with the plants are based on previous experience and assumptions.

The rates used were updated by quotes from demolition and civil contractors and professionals wherever possible. Rate formulation takes into consideration the total labour costs, plant costs, fuel costs and construction costs and provides an accurate, defendable rate.

The closure cost model was compiled in Microsoft Excel. The model consists of an input sheet, containing all measurements of each area of the infrastructure and activities, a standard rate sheet and a summary sheet which summarises the costs for closure. Each sheet is linked to the rate sheet, thereby, allowing the costs calculations to be updated easily from year to year.

The financial provision for the Kloof Mining Right area is R 280 009 667.16, with the unplanned closure cost being R 146 651 567.34, as summarised in Table 8-1.

Table 8-1: Summary of the Closure Cost Liability for the Kloof Mining Right Area

Description	Planned Closure Cost		Unplanned Closure Cost after 10 years		Unplanned Closure Cost after 1 year	
Central Processing Plant	R	57,013,822.86	R	57,013,822.86	R	19,004,607.62
Dams	R	1,088,759.52	R	1,088,759.52	R	1,088,759.52
Linear Infrastructure	R	2,538,491.76	R	2,538,491.76	R	2,538,491.76
RTSF	R	172,308,394.02	R	172,308,394.02	R	77,172,014.32
Total	**R**	**232,949,468.17**	**R**	**232,949,468.17**	**R**	**99,803,873.23**
Monitoring Costs (groundwater)	R	809,750.00	R	809,750.00	R	809,750.00
Monitoring Costs (vegetation)	R	260,797.42	R	260,797.42	R	139,897.42
Maintenance Costs (vegetation)	R	12,055,263.66	R	12,055,263.66	R	6,256,591.14
Cyanide Decontamination	R	1,552,473.00	R	1,552,473.00	R	517,491.00
Radiation Clearance	R	1,110,000.00	R	1,110,000.00	R	1,110,000.00
Project Management (12%)	R	13,976,968.09	R	13,976,968.09	R	7,128,508.85
Contingency (10%)	R	23,294,946.82	R	23,294,946.82	R	11,880,848.08
GRAND TOTAL	**R**	**286,009,667.16**	**R**	**286,009,667.16**	**R**	**146,651,567.34**

8.1.6 Item (i)(1)(f): Confirm that the financial provision will be provided as determined

The applicant, SGL, confirms that the financial provision will be provided for as determined in Section 8.

9 Monitoring Compliance with and Performance Assessment

SGL will be responsible for the implementation of all of the monitoring of mitigation and management measures, as well as compliance with the EMP. The recommended monitoring for the identified impacts is detailed below. SGL will keep a record of all environmental monitoring undertaken as part of the WRTRP. A summary of the environmental monitoring to be undertaken is included in Table 9-3.

9.1 Item 1(g): Monitoring of Impact Management Actions

9.1.1 Air Quality

9.1.1.1 Dust Monitoring Programme

There is an existing dust monitoring networks for the respective Mining Right areas (Driefontein, Ezulwini, Kloof and Cooke) and it is considered that the number of monitoring locations is sufficient for the WRTRP. However, the dust monitoring network does not include the proposed RTSF site. It is recommended that some of the existing monitoring locations are decommissioned, particularly where monitoring locations are in close proximity to each other, and replaced with monitoring locations around the proposed RTSF complex.

There must be a monitoring programme in place to ensure regular review and update of the network and to assess the data collected against regulatory standards. If such data are assessed properly, tailored mitigation measures can be applied to sources that will contain fugitive dust, resulting in reduced risk of damage to property, improved visibility, and reduced impacts on flora and fauna habitats.

9.1.1.2 PM_{10} Monitoring Programme

A PM_{10} monitoring network has been established as part of the Kloof Mine. It is recommended that the PM_{10} monitoring network is expanded, with a minimum of one PM_{10} monitoring site commissioned for each Mining Right area. The monitoring network should be established prior to the commencement of the project to establish ambient PM_{10} levels. The monitoring sites should be located downwind of the activities and at the closest receptors. The monitors must be calibrated on an annual basis to ensure the integrity of the measured data.

9.1.1.3 Gaseous Monitoring Programme

It is recommended that isokinetic sampling of emissions from the different stacks be conducted at least twice a year, once the project commences. The following ground level concentration should be monitored:

- Sulfur dioxide (SO_2);
- Nitrogen dioxide (NO_2);
- Volatile organic compounds (VOCs);
- Carbon monoxide (CO); and
- Carbon dioxide (CO_2).

The proposed ambient monitoring must be a continuous process for the life of the WRTRP to assess the public exposure concentrations at the nearest residential receptors.

9.1.2 Fauna and Flora

The fauna and flora monitoring programme should be initiated prior to construction and continue throughout the construction phase and must be conducted annually during the growing season (December to March). Annual monitoring must be undertaken during the same months each year. Should the monitoring results indicate the additional presence of Red Data species, or threatened species, this may necessitate the need to undergo monitoring for that particular species more frequently, especially during the breeding and birthing seasons for that species.

Monitoring will include sites in the undisturbed vegetation which will act as control plots, plots within the disturbed infrastructure areas which will have baseline data and then be monitored during rehabilitation. The same plots will be monitored with each survey so as to ensure collected data is comparable and trends are identified.

Where rehabilitation is conducted, additional plots will be included to monitor the efficacy of the vegetation establishment. Aspects that will be monitored in the annual surveys will include, species richness, vegetation composition i.e. proportion grasses, forbs and woody species, canopy height, cover percentage, presence of Red Data or protected species, and presence of alien invasive species.

9.1.2.1 Flora

9.1.2.1.1 Vegetation Cover Monitoring

The vegetation cover established on the disturbed areas needs to be monitored annually for the first five years after rehabilitation has been carried out to ensure that the rehabilitation has been successful in terms of stabilising the newly formed surfaces (preventing air and water erosion from affecting those surfaces). In addition, monitoring must ensure that the newly established vegetation cover is trending towards convergence with the original vegetation cover found on the areas prior to disturbance (and on adjacent undisturbed areas) (Dawson, 2007). SGL is currently undertaking biodiversity assessments and has a Biodiversity Management Action Plan in place; these must be extended to include the WRTRP.

Various parameters need to be measured, both on the rehabilitation sites and in the adjacent undisturbed areas, to determine the success or otherwise of the establishment of the rehabilitation vegetation cover and how this compares with the undisturbed vegetation in the area.

These parameters include (Dawson, 2007):

- Presence or absence of plant species;
- Presence or absence of weed species in rehabilitated areas;
- The number of individuals of a species in a given area (density);
- The number of times a species is recorded in a given number of sample points (frequency);
- The area covered by vegetation at ground level (basal cover);
- The biomass of representative sample plots, giving an indication of the mass of living material present above the surface;
- An assessment of the vitality or vigour of the various species present. This can be assessed by measuring factors such as the amount of inflorescences (flowering heads) or seed produced, and the proportion of senescent (dead) material present within the vegetation cover;
- Photographic recording of vegetation appearance, at fixed points, to provide a visual record of appearance and changes over time; and
- Potential climatic influences on local biodiversity, which will be apparent with inclusion of control plots.

This assessment needs to be undertaken by a botanist / environmental scientist trained and experienced in vegetation assessments of this nature (Dawson, 2007).

Vegetation cover of rehabilitated areas should be assessed during the summer growing season, at least a month after rain has fallen (so that there has been an opportunity for fresh plant growth to have occurred). It is recommended that this should be done annually for the first five years. Thereafter, visual spot-checking with photographic recording by an experienced field botanist / rehabilitation practitioner every three years will suffice, depending on results found. Remote sensing information and aerial photos will also be used to determine impacts and management plans. A detailed botanical study should again be undertaken, comparing plots on the rehabilitated areas with plots in the undisturbed adjacent vegetation 20 years post rehabilitation (Dawson, 2007)

The environmental indicators which will demonstrate whether the rehabilitation has been successful or not include:

- Increasing similarity between rehabilitated and undisturbed areas in terms of species composition and vegetation structure;
- Increasing species diversity of desired (local) species in rehabilitation cover over time;
- Reduction in presence of alien invasive vegetation species over time;
- Increase in woody plant growth, and achievement of reproductive status and production of reproductive propagules (seed);
- Ability of the rehabilitation species populations to reproduce, indicated by the presence of seedlings of the rehabilitation species once the original generation has reached sexual maturity (population recruitment);
- Increase in vegetation basal cover and biomass; and
- Increase in soil organic matter.

In the event that the vegetation cover remains static or should deteriorate, additional seeding, with locally harvested species, and possibly fertilisation would be required as a mitigation measure.

9.1.2.1.2 Alien Invasive Vegetation monitoring

During vegetation monitoring, the presence of alien invasive vegetation species should also be detected. The existing SGL active programme of weed management must be expanded for the WRTRP and implemented to control the presence and spread of invasive weeds. Species likely to be problematic include those identified during the fauna and flora study of the site, namely *Datura stramonium* and *D. ferox* and *Opuntia ficus-indica*.

The environmental indicator assessed in this instance is the reduction in presence of alien invasive vegetation species over time, to the point where no alien invasive vegetation species are present and no further population recruitment occurs. The WRTRP must aim to reduce the alien invasive vegetation infestation to zero for all areas considered as part of the operations.

9.1.2.2 Fauna

The fauna monitoring will be closely linked to the flora monitoring to enable solid scientific conclusions and comparisons; in addition, the strong ecological link between vegetation and animals can only be measured if monitoring is similar (e.g. in terms of monitoring points) for both disciplines.

To monitor faunal and floral biodiversity successfully, a solid baseline (pre-construction) will be established through the first round of monitoring. This needs to be supplemented with regular repeats to compile a reasonable comparison between the pre-construction faunal communities present and faunal communities found in the same areas during various stages of construction and operation of the proposed project.

9.1.2.2.1 Mammals

Small mammals will be surveyed by using small mammal live traps and line transects to gather repeatable quantitative data with regards to species richness and population dynamics. Tracks and ecological indicators will be used to assess the presence of larger free-roaming mammals; frequencies of such observations will be used for quantitative comparisons. The nesting sites, burrows and possible home ranges of these species will be recorded, marked, monitored and actively avoided.

All wetland and riverine habitats must be continuously surveyed for the following mammal species:

- Rough-haired golden moles (*Chrysospalax villosus);*
- Spotted-necked otter (*Lutra maculicollis*); and
- African marsh rat (*Dasymys incomtus*).

This must also include any other SSC that has been identified on or near the project area.

9.1.2.2.2 Birds

Line transects will be used to compile quantitative lists of birds present in the areas surveyed; both sounds and visual observations will be used. Nesting sites of threatened birds will be marked and the area preserved with an adequate buffer zone. It is recommended that the more detailed avifaunal monitoring is conducted in the breeding season between October and January.

Surveys for terrestrial birds must be conducted in summer, but only once the vegetation layer has recovered sufficiently from winter fires to allow for assessment of available habitat. Surveys for aquatic birds must also be conducted in summer. For species associated with rivers, the assessment must coincide with average flow conditions (i.e. not dry and not in flood) and preferably within the breeding season. For species associated with wetlands, the assessment must follow good summer rains i.e. standing water must be present and the vegetation must have recovered sufficiently from winter fires to allow for assessment of available habitat.

9.1.2.2.3 Reptiles and Amphibians

Active searches for both reptiles and amphibians will be used to assess species richness of these groups in the area; due to the difficulty in recording occurrence of these groups data gathering will be limited to species counts.

9.1.2.2.4 Invertebrates

Invertebrate biodiversity will be measured by using pitfall trap lines. This method concentrates on ground-living invertebrates; the groups found in pitfall traps are good indicator groups for general biodiversity. Pitfall traps can be repeated exactly and works well in areas where vegetation cover at ground level is low (open habitat) as is found in the study area. In addition sweep net sampling will be conducted to provide an indication of airborne and canopy dwelling species.

9.1.3 Aquatics

An aquatic biomonitoring programme is an essential management tool. The monitoring programme should be designed to enable the detection of potential negative impacts brought about by the proposed project. SGL has an existing biomonitoring programme in place and this will be expanded to take into account the WRTRP.

Aquatic biotas have been proven to be excellent indicators of water quality and ecosystem health. In addition, aquatic biota can detect slight changes in the aquatic environment, which have been shown to be a fluctuating system. Table 9-1 highlights some important aspects to monitor in reference to aquatic biota for the duration of the proposal. Key performance indicators for the aquatic biomonitoring study would be an improvement of SASS5 scores, ASPT values and the increased presence of fish (when compared to this study).

Table 9-1: Aquatic Ecology Monitoring Programme

Location	Monitoring objectives	Frequency of monitoring	Parameters to be monitored
Current sites used in this study will suffice.	Determine if habitat deterioration is occurring.	Bi-annual	Water clarity should not vary between surveys by more than 40%.
Current sites used in this study will suffice.	Determine if water quality deterioration is occurring.	Bi-annual	SASS5 scores should not decrease as a result of the WRTRP (currently impacts are related to sewage/urban runoff).
Site used in this study and the surface water assessment.	Determine if water quality deterioration is occurring.	Monthly	Standard water quality monitoring, as per the surface water specialist report.
Current sites used in this study will suffice.	Determine if water/habitat quality deterioration is occurring.	Bi-annual	Monitor for presence of fish.

9.1.4 Wetlands

Monitoring of the wetlands and the above discussed mitigation measures are important as the impacts from the activities need to be identified and rectified as far as possible. This will be mostly relevant during the construction phase. Monitoring should be done by a qualified wetland specialist on a monthly basis for the duration of the construction phase. The wetland monitoring should be undertaken concurrently with the faunal monitoring.

9.1.5 Groundwater

Groundwater monitoring has to continue at all phases of the mine operation to identify potential impacts on the groundwater to ensure effective measures can be undertaken at the early stage before serious damage to the environment takes place.

9.1.5.1 Monitoring Boreholes

The main objective in selecting suitable monitoring boreholes is to monitor the movement of polluted groundwater moving away from the RTSF. The positions of the recommended monitoring points are listed in Table 9-2. The monitoring points consist of:

- There are a number of boreholes in the vicinity of the RTSF. It is not necessary to monitor each of the closely spaced boreholes as the water quality is expected to be the similar. A total of 45 boreholes have been selected consisting of:
  - 25 private boreholes located in the proximity of the proposed RTSF; and
  - 20 boreholes drilled by Sibanye Gold and Gold One;
- The boreholes located within the RTSF footprint are expected to be decommissioned during the operational phase and have been excluded from the monitoring list.

Table 9-2: Coordinates of the proposed monitoring points

BH ID	Ycoord	Xcoord	Borehole Status
BNDBH1	-2936058	67348	Private Borehole
CDV01	-2933825	60449	Private Borehole
CDVBH8	-2929727	62643	Private Borehole
DGV04	-2934419	59511	Private Borehole
KLBBH10	-2933963	66494	Private Borehole
Raa03A	-2937767	67064	Private Borehole
Raa04	-2937864	65499	Private Borehole
Rfn07	-2932967	58309	Private Borehole
WDBBH3	-2929541	57935	Private Borehole
WDBBH4	-2931495	58049	Private Borehole

BH ID	Ycoord	Xcoord	Borehole Status
Dfn14	-2936771	59941	Private Borehole
Kbf06	-2934547	67535	Private Borehole
Kbf09	-2933631	67784	Private Borehole
KLBBH24	-2931332	67422	Private Borehole
KLBBH3	-2931280	66775	Private Borehole
KLBBH6	-2931943	68519	Private Borehole
Klp01	-2937727	68208	Private Borehole
Raa02	-2939584	65604	Private Borehole
Raa05	-2940092	67309	Private Borehole
Rfn16	-2934106	56122	Private Borehole
RTNBH7	-2932969	56396	Private Borehole
SPRBH1	-2928247	62118	Private Borehole
Tfn02	-2941820	65850	Private Borehole
Tfn05	-2942393	60961	Private Borehole
CDVBH7	-2929538	63581	Private Borehole
DM10	-2937268	62832	Sibanye Borehole
DM11	-2935623	63089	Sibanye Borehole
DM12	-2935830	63921	Sibanye Borehole
DM14	-2934442	60251	Sibanye Borehole
DM5	-2934447	61950	Sibanye Borehole
DM6	-2934433	62305	Sibanye Borehole
DM7	-2935060	61262	Sibanye Borehole
DM8	-2934789	63123	Sibanye Borehole
DM9	-2936220	63102	Sibanye Borehole
SBNBH1	-2930795	58656	Sibanye Borehole
SBNBH10	-2932794	64767	Sibanye Borehole
SBNBH11	-2934212	65125	Sibanye Borehole
SBNBH12	-2935225	64602	Sibanye Borehole
SBNBH13	-2932460	59143	Sibanye Borehole
SBNBH3	-2929726	60340	Sibanye Borehole

BH ID	Ycoord	Xcoord	Borehole Status
SBNBH4	-2929328	61724	Sibanye Borehole
SBNBH5	-2930188	62284	Sibanye Borehole
SBNBH7	-2930754	62880	Sibanye Borehole
SBNBH8	-2931441	64201	Sibanye Borehole
SBNBH9	-2931591	64122	Sibanye Borehole

9.1.5.2 Groundwater Level

Groundwater levels must be recorded on a monthly basis using an electrical contact tape or pressure transducer, to detect any changes or trends in groundwater flow direction.

9.1.5.3 Water Sampling and Preservation

When sampling the following procedures are proposed:

- One (1) litre plastic bottles, with a cap are required for the sampling – these are provided by the laboratory; and
- Sample bottles should be marked clearly with the borehole name, date of sampling, sampling depth and the sampler's name and submitted to a SANAS accredited laboratory.

9.1.5.4 Sampling Frequency

Groundwater is a slow-moving medium and drastic changes in the groundwater composition are not normally encountered within days. Due to the proximity of private boreholes and streams to the proposed RTSF footprint, monitoring should be conducted quarterly. Samples should be collected by an independent groundwater consultant, using best practice guidelines and should be analysed by a SANAS accredited laboratory.

It is suggested that quarterly samples be collected, including up to two years post closure and based on the results it can be adjusted accordingly. Generally groundwater sampling and chemical analyses are expected to be conducted on a bi-annual basis after mine closure. Monitoring should continue until a sustainable situation is reached.

9.1.5.5 Parameters to be Monitored

At gold mining waste facilities, analyses of the following constituents are recommended:

- Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO3, F, Cl;
- Initial full suite metals and then As, Al, Fe, Mn and other metals identified according to results of the initial analyses;
- pH and Alkalinity;
- TDS and EC; and

- Radio-active constituents, particularly uranium and its daughter decay nuclides.

9.1.5.6 Data Storage

In any project, good hydrogeological decisions require good information developed from raw data. The production of good, relevant and timely information is the key to achieve qualified long-term and short-term plans. For the minimisation of groundwater contamination it is necessary to utilize all relevant groundwater data.

The generation and collection of this data is very expensive as it requires intensive hydrogeological investigations and therefore has to be managed in a centralised database if funds are to be used in the most efficient way. Digby Wells has compiled a WISH-based database during the course of this investigation and it is highly recommended that Sibanye Gold utilises this database and continuously update and manage as new data becomes available.

9.1.6 Socio-economic Environment

It is proposed that a monitoring programme be developed and implemented to monitor the implementation of social management actions. Furthermore, it is recommended that this is conducted by a competent monitoring and evaluation officer as the implementation of monitoring tools (surveys, databases, etc.) will require specialised skills.

The monitoring and evaluation approach recommended is based on the “inputs-outputs-outcomes-impacts” model, which assesses performance of each level of the "results chain". As such, the following four categories of monitoring and evaluation indicators have been defined:

- **Input indicators:** These indicators measure the quantity, quality, and timeliness of resources – human, financial and material, technological and information – provided for an activity/ project/ programme;
- **Output indicators:** These indicators measure the quantity, quality, and timeliness of the products – goods or services – that are the short-term results of an activity/ project/ programme;
- **Outcome indicators:** These indicators measure the intermediate results generated by programme outputs. They often correspond to any change in people’s behaviour as a result of programme; and
- **Impact indicators:** These indicators measure the quality and quantity of long-term results generated by programme outputs (e.g. measurable change in quality of life, reduced incidence of diseases, increased income, reduced mortality, etc.).

The framework for monitoring the implementation and performance of social management actions will need to be compiled and developed once all social programmes and structures are in place for the project. A detailed example is provided in Appendix O which will require updating once the project has been approved to commence.

9.2 Item 1(h): Monitoring and Reporting Frequency

The monitoring and reporting frequency for the monitoring programmes per environmental aspect are supplied in Table 9-3.

9.3 Item 1(i): Responsible Persons

The responsible persons for the respective monitoring programmes are detailed in Table 9-3.

9.4 Item 1(j): Time Period for Implementing Impact Management Actions

The time period for implementing impact management actions has been provided for in Table 9-3.

9.5 Item 1(k): Mechanism for Monitoring Compliance

Table 9-3 sets out the method of monitoring the implementation of the impact management actions, the frequency of monitoring the implementation of the impact management actions, an indication of the persons who will be responsible for the implementation of the impact management actions, the time periods within which the impact management actions must be implemented and the mechanism for monitoring compliance with the identified impact management actions.

Table 9-3: Monitoring and Management of Environmental Impacts

Activities	Impacts requiring monitoring programmes	Functional requirements for monitoring	Roles and responsibilities (For the execution of the monitoring programmes)	Monitoring and reporting frequency and time periods for implementing impact management actions

All activities associated with the Kloof Mining Right Area	Deterioration to the ambient air quality	The following aspects should be monitored on a continuous basis, with analysis taking place monthly:
		▪ Dust deposition;
		▪ PM_{10}; and
		▪ Gaseous emissions including:
		  ▪ Sulfur dioxide (SO_2);
		  ▪ Nitrogen dioxide (NO_2);
		  ▪ Volatile organic compounds (VOCs);
		  ▪ Carbon monoxide (CO); and
		  ▪ Carbon dioxide (CO_2).
			An Air Quality Specialist must undertake the monitoring of the air quality and must be responsible for the changing of the dust buckets on a monthly basis. An independent or suitably qualified internal specialist is sufficient.	The dust buckets must be analysed on a monthly basis, with a report compiled every quarter. The Environmental Manager will be responsible for implementing impact management actions based on the findings and results of the quarterly reports.

	Loss of biodiversity	The fauna and flora monitoring must be undertaken on a yearly basis by an independent ecologist, starting prior to construction and commencing until post closure. The fauna and flora monitoring must be undertaken during the growing season (December to March) and must monitor the following: ▪ Vegetation cover; ▪ Alien invasive vegetation establishment; ▪ Mammals; ▪ Birds; ▪ Reptiles and amphibians; and ▪ Invertebrates.	An independent or internal ecologist must undertake the fauna and flora monitoring and compile a yearly report. It is the responsibility of the Environmental Manager to appoint the ecologist on an annual basis.	Annual monitoring and reporting must take place. The reporting must detail the changes in the biodiversity based on previous monitoring findings.
	Impact to water quality and aquatic ecosystems.	Bi-annual aquatic monitoring must take place and must include monitoring of the water clarity, SASS5 scores and the presence of fish. The bi-annual monitoring must be undertaken during the high-flow and low-flow seasons. The aquatic monitoring locations utilised in the Aquatic Impact Assessment must be used. In addition, monthly water quality monitoring must be undertaken.	An independent Aquatic Ecologist must be appointed for the bi-annual monitoring.	Bi-annual monitoring and reporting must be undertaken by the independent aquatic ecologist.
	Deterioration of groundwater quality and reduction in water levels.	Water levels must be monitored on a monthly basis by a groundwater specialist at the boreholes listed in Table 9-2. In addition to the monitoring of the water levels, groundwater quality monitoring must be undertaken on a quarterly basis and must analyse the following constituents: ▪ Macro Analysis i.e. Ca, Mg, Na, K, SO4, NO_3, F, Cl; ▪ Initial full suite metals and then As, Al, Fe, Mn and other metals identified according to results of the initial analyses; ▪ pH and Alkalinity; ▪ TDS and EC; and ▪ Radio-active constituents, particularly uranium and its daughter decay nuclides.	A groundwater specialist, either independent or an internal specialist, must undertake the monthly water level monitoring and quarterly groundwater quality monitoring.	Water levels will be monitored monthly, with groundwater quality monitored on a quarterly basis. A database must be managed and must keep records of all monitoring results. A report must be compiled on a quarterly basis detailing the results of the water levels and groundwater quality.

10 Item 1(l): Indicate the Frequency of the Submission of the Performance Assessment Report

A performance assessment will be undertaken every two years by a suitably qualified person. Following the performance assessment, a report will be compiled and submitted to the DMR for review.

11 Item 1(m): Environmental Awareness Plan

11.1 Item 1(m)(1): Manner in which the Applicant Intends to Inform his or her Employees of any Environmental Risk which may Result from their Work

Kloof Gold Mine has a management procedure for identifying environmental training needs and providing awareness and competence training that was developed and successfully implemented as part of the Environmental Management System (EMS) of the mine. The EMS has been based on ISO 14001:2004 principles.

Section 4.4.2 of the ISO 14001 standard requires that an organisation shall ensure that persons performing tasks on its behalf, who have the potential to cause significant environmental impacts, are competent on the basis of appropriate education, training or experience and that relevant records of training are retained.

The purpose of this procedure includes:

- To describe how environmental training needs of personnel are identified within the company; and
- To describe how persons working for or on behalf of the company are made aware of conformity with the environmental policy and procedures, as well as the requirements of the EMS and the significant environmental aspects, roles and responsibilities in achieving conformity with the requirements of the EMS.

Figure 11-1 summarises the training and training awareness procedures.

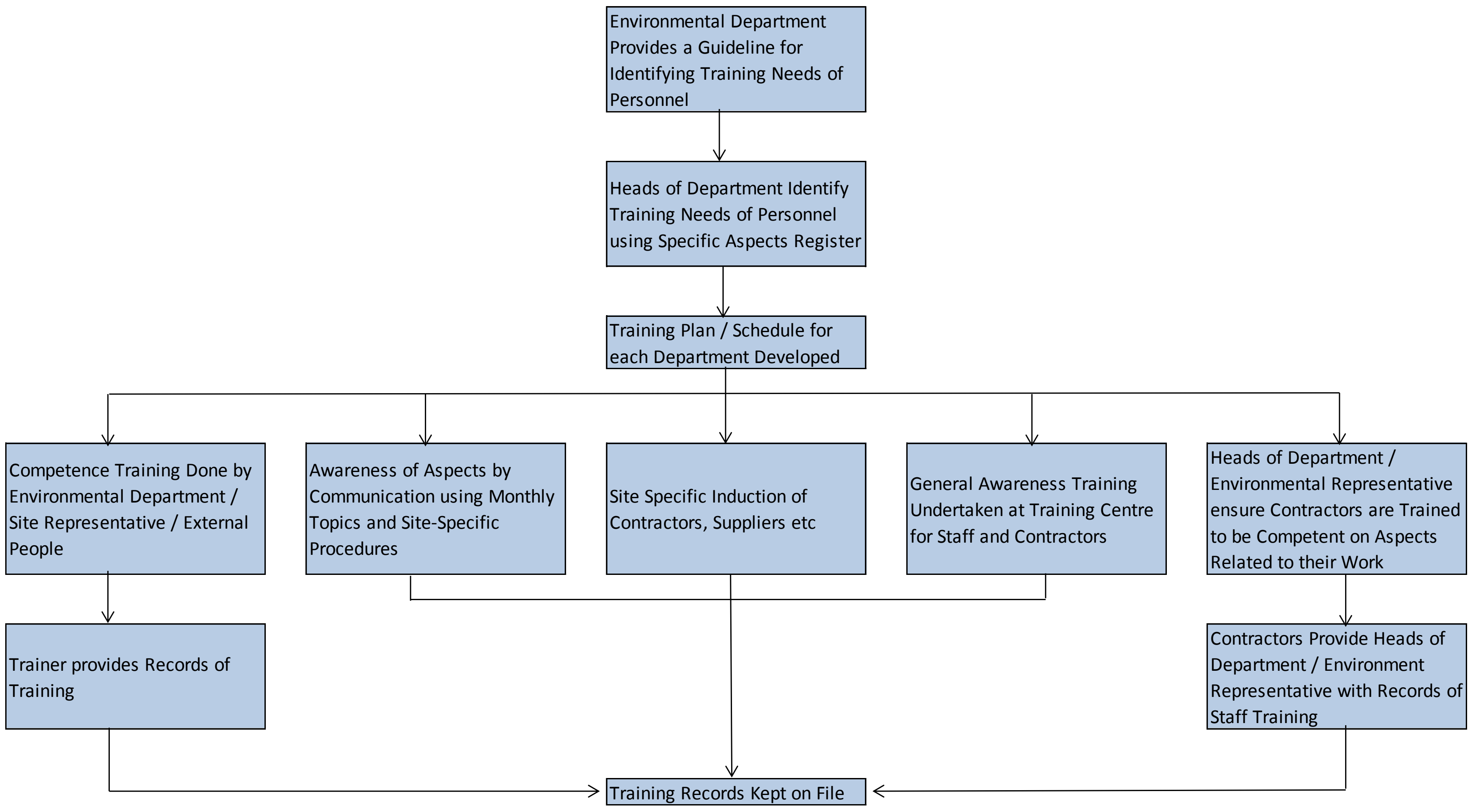

Figure 11-1: Kloof Gold Mine Environmental Awareness and Competence Training Procedure

11.2 Item 1(m)(2): Manner in which Risks will be dealt with to Avoid Pollution or the Degradation of the Environment

An environmental emergency and remediation plan has been developed for the Kloof Mining Right area as part of Kloof Gold Mine. Emergency response will be conducted in accordance with the Kloof ISO 14001 EMS procedure. The procedure describes how emergencies and incidents will be dealt with and recorded. The objective is to ensure that all employees are trained and capable of reacting effectively to emergencies to mitigate the impacts on the environment.

The emergency preparedness and response procedure describes:

- The identification of incidents;
- Emergency responses to emergencies;
- Incident and emergency training; and
- Emergency drills.

In addition, the mitigation and management measures associated with environmental risks for unplanned events that may arise during the operation of the project are provided in Table 11-1. It must be noted that the potential impacts as a result of the project risks have not been rated or assessed in terms of their significance as these are unplanned events.

Table 11-1: Mitigation Measures for Environmental Risks

Unplanned Event	Environmental Aspects	Potential Impact	Mitigation and Management Measures
Hydrocarbon spillages	Aquatics, surface water, groundwater and wetlands	Degradation of surface water quality, impacting downstream users, wetlands functioning and aquatic habitats.	▪ Bunded storage of hydrocarbons outside 1:100 floodline or 500m buffer, whichever is greater. ▪ Hydrocarbon spill kits and employee training in their use; ▪ Regular inspection for leakages and subsequent repair (maintenance); ▪ Emergency Response Plan; and ▪ The refuelling and replacement of oil for vehicles must be undertaken in contained areas (bunded areas) built to the capacity of the facility provided with sumps.
Pipeline leaks, spills, bursts and failure	Wetlands and Surface Water	Deterioration of surrounding wetlands' health and functioning, as well as impacting on water quality	▪ Pipelines are to be supported on reclaimed railway sleepers placed at 9m intervals as it approaches the wetland; ▪ The pipeline will be unsupported across the 15 m wetland/ river span and this will also contain a continuous HDPE liner; ▪ The pipeline will not contain any flanges for the full length of the wetland crossing; ▪ 50 m before and after the wetland crossing, the pipeline will be supported on plinths (an in-situ cast concrete support) with foundations located at 9m intervals and also fitted with steel straps; ▪ The pipeline will be fitted with inspection points; ▪ All flanges within 100m of the wetland will be fitted with spray prevention plates; ▪ The spillage paddock will be located outside on the wetland; ▪ Electronic monitoring of pipeline pressure to identify potential leaks or bursts and soon as possible;

Unplanned Event	Environmental Aspects	Potential Impact	Mitigation and Management Measures
			▪ Emergency valves must be shut down immediately should a burst pipeline be identified; ▪ No flanges to be utilised in the floodline demarcated areas; ▪ Implement the Emergency Response Plan; ▪ Known heritage resources in proximity to burst pipelines must be assessed for potential damage. Any change to the status quo of the heritage resource must be reported to the responsible HRA immediately
	Heritage	Damage to heritage resources protected under Section 43 to 37 of the NHRA.	▪ Known heritage resources in proximity to burst pipelines must be assessed for potential damage. Any change to the status quo of the heritage resource must be reported to the responsible HRA immediately
Accidental exposure of unidentified heritage resources	Heritage	Damage or destruction to heritage resources generally protected under Section 35 and 36 of the NHRA.	▪ Chance Find Procedures must be developed prior to the construction phase.
Delays and health and safety impacts to pedestrian, cyclists and motorists.	Traffic	Delays and health and safety impacts to pedestrian, cyclists and motorists.	▪ Regular pedestrian and cycling activity awareness by drivers as part of the formal driver training and regular health and safety briefings; ▪ Site related heavy vehicles must avoid low order roads in residential areas as far as practical; ▪ Regular road safety awareness campaigns within the neighbouring communities must be undertaken; and ▪ Discourage right turns by heavy vehicles on busy roads.

12 Item 1(n): Specific Information Required by the Competent Authority

The financial provision for the environmental rehabilitation and closure requirements of mining operations is governed by the NEMA which provides, in Section 24P, that the holder of a Mining Right must make financial provision for rehabilitation of negative environmental impacts. The financial revision will be reviewed on an annual basis.

13 Item 2: Undertaking

The EAP herewith confirms:-

2(a) the correctness of the information provided in the reports

2(b) the inclusion of comments and inputs from stakeholders and I&APs ;

2(c) the inclusion of inputs and recommendations from the specialist reports where relevant; and

2(d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

Appendix A: Plans

Appendix B: CV and Proof of Qualifications

Appendix C: Macro-Economic Impact Assessment

Appendix D: Public Participation Process

Appendix E: Air Quality Impact Assessment

Appendix F: Groundwater Impact Assessment

Appendix G: Soils Impact Assessment

Appendix H: Surface Water Impact Assessment

Appendix I: Fauna and Flora Impact Assessment

Appendix J: Aquatics Impact Assessment

Appendix K: Wetlands Impact Assessment

Appendix L: Topography and Visual Impact Assessment

Appendix M: Noise Impact Assessment

Appendix N: Heritage Impact Assessment

Appendix O: Social Impact Assessment

Appendix P: Traffic Impact Assessment

Appendix Q: Radiological Impact Assessment

Appendix R: Rehabilitation Plan

Appendix S: Closure Cost Assessment