CROWN GOLD RECOVERIES (PTY) LTD: THE RECLAMATION OF THE SOWETO CLUSTER DUMPS IN THE CITY OF JOHANNESBURG METROPOLITAN MUNICIPALITY, GAUTENG

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

6 December 2019

DMRE Reference: GP/5/1/1/2 (000002) BP

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

FINAL ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH THE RECLAMATION OF THE SOWETO CLUSTER DUMPS IN THE CITY OF JOHANNESBURG, GAUTENG PROVINCE.

APPLICATION FOR ENVIRONMENTAL AUTHORISATION (EA):

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT (ACT 107, 1998) (AS AMENDED), THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT (ACT 59, 2008) (AS AMENDED), AND THE NATIONAL WATER ACT (ACT 36, 1998) (AS AMENDED).

THE APPLICATION TAKES INTO CONSIDERATION ACTIVITIES TRIGGERED IN ACCORDANCE WITH THE MINERALS AND PETROLEUM RESOURCES DEVELOPMENT ACT (ACT 28, 2002) (AS AMENDED).

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Draft Environmental Impact Assessment Information

Project:	Crown Gold Recoveries (Pty) Ltd: Soweto Cluster
Report Title:	The reclamation and reprocessing of the Soweto Cluster dumps in the City of Johannesburg, Gauteng.
DMRE Reference No:	GP/5/1/1/2 (000002)
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Verification	Capacity	Name	Signature	Date
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SECTION 1:

ENVIRONMENTAL IMPACT ASSESSMENT REPORT OVERVIEW

Important Notice

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act, 1998 (Act 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 Regulation 16(3) (b) of the Environmental Impact Assessment Regulations 2017, 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 Regulation 17 (1) (c) the Competent Authority must check whether the application has considered 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 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 Regulations 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

1) The objective of the Environmental Impact Assessment process is to, through a consultative process —

(a) 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;
(b) describe the need and desirability of the proposed activity, including the need and desirability of the activity in the context of the preferred location;
(c) identify the location of the development footprint within the preferred site based of an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;
(d) determine the –

I. nature, significance, consequence, extent, duration and probability of the impacts occurring to inform identified preferred alternatives; and
II. degree to which these impacts –
   - can be reversed;
   - may cause irreplaceable loss of resources; and
   - can be avoided, managed or mitigated;

(e) identify the most ideal location for the activity within the preferred site based on the lowest level of environmental sensitivity identified during the assessment;
(f) identify, assess, and rank the impacts the activity will impose on the preferred location through the life of the activity;
(g) identify suitable measures to manage, avoid or mitigate identified impacts; and
(h) identify residual risks that need to be managed and monitored.

Public Review Period for the Draft EIA/EMPr Report

Members of the public, local communities, and stakeholders were invited to comment on the Draft Environmental Impact Assessment and Environmental Management Programme Report (EIA/EMPr) which was made available for public review and comment from **Thursday, 24 October 2019 to Friday, 22 November 2019.**

The Draft EIA/EMPr was also submitted to the Department of Mineral Resources (DMRE) and was made available at the following locations.

LOCATION	PHYSICAL ADDRESS	CONTACT PERSON
Hard copies		
Bramfischerville Public Library	Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville	Ms Patricia Mathe (Librarian) Tel: (011) 765 4025
Roodepoort Public Library	Cnr Berlandina & Hodgson Streets	Ms Monique Ramabulana Tel: (011 763 1031)
Electronic copies		
Kongiwe Environmental website at www.kongiwe.co.za public documents		
For a CD copy please contact the stakeholder engagement team (Sibongile Bambisa/ Vanessa Viljoen), Tel: 012 003 6627, Email: stakeholders@kongiwe.co.za		

Comments received from the public throughout the EIA phase of the project have been included in Appendix C9 of the Comments and Responses Report.

Comments received during the 30-day public review of the draft impact assessment phase have been incorporated into the Final Environmental Impact Assessment report and Environmental Management Programme report.

Executive Summary

Kongiwe has been appointed as the Independent Environmental Service Provider, tasked with conducting the Scoping and Environmental Impact Assessment (S&EIA) process which is aimed at critically evaluating the potential environmental and social impacts of the proposed **Soweto Cluster Dumps Reclamation and Reprocessing Project** (hereafter the Proposed Project).

The Application for Environmental Authorisation was submitted to the Department of Mineral Resources and Energy (DMRE) on **Thursday**, **30th May 2019**, and the Final Scoping Report was submitted on **Monday, 15th July 2019.**

Project Introduction and Background

The Applicant for the reclamation of the Soweto Cluster dumps is **Crown Gold Recoveries (Pty) Limited (hereafter Crown Gold).**

The proposed projects entails the reclamation and reprocessing of gold from six historic slimes dams: 2L24; 2L20; 2L21; 2L16; 2L17 and 2L18 as well as two historic sand dumps 2A6 and 2A8. These dams and dumps are referred to collectively as the “Soweto Cluster” and were all created prior to the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) which came into force in 2004.

A Mining Right is not a prerequisite to reclaim historic Tailings Storage Facilities (TSF). Listed activities applied for are indicated in Table 4-1. Crown Gold has applied for an Environmental Authorisation for activities triggered by the National Environmental Management Act, 1998 (Act No. 107 of 1998).

Surface gold retreatment is a largely mechanised process with a risk profile that is significantly lower from that of conventional mining. The tailings material from the Soweto Cluster will be reclaimed by using high-pressure water jets (slimes dams) and by front-end loaders (sand dumps) which is fed as slurry to a metallurgical processing plant for gold recovery. Ultimately, by reclaiming the Soweto Cluster Dumps, Crown Gold will displace environmentally problematic slimes dams and sand dumps to controlled tailings disposal facilities such as the Cooke TSF and/ or the Regional TSF (RTSF).

Scoping Phase Project Alternatives

Originally, three operational alternatives were considered for the transport of slurry and return water, the processing plant to be used for gold recovery, and the related depositional facility for unprocessed tailings material.

- **Alternative 1:** Soweto Cluster is reclaimed, and slurry is transported through new pipelines from 2L24 to the Cooke Plant, south of the Soweto Cluster. Deposition will take place on the Cooke TSF which is adjacent to the plant or into the old mining pits.
- **Alternative 2:** Soweto Cluster is reclaimed, and slurry is transported through a new pipeline which will run east of dump 2L24 where it will connect to an existing pipeline network currently being

utilised for other reclamation projects. The existing pipeline will then transport the slurry to the Ergo Plant at Brakpan in the East Rand. Deposition will take place on the Brakpan/Withok TSF, south of the Ergo Plant.

- **Alternative 3:** Soweto Cluster is reclaimed, and slurry is transported though new pipelines to the Cooke Plant (as per Alternative 1), and then to the Central Processing Plant (CPP), with the option to bypass the Cooke Plant in the future. The pipeline from Cooke Plant to CPP has been authorised already but is not existing. Deposition will then take place on the RTSF, which is authorised but not yet constructed.

Alternative 3 was authorised on the **11 May 2018 (Reference: GP 30/5/1/2/3/2/1 (66) EM and 30/5/1/2/3/2/1 (51) EM)** as part of a separate Environmental Process. A detailed impact assessment was undertaken and the main activities pertaining to the Environmental Authorisation are:

- The construction and operation of:
  - The Central Processing Plant (CPP);
  - The Regional Tailings Storage Facility (RTSF);
  - The Return Water Dam (RWD);
  - The Advanced Water Treatment Facility (WTP); and
  - Roads, powerlines, pipelines and pump stations associated with the above listed infrastructure.

Specialist were commissioned to consider Alternative 1 and Alternative 2 as Alternative 3 has already been authorised.

Upon considering specialist recommendations, comments received during ongoing stakeholder engagement and the practical implementation of constructing, operating and managing **<u>Alternative 2, this option will no longer be considered for the project going forward.</u>**

Impact Assessment Phase Project Alternatives

The project therefore will now only consider the following alternatives during the impact assessment phase:

- **Alternative 1:** Soweto Cluster is reclaimed, and slurry is transported through new pipelines from 2L24 to the Cooke Plant, south of the Soweto Cluster. Deposition will take place on the Cooke TSF which is adjacent to the plant or into the pits. In view of the limited capacity of the Cooke TSF, this alternative is no longer favoured and only <u>Alternative 2 will be pursued</u>. This alternative was assessed as part of the EIA process.
- **Alternative 2:** This is the <u>Preferred Alternative</u>. Soweto Cluster is reclaimed, and slurry is transported though new pipelines to the Cooke Plant (as per Alternative 1), and then to the Central Processing Plant (CPP), with the option to bypass the Cooke Plant in the future. The pipeline from Cooke Plant to CPP has been authorised already but is not existing. Deposition will then take place on the RTSF, which is authorised but not yet constructed.

Due to the fact that the pipeline from Cooke Plant to CPP above has already been granted Environmental Authorisation, environmental impacts for this pipeline were not considered.

The slurry and return water pipelines which are linked to Alternative 2 above will require authorisation in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) for Section 21 water uses. An Integrated Water Use Licence Application (IWULA) has been prepared in accordance with the Water Use Licence Application and Appeals Regulations 2017 published in GNR 267 on 24 March 2017 and is supported by a Technical Report and Integrated Water and Waste Management Plan (IWWMP).

Environmental Impacts of the Soweto Cluster Project

The table overleaf represents a summary of the significance of impacts identified during the project lifetime for each environmental aspect. Impacts are expected to occur predominantly during the construction and operation phases, and to a lesser extent during decommissioning.

Table 1-1: Risk Matrix of Assessed Project Impacts

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
Positive (+)	**Major (high)**					**Major (high)**	❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Job security ❖ Skills development ❖ Economic growth ❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Groundwater quantity ❖ Alternative Land use ❖ Aquifer yield ❖ Economic Growth ❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Water quality ❖ Groundwater quality ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation ❖ Alternative Land-use ❖ Removal of pollution source ❖ Improved aquifer yield ❖ Opportunity for watercourses to reinstate.
Positive (+)	**Moderate (medium)**	❖ Job security ❖ Skills Development ❖ Economic growth	❖ Job security ❖ Skills development ❖ Stimulation of economic growth	❖ Groundwater quality ❖ Groundwater quantity ❖ Economic growth ❖ Alternative Land use ❖ Water Quality improvement ❖ Aquifer yield	❖ Water quality ❖ Groundwater quality	**Moderate (medium)**	❖ Job security ❖ Economic growth ❖ Respiratory Effects ❖ Health	❖ AMD removal ❖ Water Quality ❖ Groundwater quantity ❖	❖ Groundwater quality ❖ Economic growth	
Positive (+)	**Minor (low)**		❖ Economic growth			**Minor (low)**				
No Impact	**No Impact**					**No Impact**				
Negative (-)	**Minor (low)**	❖ Groundwater quantity ❖ Noise ❖ Heritage ❖ Safety ❖ Sense of place ❖ Influx of Job seekers	❖ Noise ❖ Heritage ❖ Influx of Job seekers	❖ Noise ❖ Safety ❖ Influx of Job seekers	❖ Air quality	**Minor (low)**	❖ Water Quality ❖ Groundwater Quality ❖ Air quality ❖ Heritage ❖ Health ❖ Sense of place ❖ Future land use ❖ Attitude formation ❖ Noise ❖ Biodiversity ❖ Fauna ❖ Flora ❖ Wetlands, wetland soil and wetland Vegetation	❖ Wetlands ❖ Water Quality ❖ Heritage ❖ Health ❖ Sense of place ❖ Impact on future land use ❖ Noise at night ❖ Nuisance factors ❖ Attitude formation and expectations ❖ Biodiversity ❖ Fauna ❖ Flora	❖ Water quality ❖ Air quality ❖ Noise ❖ Safety ❖ Dust nuisance on health ❖ Impacts on the Viva Settlement ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora ❖ Inappropriate closure leading to loss of wetlands	❖ Air quality ❖ Surface water quality
Negative (-)	**Moderate (medium)**	❖ Biodiversity ❖ Fauna ❖ Flora ❖ Water quality	❖ Water quality ❖ Surface Water ❖ Air quality ❖ Health	❖ Water quality ❖ Air quality ❖ Job security ❖ Skills development	❖ Surface water quality	**Moderate (medium)**	❖ Informal settlements ❖ Safety Impacts ❖ Viva Settlement	❖ Air quality ❖ Safety ❖ Heritage (burial ground)	❖ Job security ❖ Informal settlements ❖ Safety Impacts	

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
		❖ Air Quality ❖ Heritage (dam wall) ❖ Health ❖ Noise ❖ Informal settlements ❖ Sense of place ❖ Respiratory Effects ❖ Wetlands, wetland soil and wetland Vegetation	❖ Sense of place ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora	❖ Impacts on the Viva Settlement ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora				❖ Informal settlements ❖ Dust nuisance on health ❖ Viva Settlements ❖ Direct loss of wetlands ❖ Contamination of wetland ❖ Wetlands, wetland soil and wetland Vegetation		
Negative (-)	Major (high)	❖ Heritage (burial ground) ❖ Safety Impacts ❖ Heritage (Graves) ❖ Health – Existing contaminated surface and groundwater ❖ Future land use ❖ Viva Settlement ❖ Attitude formation ❖ Water quality ❖ Noise at Night ❖ Health – status quo radioactive dust	❖ Informal settlements ❖ Safety ❖ Health – Existing contaminated surface and groundwater ❖ Viva Settlements ❖ Impact on future land use ❖ Attitude formation and expectations ❖ Direct loss of wetlands ❖ Contamination of wetland ❖ Wetlands, wetland soil and wetland Vegetation ❖ Health – status quo radioactive dust	❖ Informal settlements ❖ Safety Impacts ❖ Health – Existing contaminated surface and groundwater ❖ Inappropriate closure leading to loss of wetlands ❖ Health – status quo radioactive dust		Major (high)			❖ Skills development	

Conclusions

Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Soweto Cluster Project can be mitigated to within acceptable limits and that the project should be authorised. This opinion holds provided all the recommendations proposed in the EIA and EMP as well as legislative requirements are implemented and adhered to.

An impact assessment has been undertaken using qualified specialists, which has incorporated extensive consultation with and participation of interested and affected parties. Applying the hierarchical approach to impact management, alternatives were firstly considered to avoid negative impacts, but where avoidance was not possible, to better mitigate and manage negative impacts. Where impacts were found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed.

The findings of the impact assessment have shown that the Soweto Cluster Project would conclusively result in certain negative impacts during the operational phase to the environment, however, none of the specialist studies objected to the project. Moreover, the scientific specialist mitigations measures have been included into this EIA and EMP Report to reduce the significance of all the identified negative impacts. Most of the negative impacts from the proposed project can be reduced through the implementation of mitigation measures.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of the mine dumps is extremely important and a positive benefit. It is envisioned that the removal of these dumps could significantly reduce a source of water, land and dust pollution, as well as costs associated with the dumps' maintenance. The land would be cleared to ground level and thereafter be available for future use. The proposed project would also directly and indirectly contribute to the Country's Gross Domestic Product (GDP), as well as enhance and further support workers and contractors employed or contracted to Crown Gold.

The Option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. As such, the short-term negative impacts on the environment would not transpire; equally so, the long-term positive impacts such as environmental pollution source removal, economic development, skills development, and the availability of land for re-development would not occur. The only alternative land use is to leave the dumps as they stand; there is no other potential use of the space as the project area is a cluster of polluting historic mine dumps that impact upon the surrounding biophysical and social environment.

The "No-Go" Option also assumes the continuation of the current land use, implying the absence of any reclamation activities and associated infrastructures. The means that the attraction of the gold reserves located within the dumps could potentially enhance Illegal mining, and if left as is, population settlement on or around the dumps could occur.

The ‘No Project’ alternative is not preferred due to the anticipated benefits of the proposed reclamation project. The expected indirect benefits resulting from the reclamation of the Soweto Cluster include:

- Removal and remediation of existing tailings deposits currently located on sensitive dolomitic aquifers, reducing future environmental liability and risk.
- Removal of tailings facilities, reducing health risks for surrounding communities from possible exposure to dust.
- Re-use of currently impacted mine water in the hydraulic mining process.
- Removal of a source of pollution and radiation in the area.
- The potential to unlock land for redevelopment, as read in the Metropolitan Spatial Development Vision.
- Continued supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), as well as the GDARD, the City of Johannesburg Strategic Development Framework and the Mining Belt West Framework. The reclamation and rehabilitation of the Soweto Cluster dumps will mitigate the current environmental, health and social impacts, as well as unlock land for potential future development.

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Abbreviations

ABBREVIATION/ SYMBOL	DESCRIPTION
AMD	Acid Mine Drainage
BID	Background Information Document
Bq/g	Becquerel per gram (Bq/g)
CA	Competent Authority/Authorities
CARA	Conservation of Agricultural Resources Act, 1983 (No. 43 of 1983)
CBA	Critical Biodiversity area
CE	Critically Endangered
CoJ	City of Johannesburg
CoJMM	City of Johannesburg Metropolitan Municipality
CRG	Central Rand Group
CRR	Comments and Response Report
CSIR	Council for Scientific and Industrial Research
dBA	Decibels
DEFF	Department of Environment, Forestry and Fisheries
DEM	Digital Elevation Model
DMRE	Department of Mineral Resources and Energy
DALRRD	Department of Agriculture, Land Reform and Rural Development
DSR	Draft Scoping Report
DHSWS	Department of Human Settlements, Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EIA	Environmental Impact Assessment
EIS	Ecological Importance and Sensitivity
EMPr	Environmental Management Programme
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Areas
GDARD	Gauteng Department of Agriculture and Rural Development
GSDF	Gauteng Spatial Development Framework
ha	Hectare
HGM1	Channelled valley bottoms
HGM2	Hillslope seeps
HMA	Heavily Modified Areas
I&AP	Interested and Affected Party
IBA	Important Bird and Biodiversity Areas
IDP	Integrated Development Plan
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
JRA	Johannesburg Roads Agency
LT	Least Threatened
$\mu g/m^3$	Microgram per cubic metre
µSv/a	Micro Sievert per annum

ABBREVIATION/ SYMBOL	DESCRIPTION
Mamsl	Metres above mean sea level
MAP	Mean annual precipitation
MAR	Mean Annual Runoff
$mg/m^2/day$	Milligram per cubic metre per day
Mg/L	Milligrams per litre
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)
mSv/a	Milli Sievert per annum
NAAQS	National Ambient Air Quality Standards
NBA	National Biodiversity Assessment
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:PAA	National Environmental Management: Protected Areas Act (Act No. 57 of 2003)
NEM:WA	National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008)
NEMLAA	National Environmental Laws Amendment Act, 2014 (Act No. 25 of 2014)
NFA	National Forest Act, 1998 (Act No 84 of 1998)
NFPA	National Freshwater Ecosystem Priority Area
NGO	Non-Governmental Organisations
NHRA	National Heritage Resources Act, 1999 (Act No. 25 of 1999)
NNR	National Nuclear Regulator
NPAES	National Protected Areas Expansion Strategy
NPi	National Pollutant inventory
NT	Near Threatened
NWA	National Water Act, 1998 (Act No. 36 of 1998)
ONA	Other Natural Area
PA	Protected Area
PES	Present ecological status
PM	Particulate Matter
PPP	Public participation process
SAAQIS	South African Air Quality Information System
SABAP	South African Bird Atlas Project
SANParks	South African National Parks
SANS	South African National Standards
S&EIA	Scoping, Environmental Impact Assessment and Environmental Management Programme
SAHRA	South African Heritage Resources Agency
SANBI	South African National Biodiversity Institute
SCC	Species of Conservation Concern
SCS	Soil Conservation Service
SPLUMA	Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013)
SWMP	Surface Water Management Plan
TDS	Total Dissolved Solids
TLB	Tip Load Bucket
TIA	Traffic Impact Assessment
TSF	Tailings storage facility

ABBREVIATION/ SYMBOL	DESCRIPTION
VAC	Visual Absorption Capacity
vph	Vehicles per hour
VU	Vulnerable
WMA	Water Management Area
WML	Waste Management Licence
WRF	Weather and Research Forecasting
WRG	West Rand Group
ZOI	Zone of Influence

SECTION 2:

ENVIRONMENTAL IMPACT ASSESSMENT REPORT

CHAPTER 1: INTRODUCTION

Kongiwe Environmental (Pty) Ltd ('Kongiwe') was appointed by **Crown Gold Recoveries (Pty) Ltd ('Crown Gold')** to undertake a Scoping and Environmental Impact Assessment (S&EIA) process, in support of the Environmental Authorisation (EA) application, for the proposed reclamation of the Soweto Cluster Dumps located in Soweto and Roodepoort, Gauteng.

The proposed projects entails the reclamation and reprocessing of gold from six historic slimes dams: 2L24; 2L20; 2L21; 2L16; 2L17 and 2L18 as well as two historic sand dumps 2A6 and 2A8. These dams and dumps are referred to collectively as the "Soweto Cluster" and were all created prior to the Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002) (MPRDA) which came into force in 2004.

A Mining Right is not a prerequisite to reclaim historic Tailings Storage Facilities (TSF). Listed activities applied for are indicated in Table 4-1. Crown Gold has applied for an Environmental Authorisation (EA) for activities triggered by the National Environmental Management Act (Act 107 1998).

The Proposed project supports the City of Johannesburg's (COJ) '*Corridors of Freedom'* Framework and Mine Belt West Framework as read in the City's Integrated Development Plan (2018/2019). Ultimately, by reclaiming the Soweto Cluster Dumps, Crown Gold will displace environmentally problematic slimes dams and sand dumps to controlled tailings disposal facilities such as the Cooke TSF and the Regional Tailings Storage Facility (RTSF). The displacement of these dams and dumps will unlock valuable areas of land (or corridors) for development - in line with the City's transformation vision.

1.1 Project Overview

Few landscapes have seen gold mining activity on the scale at which it occurred in the Gauteng Province years ago. From 1970 onwards, gold mining in Gauteng rapidly declined, and a shift to a service-oriented economy occurred. Gold mining still happens in Gauteng, and the province is home to the world's two deepest mines, the Mponeng and TauTona gold mines owned by AngloGold Ashanti - they extend to depths of almost 4km below ground. As the gold mines in South Africa become increasingly deeper and their operation becomes more expensive, reprocessing to recover economic value from historic surface gold TSF (or 'dumps') has generated much interest in the last number of years.

These historic dumps are a natural consequence of underground mining, where a combination of waste rock and ore is brought to surface for crushing, treatment and then separation from the valuable mineral stream, which is further processed to release gold. In the stamp milling era of ore processing, processing plants typically produced sand whereas current milling reduces all ores to finer-particle slimes before the extraction of gold. In terms of nomenclature, historic sand dumps are denoted with an 'A' and historic slimes dams with an 'L'.

As the price per ounce for gold continues to rise, the economic realisation from reclaiming and reprocessing historic TSFs is seen as favourable. However, the reclamation of historic TSFs is not only economically based, but also responds to the growing awareness of the problems related to pollution, health and safety, such as dust (which is sometimes radioactive) and Acid Mine Drainage (AMD). An added complication is that human settlements, both formal and informal, have developed around these dumps, far closer than was ever envisaged by any legislation or regulation.

Ultimately, Crown Gold intends to process these historic TSFs more responsibly regarding leaving behind a less toxic, more stable, smaller quantity of tailings whilst liberating large areas of land in corridors that have been earmarked for future development.

With the above in mind, it is the intention of Crown Gold to reclaim and reprocess the Soweto Cluster dumps. The project will reclaim slime dumps 2L24; 2L20; 2L21; 2L16; 2L17 and 2L18, as well as sand dumps 2A6 and 2A8. In terms of locality, the Soweto Cluster dumps are situated in ward 49 and ward 127 of the township of Soweto and in the city of Roodepoort (Figure 1-1). The cluster of dumps can be is divided into 3 sites:

- Site 1: The large 2L24 slimes dam (Vlakfontein Dump) which covers an area of approximately 273.64 hectares (Ha);
- Site 2: Three northern deposits (2L20; 2L21 and 2A8), which cover an approximate area of 59.58 Ha; and
- Site 3: Four north easterly deposits:(2L16; 2L17; 2L18 and 2A6), which cover an approximate area of 97.14 Ha

The project is considered a "Brownfield Project" as it is the reclamation of historic TSF deposits with partly existing infrastructure. The project is located on farms Roodepoort 237 IQ and Vlakfontein 238IQ. The majority of the other properties have been identified as directly affected landowners for the pipeline alternatives of the project.

Table 1-1: Description of the Property.

Farm Names	**Farm Name:**	**Farm ID**	**Portion**	**Landowner**[1]
	Braamfischerville	649 IQ	2	Undetermined
	Braamfischerville	649 IQ	3	Undetermined
	Braamfischerville	649 IQ	1	Undetermined
	Doornkop	239 IQ	131 (RE)	Randfontein Estates Ltd
	Doornkop	239 IQ	130 (RE)	Randfontein Estates Ltd
	Doornkop	239 IQ	39	Provincial Government of Gauteng

[1] Properties/Farms which remain Undetermined: Research at the Surveyor General's office found that these properties are currently not registered. In addition there is no Deeds Office information. Refer to Appendix C of this EIA for proof of correspondence from site visits to the undetermined properties, deeds office searches as well as correspondence from the Surveyor Generals office. These landowners cannot be identified.

	Doornkop	239 IQ	38	City of Johannesburg Metropolitan Municipality
	Luipaardsvlei	243 IQ	141	Undetermined
	Luipaardsvlei	243 IQ	14 (RE)	Rand Uranium (Pty) ltd
	Luipaardsvlei	243 IQ	13	Rand Uranium (Pty) ltd
	Luipaardsvlei	243 IQ	96 (RE)	Undetermined
	Luipaardsvlei	243 IQ	7 (RE)	Rand Uranium (Pty) ltd
	Luipaardsvlei	243 IQ	10	Rand Uranium (Pty) ltd
	Luipaardsvlei	243 IQ	88	Rand Uranium (Pty) ltd
	Luipaardsvlei	243 IQ	134 (RE)	Randfontein Estates Gold Mining Co Witwatersrand Ltd
	Luipaardsvlei	243 IQ	43	Rand Uranium (Pty) ltd
	Paardekraal	226 IQ	215	Transnet Ltd
	Paardekraal	226 IQ	245	Undetermined
	Paardekraal	226 IQ	2 (RE)	Industrial Zone (Pty) Ltd
	Paardekraal	226 IQ	5 (RE)	Industrial Zone (Pty) Ltd
	Paardekraal	226 IQ	26	Undetermined
	Paardekraal	226 IQ	212 (RE)	Transnet Ltd
	Roodepoort	237 IQ	1	Dino Prop (Pty) Ltd
	Roodepoort	237 IQ	5 (RE)	Dino Prop (Pty) Ltd
	Roodepoort	237 IQ	1 (RE)	Dino Prop (Pty) Ltd
	Roodepoort	237 IQ	495	Undetermined
	Roodepoort	237 IQ	495/237	
	Roodepoort	237 IQ	401 (RE)	City of Johannesburg Metropolitan Municipality
	Roodepoort	237 IQ	1	Dino Prop (Pty) Ltd
	Vlakfontein	238 IQ	1 (RE)	DRD Gold Ltd
	Vlakfontein	238 IQ	94 (RE)	City of Johannesburg Metropolitan Municipality
	Vlakfontein	238 IQ	92	Undetermined
	Vlakfontein	238 IQ	4	Quarrytown Ltd
	Vogelstruisfontein	233 IQ	46	Undetermined
	Vogelstruisfontein	233 IQ	38	Ablesun Inv (Pty) Ltd
	Vogelstruisfontein	231 IQ	161	Rand Leases Securitisation (Pty) Ltd
	Vogelstruisfontein	231 IQ	227	Undetermined
	Vogelstruisfontein	231 IQ	17 (RE)	Fleurhof Extension 2 (Pty) Ltd
	Zuurbult	240 IQ	240	Undetermined
Application Area (ha)	2L24 covers an area of approximately 273.64 hectares (Ha); 2L20; 2L21 and 2A8 cover an approximate area of 59.58 Ha; 2L16; 2L17; 2L18 and 2A6 cover an approximate area of 97.14 Ha.			

Magisterial District	Ward 49 and Ward 127 of the City of Johannesburg Metropolitan Municipality
Distance and Direction from Nearest Town	The site is within the City of Johannesburg. Bramfischerville, Dobsonville, Witpportjie and Roodepoort are located immediately around the Soweto Cluster.

21-digit Surveyor General Code for each Farm Portion	**Farm Name:**	**Farm ID**	**Portion**	**SG Code**
	Braamfischerville	649 IQ	2	T0IQ00000000064900002
	Braamfischerville	649 IQ	3	T0IQ00000000064900003
	Braamfischerville	649 IQ	1	T0IQ00000000064900001
	Doornkop	239 IQ	131 (RE)	T0IQ00000000023900131
	Doornkop	239 IQ	130 (RE)	T0IQ00000000023900130
	Doornkop	239 IQ	39	T0IQ00000000023900039
	Doornkop	239 IQ	38	T0IQ00000000023900038
	Luipaardsvlei	243 IQ	141	T0IQ00000000024300141
	Luipaardsvlei	243 IQ	14 (RE)	T0IQ00000000024300014
	Luipaardsvlei	243 IQ	13	T0IQ00000000024300013
	Luipaardsvlei	243 IQ	96 (RE)	T0IQ00000000024300096
	Luipaardsvlei	243 IQ	7 (RE)	T0IQ00000000024300007
	Luipaardsvlei	243 IQ	10	T0IQ00000000024300010
	Luipaardsvlei	243 IQ	88	T0IQ00000000024300088
	Luipaardsvlei	243 IQ	134 (RE)	T0IQ00000000024300134
	Luipaardsvlei	243 IQ	43	T0IQ00000000024300043
	Paardekraal	226 IQ	215	T0IQ00000000022600215
	Paardekraal	226 IQ	245	T0IQ00000000022600245
	Paardekraal	226 IQ	2 (RE)	T0IQ00000000022600002
	Paardekraal	226 IQ	5 (RE)	T0IQ00000000022600005
	Paardekraal	226 IQ	26	T0IQ00000000022600026
	Paardekraal	226 IQ	212 (RE)	T0IQ00000000022600212
	Roodepoort	237 IQ	14	T0IQ00000000023700014
	Roodepoort	237 IQ	5 (RE)	T0IQ00000000023700005
	Roodepoort	237 IQ	1 (RE)	T0IQ00000000023700001
	Roodepoort	237 IQ	495	T0IQ00000000023700495
	Roodepoort	237 IQ	495/237	T0IQ00000000023700237
	Roodepoort	237 IQ	401 (RE)	T0IQ00000000023700401
	Roodepoort	237 IQ	1	T0IQ00000000023700401
	Vlakfontein	238 IQ	1 (RE)	T0IQ0000000023800001
	Vlakfontein	238 IQ	94 (RE)	T0IQ0000000023800094
	Vlakfontein	238 IQ	92	T0IQ0000000023800092
	Vlakfontein	238 IQ	4	T0IQ0000000023800004

	Vogelstruisfontein	233 IQ	46	T0IQ00000000023300046
	Vogelstruisfontein	233 IQ	38	T0IQ00000000023300038
	Vogelstruisfontein	231 IQ	161	T0IQ00000000023100161
	Vogelstruisfontein	231 IQ	227	T0IQ00000000023100227
	Vogelstruisfontein	231 IQ	17 (RE)	T0IQ00000000023100017
	Zuurbult	240 IQ	240	T0IQ00000000024000000

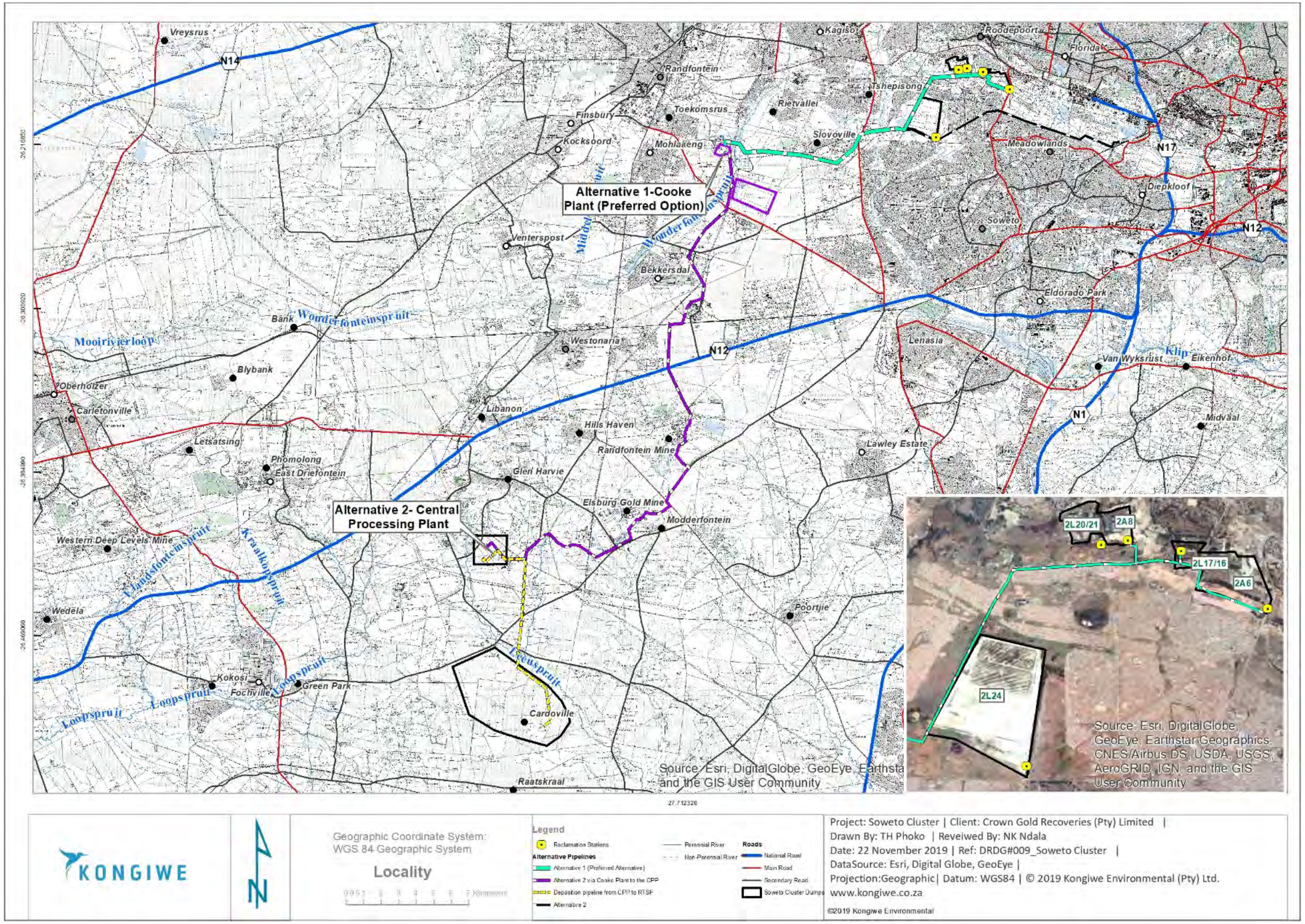

Figure 1-1: Site Locality Map

The reclamation methods used for the proposed project are **hydraulic reclamation** (for slimes dams) and **mechanical removal** (for sand dumps).

The Hydraulic monitoring will comprise high-pressure water cannons that will be directed onto the face of the slimes dams to break up the material and turn it into slurry as it mixes with the runoff water. The slurry will flow via slurry trenches to a catchment dam, feeding a pump station where screens will be used to remove vegetation, lumps of tailings and rubbish. Thereafter the slurry will be pumped via pipelines to the Plant. Mining will commence in the South East section and progress in a northerly direction. Concurrent rehab will take place as mining progresses.

The sand dumps will be reclaimed via front-end loaders. Two options have been investigated for the method of mechanical removal and slurry pumping.

- **Alternative 1:** The front-end loader will dump the sand tailings onto a conveyer belt from where the material will first be screened to separate rocks, roots and other large waste material. All material larger than 2 mm (e.g. wood fibre, ash, quartz, grit larger and rocks) will be stockpiled. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the gold plant via pipelines.
- **Alternative 2:** A hopper has been investigated as a potential alternative for pre-processing the sand dumps. Sand will be mixed with water and passed over a finger screen at the hopper. The resultant slurry will then be pumped a short distance from the hopper at the sand dumps to a point of connection with the slimes dam's slurry pipeline. The pipeline are envisioned to have sufficient capacity to pump the required slurry

The following infrastructure will be utilised on site:

- Overland slurry pipelines of 500 mm – 600 mm in diameter;
- Overland return water pipelines of 500 mm – 600 mm in diameter;
- Reclamation pump stations;
- Water infrastructure, stormwater systems and spillage handling systems;
- Electricity reticulation;
- Temporary administration buildings, including change houses and ablution facilities;
- Emergency Stormwater Dam;
- Access roads, routed from existing entry points; and
- Construction contractors' yards (temporary facilities).

More details regarding the proposed project are included in Chapter 2 of this EIA report.

1.2 Requirements for Environmental Authorisation

The Department of Environmental Affairs Forestry and Fisheries (DEFF), in consultation with the Department of Mineral Resources and Energy (DMRE) identified the need for the alignment of Environmental Authorisations (EAs) and promulgated a single environmental system under the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA). This has resulted in simultaneous decisions in terms of NEMA, the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM:WA) and other specific environmental management Acts.

As from 2 September 2014 the statutory dispensation regarding environmental management on mines changed with the implementation of the One Environmental System and the commencement of the National Environmental Management Laws Amendment Act, 2014 (Act No. 25 of 2014) (NEMLAA). In line with the One Environmental System the Environmental Impact Assessment Regulations (EIA 2014 Regulations) were promulgated and came into force on 8 December 2014. The EIA 2014 Regulations have subsequently been amended on the 7th of April 2017. With reference to the aforementioned, this S&EIA, prepared in support of the EA application, will comply with the requirements of the EIA 2014 Regulations, as amended.

The Proposed Project therefore requires an EA in terms of the NEMA and the NEM:WA and will follow a S&EIA process in terms of the EIA 2014 Regulations, as amended. The aforesaid regulations enforce a strict timeframe and require a decision by the competent authority, the DMRE, within **300 days** from submission of the EA application.

The nature and extent of the Proposed Project, as well as the potential environmental impacts associated with the construction, operation, decommissioning and rehabilitation of a facility of this nature is assessed and presented in this Environmental Impact Assessment Report (EIAr).

1.3 Overview of the Environmental Impact Assessment (EIA) Process

1.3.1 Overview of the Environmental Impact Assessment (EIA) Process

The following applications will be made to the DMRE for the Proposed Project:

1. **Application for EA** for listed activities triggered in Listing Notices GN R983, GN R984 and GN R985[2] published pursuant to the EIA Regulations 2014 (as amended), promulgated in terms of the National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA); and
2. **Application for a waste management licence (WML) authorising waste management activities listed** in GN R921 of 29 November 2013 published in terms of the National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (as amended) (NEM:WA).

In addition, the following applications will be made to the relevant Competent Authorities:

- **An Integrated Water Use Licence Application (IWULA)** in terms of the National Water Act, 1998 (Act No. 36 of 1998) (NWA) will be submitted to the Department of Human Settlements, Water and Sanitation (DHSWS) for any potential impact to water resources by the Proposed Project.

The period of the EA applied for is **20 years for the reclamation period.** It must be noted that even though

[2] These Listing Notices have been amended by GN R327, GN R325 and GN R324 of 7 April 2017

the EA applied for is a 20 year period, it may be the case that the project does not begin immediately until all environmental authorisations, surface right permissions, legal matter and favourable economics are in place.

The EIA findings, including specialist findings, are used by the applicant and authorities to obtain an objective view of the potential environmental, social and cultural impacts that could arise during the mining of the proposed area. Measures for the avoidance or mitigation of negative impacts will be proposed and positive impacts will be enhanced.

1.3.2 Methodology applied to conducting the Scoping Process

The outcome of the first phase of the S&EIA is the Scoping Report, which provides the terms of reference for undertaking the EIA Phase of the project. The figure below indicates the methodology that is applied in conducting the S&EIA process.

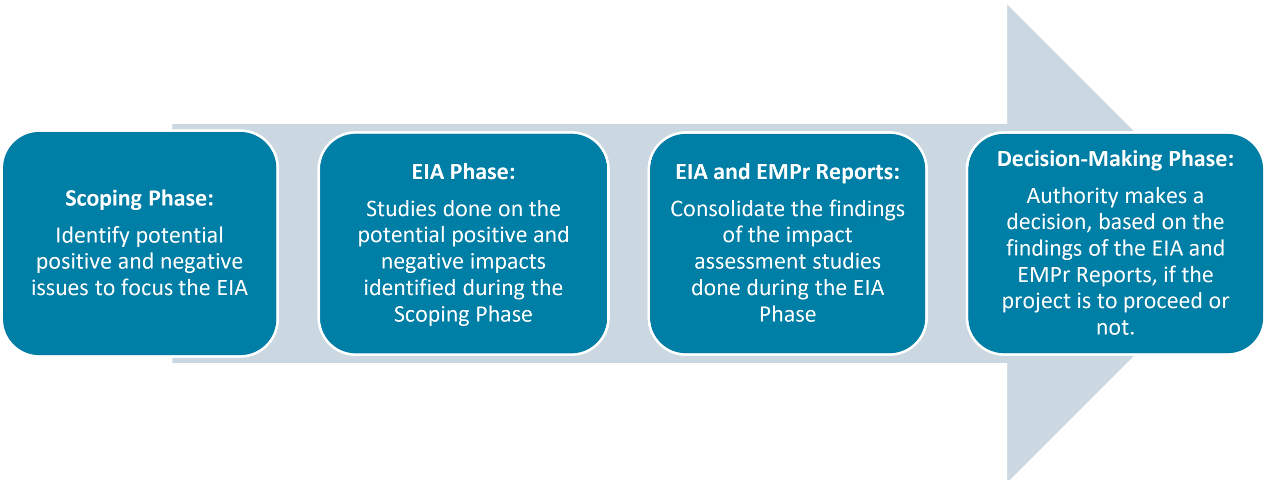

Figure 1-2: Methodology applied to conducting a S&EIA process

1.3.3 S&EIA Timeframes

- The **Draft Scoping Report (DSR)** was submitted and made available for a 30-day public review period. The comments received during this period were captured in a Comments and Responses Report (CRR) that was submitted with the Final Scoping Report.
- The **Final Scoping Report (FSR)** was submitted to the DMRE. The Department must either accept or reject the Scoping Report within 43 days. Once confirmation of acceptance has been received from the DMRE, the EIA Phase commences and will run for a period of 106 days, in which time stakeholders will be afforded a 30-day period in which to review and comment on the S&EIR documentation.
- Upon submission of the **Environmental Impact Assessment / Environmental Management Programme (EIA/EMPr)** document, the Competent Authority will have 107 days to reach a decision on the project (Record of Decision (RoD)). The RoD is otherwise referred to as the EA which authorises the activities to proceed. The decision to grant the EA may be appealed (within

20 days) by any party, including the Applicant, following the process outlined in the National Appeal Regulations (GNR 993 of 8 December 2014) published in terms of the NEMA.

- If **significant changes** to the EIA/EMPr are required which significant changes were not consulted on during the initial public participation process, a notice may be submitted to the DMRE stating that the EIA/EMPr will be submitted within 156 days from date of acceptance of the Scoping Report. During the aforesaid 156-day period, stakeholders will be afforded a further 30-day period in which to review the amended EIA/EMPr documentation.

Figure 1-3: S&EIA Timeframes

1.3.4 Public Participation Process

The Public Participation Process (PPP) has been designed to comply with the regulatory requirements set out in the EIA Regulations of 2014 (as amended). The PPP provides the opportunity for communication between agencies making decisions and the public. This communication can be an early warning system for public concerns, a means through which accurate and timely information can be disseminated, and can contribute to sustainable decision-making (IAP2, 2006).

Kongiwe encourages stakeholders to provide input into the S&EIA. The sharing of information forms the basis of PPP, with an aim to encourage the public to have meaningful input into the decision-making process from the onset of the project. Stakeholders can become involved in the project in the following ways:

During the Scoping Phase:

Identify issues of concern and suggestions for enhanced benefits	Verify that issues have been accurately recorded	Assist in identifying reasonable alternatives, where required	Contribute relevant local information and knowledge to the environmental assessment

During the EIA Phase:

Contribute relevant local information and knowledge to the environmental assessment	Verify that issues have been considered in the environmental investigations as far as possible	Comment on the findings of the environmental assessments

During the Decision-Making Phase:

Be advised of the outcome of the Competent Authorities decision, and how and by when the decsion can be appealed

1.4 Conclusions from the Scoping Phase

1.4.1 Evaluation of the Proposed Project

The Scoping study for the reclamation and reprocessing of the Soweto cluster dumps, which commenced in June 2019, was undertaken in accordance with the EIA Regulations of 2014 (as amended), promulgated in terms of Section 24 (5) of the NEMA. The Scoping report was aimed at detailing the nature and extent of the project, detailing the possible project risks and mitigation measures as well as the plan going forward into the EIA phase.

The baseline environmental information provided in the Scoping report was compiled as a high-level desktop investigation, and the project information is sourced from existing background information, relevant to the Proposed Project. A site visit was undertaken by Kongiwe on the 14th of August 2019 and photographs were taken by the project team to illustrate the current site conditions. Refer to Appendix B8 for photographic evidence of the site visit.

1.4.2 Potential Impacts Identified in the Scoping Phase

Preliminary environmental impacts were determined and have been populated in Table 1-2

As part of the Plan of Study for the EIA phase, these impacts have been further refined, calculated and assessed for all the feasible alternatives identified. Mitigation and management measures have been suggested by the specialists for all impacts identified.

Table 1-2: Potential identified impact because of the Proposed Project.

ENVIRONMENTAL COMPONENT	COMPONENT TYPE	POTENTIAL IMPACT	SPECIALIST STUDY PLANNED FOR EIA
Physical Environment (non-living)	Hydrology (including wetlands, surface water and ground water) Soils	❖ Potential for acid mine drainage (AMD), increased heavy metal concentration and increased sulphate concentration. ❖ Changes to water quality. ❖ Release of contaminated water to the environment. ❖ Changes in natural surface water flow parameters. ❖ Disruption to stream banks and wetlands. ❖ Changes to water regime of wetlands and affected streams. ❖ Further downstream movement of a pollution plume within the weathered zone aquifer. ❖ Soil contamination. ❖ The removal of the slime dams and sand dumps will lead to the removal of a major pollution source.	Surface Water Impact Assessment Groundwater Impact Assessment Wetland Impact Assessment
Biological Environment (living)	Ecology and Biodiversity (including fauna and flora)	❖ Disturbance of sites of conservation importance. ❖ Loss of migration corridors, and access to nesting and refuge areas, watering points, food supplies. ❖ Displacement of animal species ❖ Removal of invasive species from the slimes dams and sand dumps.	Biodiversity Impact Assessment
Cultural Environment	Heritage Resources	❖ Should heritage resources be present in the area, the reclamation project could potentially impact these.	Heritage Impact Assessment
Social and Economic Environment	Employment	❖ Continued employment and job security ❖ Continued investment in local economy	Social Impact Assessment
	Land-use	❖ Land use will change to an active reclamation site. ❖ Restoration and unlocking of land for future land uses. ❖ Management and control of the area	Social Impact Assessment
	Noise	❖ Increase in ambient noise levels. ❖ Disturbances to sensitive receptors.	Noise Impact Assessment

ENVIRONMENTAL COMPONENT	COMPONENT TYPE	POTENTIAL IMPACT	SPECIALIST STUDY PLANNED FOR EIA
	Illegal Mining	❖ Mitigating illegal mining in the project are through the removal of the dumps	Social Impact Assessment
	Air Quality	❖ Possible Increase in dust levels in areas where mechanical removal occurs. ❖ Fallout dust nuisances. ❖ Decreased dust levels in areas where hydraulic reclamation occurs. ❖ Air quality impacts on fauna and flora. ❖ Health impacts due to fine particulate emissions and gaseous emissions. ❖ The air quality will improve and dust pollution within the area will decrease once the unmanaged dumps and dams have been removed.	Air Quality Impact Assessment

1.4.3 Main issues arising in the Scoping Phase

During the Scoping phase of the project, issues and concerns were raised by various Interested and Affected Parties (I&APs) and Organs of State. This section provides a summary of the main issues raised during the Scoping Phase and provides an indication of where in this EIA these issues have been addressed.

The main issues raised have been sourced from the Comments and Responses Report (CRR) included as part of the Final Scoping Report (FSR) (dated 15 July 2019), which was submitted to the DMRE for their consideration.

Table 1-3: Potential identified impact because of the Proposed Project.

PROJECT STAKEHOLDER	MAIN ISSUE RAISED	REFERENCE IN THE EIA REPORT
Rand Water	❖ Concerned about the physical impact of pipeline infrastructure/construction on rivers, streams and wetlands	Chapter 7 and Chapter 8 Appendix D2 and Appendix D1
	❖ Concerned about the potential for pollution of rivers, streams and wetlands should a pipeline fail	Chapter 7 and Chapter 8 Appendix D2 and Appendix D1
Freedom for a Sustainable Environment (FSE)	❖ Concerned about the effect of incomplete rehabilitation of reclaimed dumps	Chapter 9 and Appendix E4
	❖ Concerned about the long-terms seepage impacts on groundwater should deposition occur at Brakpan/Withok TSF, the Cooke TSF.	Chapter 7 and Chapter 8 Appendix D3
	❖ Concerned about the elevated levels of residual radioactivity in the soils following rehabilitation and the use of the land considering residual radioactivity.	Chapter 9 and Appendix E4
	❖ Concerned about the remobilization of contaminants (such as uranium and cyanides) during reclamation.	Chapter 7 and Chapter 8
Thero Services	❖ Questioned how the mining plan address the challenge of Acid Mine Drainage, dust nuisance and radioactive chemicals associated with the Western Basin?	Chapter 7 and Chapter 8
Skyy Crew Environmental Consultancies and Projects	❖ Concerned about the dust fallout effects on the community, livestock and subsistence farms if reclamation takes place during windy months such as August.	Chapter 7 and Chapter 8 Appendix D4
	❖ Concerned about the impact of the proposed project on the Klipriver spruit, which is already heavily contaminated by raw sewage and acid mine drainage up stream.	Chapter 7 and Chapter 8 Appendix D2

Comments received outside of, or on the last day of the 30-day commenting period of the DSR (4 June 2019 – 8 July 2019) were not included in the CRR of the FSR. However, Table 1-4 below highlights the main concerns stakeholders raised during this period. Furthermore, these comments have been included in the CRR of this EIA in Appendix C.

Table 1-4: Potential identified impact because of the Proposed Project.

PROJECT STAKEHOLDER	MAIN ISSUE RAISED	REFERENCE IN THE EIA REPORT
Gauteng Department of Health	❖ Concerned about the health effects of dust emissions and radioactivity on the community	Chapter 7 and Chapter 8 Appendix D8 and Appendix D4
	❖ Concerned about the management of waste throughout the life of the project	Appendix E2
City of Johannesburg	❖ Concerned about stormwater management around the facilities to prevent flooding.	Chapter 7 and Chapter 8 Appendix E5
	❖ Concerned about the informal mining by Zama-Zama's	Chapter 5, Chapter 7 and Chapter 8
Eskom	❖ The impact of the construction and operation of the pipelines on Eskom's overhead and underground cables.	Chapter 2 and Chapter 3
Living Africa	❖ Concerned that due the lack of vegetation on the current 2L20 dump air-quality may be even more compromised during reclamation.	Chapter 7, Chapter 8 and Appendix D4
Freedom for a Sustainable Environment (FSE)	❖ Concerned about dust fallout and radiation impacts on health and suitable prevention measures thereof.	Chapter 7, Chapter 8 and Appendix D4 and Appendix D8
	❖ Concerned that there will be a risk of the remobilisation of the metals and radionuclides during the reclamation process	Chapter 7 and Chapter 8
Umhlaba Environmental Consulting (on behalf of Rand Leases)	❖ Concerned about the implications of residual radiation levels and the impact of groundwater pollution plumes.	Chapter 7 and Chapter 8 Appendix D3
	❖ Concerned about pipeline spills and leaks.	Chapter 7 and Chapter 8
	❖ Concerned about the implications of unscheduled closure, and how this would be handled.	Chapter 2 and Chapter 8
	❖ Concerned about the impact of pipeline Alternative 2, consider it traverses Maxam Dantex explosives where regular blasting takes place.	Chapter 2 and Chapter 3

1.4.4 Scoping Phase Conclusions and Recommendations

The Scoping report found that **__no environmental fatal flaws__** exist for the Proposed Project. While some limitations do exist, it is anticipated that the implementation of appropriate mitigation measures would assist in reducing the significance of such impacts to acceptable levels

It is important to take note of the current conditions of the propose project area. Currently the area is unmanaged. It was concluded that the economic benefits arising from the project include the stimulation of economic activity, realising the mineral wealth that was trapped in these dumps, and releasing prime land located within the hub of economic activity for re-development - in line with the City of Johannesburg's plans for transformation.

The environmental benefits are significant in the sense that reprocessing eradicates the badly located and constructed dumps and the waste resulting from retreatment is consolidated in new dumps constructed in line with best environmental practice, lastly the dust and water emissions/pollution should be minimised in the long term.

1.5 Details of the Independent Environmental Assessment Practitioner (EAP)

Kongiwe Environmental (Pty) Ltd (Kongiwe) is a contemporary, problem-solving consultancy specialising in solving real-world environmental challenges. We pride ourselves in using the latest technology available to realise pragmatic solutions for our clients. The company was created with the essential intent: *'To solve environmental challenges for a world driven towards a sustainable future'.*

Based in Johannesburg, South Africa, our team of professional Environmental Scientists are highly trained in various environmental disciplines and have significant, hands-on experience in an array of projects across various industries. The company has extensive environmental and project management experience in multiple sectors, with significant experience in South Africa, as well as internationally. Kongiwe focuses on the integration of environmental studies and processes into larger engineering and mining projects. Moreover, Kongiwe provides clients with strategic environmental assessments and compliance advice, the identification of environmental management solutions and mitigation / risk minimising measures throughout the project lifecycle.

1.5.1 Contact Person and Corresponding Address

Details of the Environmental Assessment Practitioner (EAP) who prepared the report are presented in Table 1-5:

Table 1-5: Details of EAP.

NAME OF PRACTITIONER	Ashleigh Blackwell
TEL NO	+27 (10) 140 6508
FAX NO	086 476 6438
E-MAIL ADDRESS	ablackwell@kongiwe.co.za

1.5.2 Expertise of the EAP

Ashleigh Blackwell has an B.Sc. (Hons) in Conservation Ecology from the University of Stellenbosch and is a registered Natural Scientist with the South African Council for Natural Science (SACNASP) (Environmental Scientist) (Registration No: 117167). She has 4 years' work experience, predominantly in the renewable energy and mining industry. Her qualifications can be found in Appendix A.

1.5.3 Summary of the EAP's Past Experience

Ashleigh Blackwell has 4 years' work experience as an environmental consultant, predominantly in the renewable energy and mining industry. Her practical experience in the mining and construction industry has given her a depth of knowledge regarding project processes from pre-feasibility phase through to implementation. She is adept at working in different contexts, and problem-solving with her team to meet client needs. She has expertise in relation to Environmental Authorisation Processes in terms of the South African legal framework. In addition, Ashleigh has attended various training courses in Environmental Law and is currently completing her M.Sc in Soil Science through the University of Pretoria.

1.5.4 Additional Project Team Members

Team members that have been integral in the successful production of this Environmental Impact Assessment and Environmental Management Programme (EIA/EMPr) are represented in Table 1-6 below.

Table 1-6: Kongiwe team members.

TEAM MEMBER	POSITION IN THE COMPANY	ROLE AND RESPONSIBILITIES
Bradly Thornton	Chief Executive	High-Level project management and report review.
Gerlinde Wilreker	Technical Director (Pr.Sci.Nat)	Report review and Authorisation
Michael Hennessy	Legal Director	Legal review of report documentation
Sibongile Bambisa	Stakeholder Engagement and Social Consultant	Stakeholder Engagement and all other Public Participation requirements Social Impact Assessment
Vanessa Viljoen	Social Consultant	Assistance with Stakeholder Engagement and all other Public Participation requirements
Nokuthula Ndala	GIS Consultant	GIS Mapping
Foord Ceronio	Environmental Consultant	Scoping phase report compilation
Siphesihle Dambuza	Environmental Consultant	Compilation of the IWULA and Water Use Licence process.

1.5.5 Independent Specialist Team Members

A number of independent specialist consultants have been appointed as part of the S&EIA team to adequately identify and assess potential impacts associated with the proposed project (Table 1-7). The specialist consultants have provided input into this EIAr as well as EMPr (Refer to Appendix D).

Table 1-7: Specialist team members.

SPECIALIST STUDY	SPECIALIST COMPANY	SPECIALIST NAME	PEER REVIEWER
Biodiversity (Fauna, Flora, Wetlands and Aquatics)	The Biodiversity Company	Andrew Husted (Pr.Sci.Nat)	Anita Rautenbach (Pr.Sci.Nat)
Surface Water	HydroSpatial	Andy Pirie (Pr.Sci.Nat)	Sivan Daher (Pr.Sci.Nat)
Groundwater	Groundwater Abstract	Lucas Smith (Pr.Sci.Nat)	Irene Lea (Pr.Sci.Nat)
Air Quality	Gondwana Environmental Solutions	Anja van Basten	Dr Martin van Nierop
Heritage	PGS Heritage	Wouter Fourie (APASA) (APHP)	Jaco van der Walt (ASAPA) (SAHRA) (AMAFA)
Social	Kongiwe Environmental	Sibongile Bambisa	Gerlinde Wilreker (Pr.Sci.Nat)
Noise	Enviro Acoustic Research	Morné de Jager	Johan Maré (Pr.Sci.Nat)
Traffic	EDL Consulting Engineers	John v Rooyen	Eben D. Kotze (Pr.Tech.Eng)
Health	Kongiwe Environmental	Gerlinde Wilreker (Pr.Sci.Nat)	Natasha Taylor-Meyer

1.6 Structure of this Environmental Impact Assessment report (EIA)

The nature and extent of the proposed project, as well as the potential environmental impacts associated with the construction, operation and decommissioning is assessed and presented in this EIA/EMPr.

This EIA has been compiled in terms of the provisions of Appendix 3 and Appendix 4 of the EIA Regulations 2014, as amended, and the Directive set out in the template prescribed by the DMRE. Table 1-8 cross-references the various sections in this report with these requirements.

Table 1-8: Structure of the Final EIA Report in line with the Appendix 2 of the EIA 2014 Regulations

NEMA REGULATION REQUIREMENT		REPORT SECTION	PAGE NUMBER
(a)	**Details of -**		
(iii)	The EAP who prepared the report and;	Chapter 1.5	10
(iv)	The expertise of the EAP, including a CV	Appendix A	11
(b)	**The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:**	Chapter 1.1	
(i)	The 21-digit Surveyor General code of each cadastral land parcel		4
(ii)	Where available, the physical address and farm name		2-5
(iii)	Where the required information in terms of (i) and (ii) is not available, the		2-5

	NEMA REGULATION REQUIREMENT	REPORT SECTION	PAGE NUMBER
	coordinates of the boundary of the property or properties		
(c) (i) (ii)	**A plan which locates the proposed activity or activities applied for as well as the associated structures and infrastructure at an appropriate scale, or, if it is –** A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken On land where the property has not been defined, the coordinates within which the activity is to be undertaken	Appendix B3	
(d) (i) (ii)	**A description of the scope of the proposed activity, including –** All listed and specified activities triggered and being applied for A description of the associated structures and infrastructure related to the development	Chapter 4.1 Chapter 2.2	44-45 21-24
(e)	**A description of the policy and legislative context within which the development is located and an explanation of how the proposed development complies with and responds to the legislation and policy context**	Chapter 4	42-63
(f)	**a motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report**	Chapter 5	64-66
(g)	**A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report**	Chapter 3.1	30-40
(h)	**A full description of the process followed to reach the proposed development footprint within the approved site as contemplated in the accepted scoping report, including -**	Chapter 3	30-41
(i)	Details of the development footprint alternatives considered	Chapter 3	30-41
(ii)	Details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs	Chapter 6 Appendix C	69
(iii)	A summary of the issues raised by interested and affected parties, and an indication of the manner in which the issues were incorporated, or the reasons for not including them.	Appendix C9	
(iv)	The environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Chapter 7	81-205
(v)	The impacts and risks identified for each alternative, including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts – (aa) can be reversed; (bb) may cause irreplaceable loss of resources; and (cc) can be avoided, managed or mitigated	Chapter 8	206-271
(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks	Chapter 8.1	206-208

	NEMA REGULATION REQUIREMENT	REPORT SECTION	PAGE NUMBER
(vii)	Positive and negative impacts that the proposed activity and alternatives will have on the environment and on the community, that may be affected focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects	Chapter 8.2	208-258
(viii)	The possible mitigation measures that could be applied and level of residual risk	Chapter 8.3	259-271
(ix)	If no alternative development footprints for the activity were investigated, the motivation for not considering such	Chapter 3.1 and Chapter 3.2	38-41
(x)	A concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report.	Chapter 3.1	39
(i)	**A full description of the process undertaken to identify, assess and rank the impacts the activity and associated structures and infrastructure will impose on the preferred development footprint on the approved site as contemplated in the accepted scoping report through the life of the activity, including-**	Chapter 8.1	206-207
(i)	a description of all environmental issues and risks that were identified during the environmental impact assessment process	Chapter 8.2	208-258
(ii)	an assessment of the significance of each issue and risk and an indication of the extent to which the issue and risk could be avoided or addressed by the adoption of mitigation measures	Chapter 8.2 Chapter 8.3	208-269
(j) (i) (ii) (iii) (iv) (v) (vi) (vii)	**An assessment of each identified potentially significant impact and risk, including-** cumulative impacts; the nature, significance and consequences of the impact and risk; the extent and duration of the impact and risk; the probability of the impact and risk occurring; the degree to which the impact and risk can be reversed; the degree to which the impact and risk may cause irreplaceable loss of resources; and the degree to which the impact and risk can be mitigated;	Chapter 8.3	259-269
(k)	**Where applicable, a summary of the findings and recommendations of any specialist report complying with Appendix 6 to these Regulations and an indication as to how these findings and recommendations have been included in the final assessment report**	Chapter 8.4	270-272
(l)	**an environmental impact statement which contains-**		
(i)	a summary of the key findings of the environmental impact assessment:	Chapter 8.4	270-272
(ii)	a map at an appropriate scale which superimposes the proposed activity and its associated structures and infrastructure on the environmental sensitivities of the preferred development footprint on the approved site as contemplated in the accepted scoping report indicating any areas that should be avoided, including buffers; and	Figure 3.4	40
(iii)	a summary of the positive and negative impacts and risks of the proposed	Chapter 8.4	270-272

NEMA REGULATION REQUIREMENT		REPORT SECTION	PAGE NUMBER
	activity and identified alternatives;		
(m)	**Based on the assessment, and where applicable, recommendations from specialist reports, the recording of proposed impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation**	Chapter 8.3	259-269
(n)	**The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;**	Chapter 3.1.2	33
(o)	**Any aspects which were conditional to the findings of the assessment either by the EAP or specialist which are to be included as conditions of authorisation**	Chapter 9.2	280
(p)	**A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed**	Chapter 9	272-280
(q)	**A reasoned opinion as to whether the proposed activity should or should not be authorised, and if the opinion is that it should be authorised, any conditions that should be made in respect of that authorisation**	Chapter 9.5	282
(r)	**Where the proposed activity does not include operational aspects, the period for which the environmental authorisation is required and the date on which the activity will be concluded, and the post construction monitoring requirements finalised**	Chapter 9.6	283
(s) (i) (ii) (iii) (iv)	**an undertaking under oath or affirmation by the EAP in relation to-** the correctness of the information provided in the reports the inclusion of comments and inputs from stakeholders and I&APs the inclusion of inputs and recommendations from the specialist reports where relevant any information provided by the EAP to interested and affected parties and any responses by the EAP to comments or inputs made by interested or affected parties	Chapter 9.6	283
(t)	**Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;**	N/A	N/A
(u) (i) (ii)	**an indication of any deviation from the approved scoping report, including the plan of study, including-** any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and a motivation for the deviation;	Chapter 3.1	30-39
(v)	**Any specific information that may be required by the competent authority**	Chapter 9.3	291
(w)	**Any other matters required in terms of section 24(4)(a) and (b) of the Act**	N/A	N/A

CHAPTER 2: PROJECT DESCRIPTION

This chapter of the EIA provides a description of the Soweto Cluster dumps reclamation and reprocessing project..

2.1 Detailed Project Description

The proposed projects entails the reclamation and reprocessing of gold from six historic slimes dams: 2L24; 2L20; 2L21; 2L16; 2L17 and 2L18 as well as two historic sand dumps 2A6 and 2A8. These dams and dumps are referred to collectively as the "Soweto Cluster" and were all created prior to the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) which came into force in 2004.

A Mining Right is not a prerequisite to reclaim historic Tailings Storage Facilities (TSF). Listed activities applied for are indicated in Table 4-1. Crown Gold has applied for an Environmental Authorisation for activities triggered by the NEMA.

2.1.1 Project Site Description

Section 1.1 and Table 1-1 provide a comprehensive overview of the locality of the project site. This section aims to describe current infrastructure impacted on by the project, the surrounding land uses and knowledge of any existing Applications and/or Licences and/or Permits.

Through consultation as well as limited fieldwork, it was found that the following infrastructure is encountered in the area:

- National and provincial roads (R41, M77 and R558);
- Residential and commercial properties:
- Industrial properties;
- Eskom Power lines;
- Rand Water pipelines;
- Transnet pipelines;
- Durban Deep Golf Course;
- Dobsonville Cricket Club;
- Harmony Doornkop Gold Mine; and
- Historic Mine Dumps.

The Soweto Cluster is situated in an urban area, located next to the suburb of Bramfischerville in Soweto. The Soweto Cluster project area is classified in the Gauteng Provincial Environmental Management Framework (GPEMF) (2014) as 3b. 3b Zones are described as Built-up land (residential, CBD, etc.) with a strong mining and/or industrial character. The communities directly adjacent to the Soweto Cluster include Bramfischerville Township 14, Thulani, Bram Fischerville, Goudrand, Matholesville, Creswell Park and Dobsonville. A site visit was undertaken by Kongiwe on the 14th of August 2019 and photographs were taken by the project team to illustrate the current site conditions. Refer to Appendix B8 for photographic evidence of the site visit.

The following community activities and infrastructure include (but are not limited to):

- Illegal mining operations;
- Places of worship;
- Grocery Stores, Supermarkets, Butcheries and Spaza Shops;
- Health facilities and Recreation facilities;
- ATMs and banking facilities;
- Taxi Ranks;
- Landfill;
- Community Led Animal Welfare (CLAW) Centre; and
- A rifle club.

The Soweto Cluster is surrounded by several active and historic mining activities. The active mining activities vary in ownership but are primarily quarries (sand and silica mining) and gold mines (Harmony; Doornkop Gold Mine, Sibanye-Stillwater, Mintails Group, and Lancaster Gold Mine). The historic mining presence is also made clear by several other unrelated mine dumps scattered around the proposed project site.

To the knowledge of the EAP, the following developments in Figure 2-1 are proposed by other Applicants within the region of the Soweto Cluster dumps. Information regarding these developments was obtained from one-on-one consultations, and to illustrate the respective developments within the project area. Maps/plans were sourced from the internet (public documentation) for the various projects and are contained within Appendix B of this EIA report.

Table 2-1: Other Known Applications around the Soweto Cluster project

APPLICANT	PROJECT	REFERENCE
Calgro M3	❖ Witpoortjie Mega City	Refer to Appendix B6 ❖ Unknown
Rand Leases	No longer affected with the removal Alternative 2 proposed in the Scoping Phase.	
Dino Properties / Blue Print Development	❖ Goudrand Mega City ❖ Matholesville Development 3 -5	Refer to Appendix B7 ❖ Unknown
Harmony Gold	❖ Harmony Doornkop Gold Mine ❖ Randfontein Estates residential development project	❖ GP30/5/1/2/2/09MR ❖ Unknown
West Wits MLI (Pty) Ltd	❖ The proposed West Wits Mining Project	Refer to Appendix GP 30/5/1/2/2/10073 MR

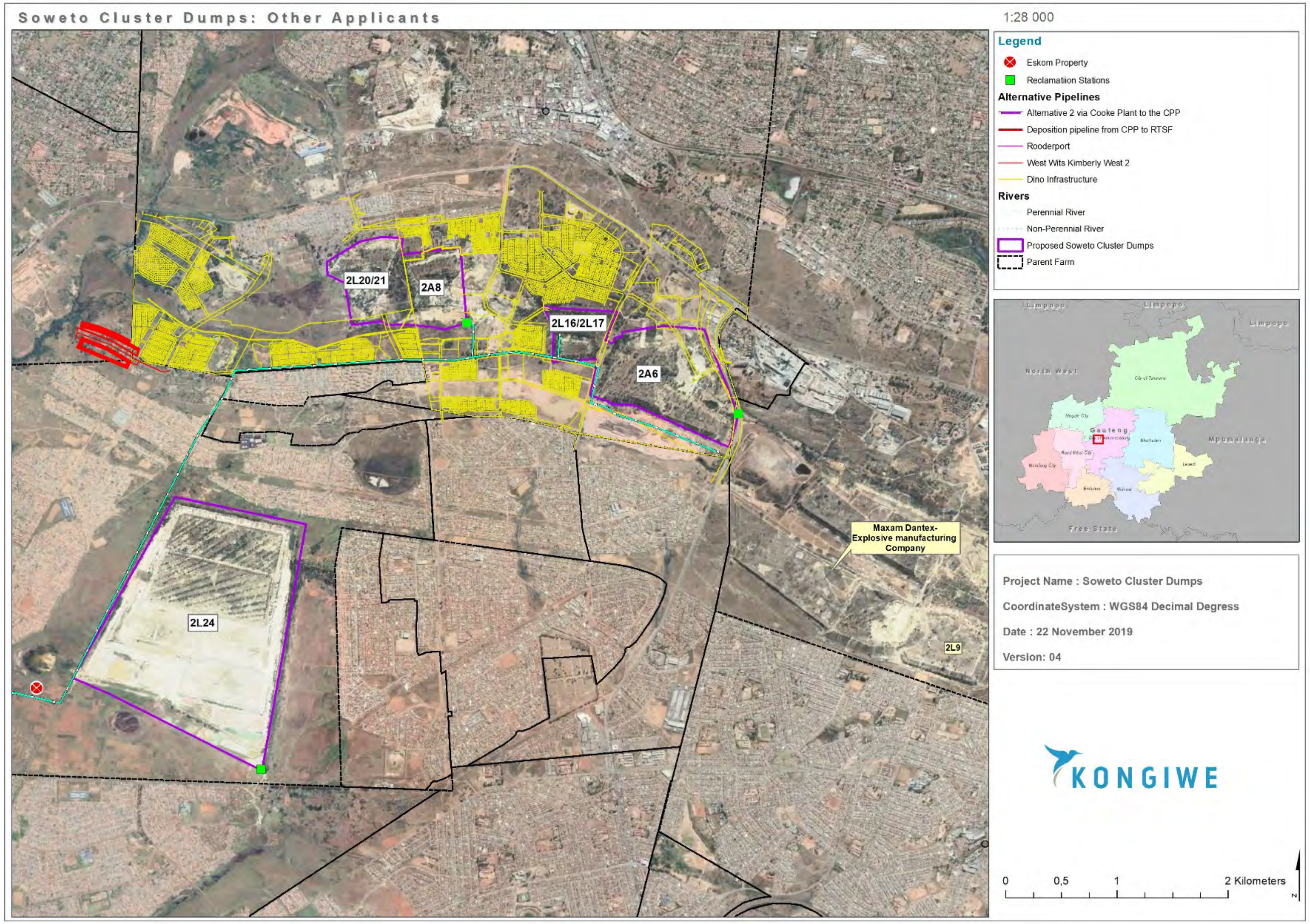

Figure 2-1: Other Applications within the Soweto Cluster Project Area

2.1.2 Description of the Reclamation Methods

2.1.2.1 Hydraulic Mining of Slimes Dams

Slimes dams are a result of older treatment methods, although they are more recent than sand dumps, and contain lower grades of gold. However, this material has become economically more viable to process owing to improved treatment methods and a higher gold price.

The proposed mining method is referred to as top-down hydraulic mining. This technique uses water monitors (or water cannons) to deliver a high-pressure water jet to hydraulically excavate unconsolidated tailings material within the slime's dams. The water from the cannon mixes with the tailings and forms a slurry with a high solids content. The slurry then flows under gravity along trenches at the base of the dump to a collection sump, which is positioned at the lowest elevation of the bench being mined.

At the sump, finger screens remove any debris that may impact pumping operations, and a penstock will control water flow into the sump. The position of the collection sump will change as the reclamation progresses. To control the volume of water reporting to the reclamation station, flapper valves are used to hold, and release slurry contained in the collection sump. This slurry is then pumped via new and existing pipelines to one of the three alternative processing plants where the slurry is prepared and treated for gold extraction and beneficiation.

Figure 2-2: Mobile tracked hydraulic monitor on a tailing's facility in South Africa

2.1.2.2 Mechanical removal of Sand Dumps

Sand dumps are the result of the less efficient 'stamp-milling' processes employed in the early gold mining years. They consist of coarse-grained particles which generally contain higher quantities of gold.

The sand dumps will be reclaimed via front-end loaders. Two options have been investigated for the method of mechanical removal and slurry pumping.

- **Alternative 1:** The front-end loader will dump the sand tailings onto a conveyer belt from where the material will first be screened to separate rocks, roots and other large waste material. All material larger than 2 mm (e.g. wood fibre, ash, quartz, grit larger and rocks) will be stockpiled. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the gold plant via pipelines. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the (1) Cooke Plant or (2) CPP.
- **Alternative 2:** A hopper has been investigated as a potential alternative for pre-processing the sand dumps. Sand will be mixed with water and passed over a finger screen at the hopper. The resultant slurry will then be pumped a short distance from the hopper at the sand dumps to a point of connection with the slimes dam's slurry pipeline. The pipeline are envisioned to have sufficient capacity to pump the required slurry. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the (1) Cooke Plant or (2) CPP.

Figure 2-3: Mechanical Removal of sand from Sand Dumps. Front-end Loaders and a conveyor in operation

Concurrent rehabiliation will take place as mining progresses. This will entail the following:

- Step 1: Removal of remnant slimes material and screen oversize;
- Step 2: Backfilling and shaping of the area;

- Step 3: Storm water control:
    - diversion channels;
    - paddocks;
    - berms;
- Step 4: Soil amelioration;
- Step 5: Vegetation establishment; and
- Step 6: Monitoring and maintenance of rehabilitated areas.

Care will be taken to ensure that the material and excavated soil required for backfilling are free of contamination from hydrocarbons.

2.2 Description of Project Infrastructure

The Soweto Cluster dumps are well serviced by existing roads and infrastructure. Capital will be expended on new pipelines, pumps stations, water infrastructure and electricity reticulation.

The following infrastructure and vehicles will be utilised on site:

1. Reclamation pump stations;
2. Mobile hydraulic water cannon;
3. Overland slurry and return water pipelines of 500 mm – 600 mm in diameter;
4. Stormwater systems and spillage handling systems;
5. Temporary administration buildings, including change houses and ablution facilities;
6. Access roads, routed from existing entry points; and
7. Front-end Loaders; and
8. Conveyors and/or a Hopper.

A pump station (or reclamation station) will be established on each of the sites which will pump the resultant slurry through new and existing pipelines to the determined plant where it will be reprocessed. The construction of the pump stations will be such that there is:

- A 0.5 ha area demarked for a pump station at the base of 2L24 at Site 1
- A 0.5 ha area demarked for a pump station at the base of 2L20 and 2L21 at Site 2
- A 0.5 ha area demarked for a pump station at the base of 2A6 at Site 2
- A 0.5 ha area demarked for a pump station at the base of 2L16, 2L17 and 2L18 at Site 3
- A 0.5 ha area demarked for a pump station at the base of 2A8 at Site 3

The pump stations are situated at the base of the dumps, at the lowest point in the topography as to assist the gravitational movement of slurry. This pump station infrastructure will consist of the following:

- Slurry storage tank 12 x 12 m;
- Linear screen 20 m^2;
- Water tank 12 x 12 m;
- Motor control centre;

- Operations office;
- 5 MVA substation.

Relevant areas will be bunded and the working area will have clean and dirty water separation as well as large pollution paddocks to contain dirty water. This water will be pumped to the Water Treatment Works for reuse in the reclamation process.

The proposed **new pipelines** will consist of a return water pipeline and a slurry pipeline. The pipelines will facilitate the connection between the dumps and pump station to the existing pipeline network located at the Cooke Plant. The slurry pipeline will be between 500 - 600 mm steel pipe lined with HDPE, which will have the capacity to transport up to 1.2 tons/month of slurry. A Preferred (36 km) and Alternate (18.5 km) route have been identified; see Appendix B3.

Major **routes** around the mine dumps are the R41 which run east to west from Randfontein towards the Johannesburg CBD; the M77 which runs north to south from the R41 through Soweto to the M68; and the R558 which runs north to south from Krugersdorp towards Lenasia. As far as possible, existing **access roads** will be utilised, and where this is not possible, these will be constructed as a two-by-two roadway, operating in both directions. Where access roads are to be constructed, these will be 4m wide gravel road with storm water earth channels and mitre drains to protect the road structure from flood damage. Intersections will be properly designed to provide safe entry and exit into the mining area. Approvals from the provincial road's authority will be obtained where necessary.

Where necessary **power** will be supplied by Eskom and **potable water** will be purchased from either Rand Water or municipal water, with a contingency for portable JoJo tanks or connection to existing water pipeline infrastructure.

In terms of **process water**, the water cycle operates as a closed circuit, meaning that limited make-up water will be required for the reclamation of the Soweto Cluster. Water required for the reclamation activities will be recovered from existing underground shafts and/or pits, an authorised water holding facility and/or a authorised water treatment plant. It has been assumed that 80 % of the monthly water used for reclamation would runoff as slurry and all water will be reused, except for water lost to evaporation.

Each site has existing paddocks and **stormwater infrastructure,** such as berms and separation trenches. Existing paddocks (containment berms) are constructed on top of, and next to, the dump to capture and contain stormwater runoff. This existing infrastructure will need to be desilted prior to commencing with operation activities. A flapper valve is proposed at the top of the dump, at the point where the slurry trench discharges into the penstock. The purpose of the flapper valve will be to contain stormwater runoff on top of the dump, in order to alleviate the amount of runoff reporting to the reclamation station. Slurry will be transported from the flapper valve, via a penstock (pipeline) to the reclamation station. All stormwater will be managed on top of the slimes dam (through the opening and closing of the flapper valve) and not at the reclamation station.

Refer to Appendix D3 for a description of stormwater management measures proposed for the project as read in the Surface Water report. Information that provides perspective on the scale of the Proposed Project is presented in the table below.

Table 2-2: Project perspective and technical details.

GROUP	SPECIFIC	DETAILS
Mining	Target Mineral	❖ Primary: Gold
	Minable Area	❖ A total of 430.36 Ha.
	Processes	❖ Abstraction of water from Underground shafts/pits, a bulk water storage facility, and a water treatment works ❖ Hydraulic reclamation and mechanical removal ❖ Disposal of residue slurry at the RTSF ❖ Gold extraction at the CPP
	Extent of area for infrastructure within the dump footprint boundary	❖ Site 1: 0.5 ha ❖ Site 2: 1 ha (0,5 ha at the slimes dams and 0,5 ha at the sand dumps) ❖ Site 3: 1 ha (0,5 ha at the slimes dams and 0,5 ha at the sand dumps) Total of 2.5 ha total development footprint
	Pumping	❖ Up to 1.2 million tons per month of slurry ❖ Pumping of water from the RTSF to the Reclamation sites
Resource use	Water demand	❖ > 20 ML per day
	Power demand	❖ Eskom
Employment	Staff allocation: construction	❖ Continual Development
	Operating Times	❖ 7 days a week- 24hrs a day

2.2.1 Authorised Central Processing Plant and Regional Tailings Storage Facility – West Rand Tailings Retreatment Project

DRDGold Limited (of which Crown Gold Recoveries is a subsidiary) concluded an acquisition for gold assets associated with Sibanye-Stillwater's West Rand Tailings Retreatment Project (WRTRP). The assets, comprising a 2.7-million-ounce reserve and acquired on August 1, 2018, are now known as Far West Gold Recoveries (FWGR). The acquisition increases DRDGold's reserves by about 82%, with both projects boasting a mineral reserve totalling six-million ounces of gold.

Infrastructure associated with the Central Processing Plant and the Regional Tailing's Storage Facility was authorised as part of this project. WRTRP is a large-scale, long-life surface tailings retreatment opportunity. The project was authorised by the DMRE on the 11th May 2018 under the reference GP 30/5/1/2/3/2/1 (66) EM.

It is for this reason that Crown Gold prefers to utilise the modern facilities to be constructed as part of the WRTRP.

2.3 Life-Cycle Phases of the Project

The mining method is divided into a number of stages, as shown in Figure 2-4 below.

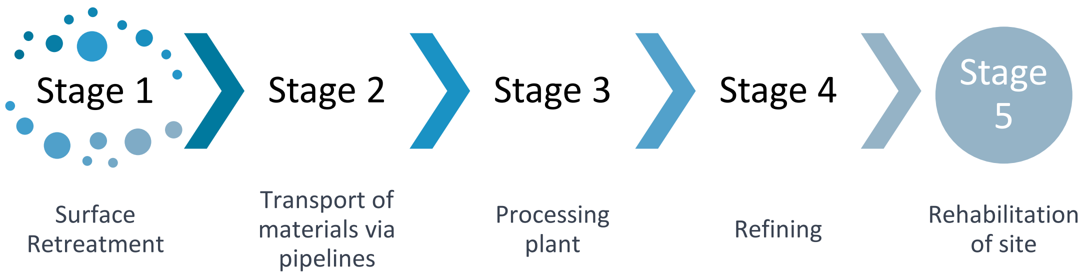

Figure 2-4: Reclamation Process

2.3.1 Estimated Project Timeframes

The anticipated life span of the project is approximately **20 years maximum.** The proposed project could start immediately (should Environmental Authorisation be granted) in 2021 and continue to 2040 following a 2 year period of post-closure environmental monitoring. It must be noted that even though the EA applied for is a 20 year period, it may be the case that the project does not begin immediately until all environmental authorisations, surface right permissions, legal matter and favourable economics are in place. Table 2-3 gives an indication of the estimated timeframes in relation to the implementation of the actions, activities or processes of the mining phases (construction, operation and decommissioning) for the proposed project.

Table 2-3: Estimated timeframes and deadlines of the different phases associated with the Reclamation of the Soweto Cluster Mine dumps

PHASE	TIMEFRAME	YEAR START DATE
Pre-Construction for all sites	2 years	2021
Construction at all sites	2 years	2023
Operations starting at 2L24	6 years	2025
Operations continuing to other dumps	6 years +	2028
Decommissioning at all sites	18 months	2034
Closure at all sites	1 year	2036
Post-Closure at all sites	Monitoring 2 years	2038

2.3.2 Life-Cycle Phases of the Project

The following table is summary of the activities that will occur at the different phases of this project.

Table 2-4: Summary table of the Activities associated with the different phases of the proposed project

ACTIVITY	DESCRIPTION
Pre-Construction	
1	Conduct Radiation walk-over survey
2	Removal of vegetation and site clearance
3	Preparation of access roads
Construction Phase	
4	Employment of workers (minimal)
5	Construction of Pump station
6	Construction of pipelines
7	Operation of construction machinery and vehicles
8	Temporary storage of construction materials and hazardous material such as contaminated soil
9	Instatement of waste management and dust control measures on site
Operational Phase	
10	Reclamation Activities (including concurrent rehabilitation)
12	Operation of pipes
12	Operation of Pump Station
Decommissioning	
13	Decommissioning and Rehabilitation activities: Demolition of temporary infrastructure such as: screens, the pump station and pipelines, and Rehabilitation of the project area.
Post-Closure	
14	Post- Closure Rehabilitation and Monitoring.

2.3.3 Pre-Construction Activities

Prior to the initiation of construction, a radiation survey will be undertaken to determine the radioactive baseline currently occurring at the sites. In addition the sites will be cleared of vegetation, and access will be prepared for construction. The existing paddocks will be desilted prior to commencing with construction.

2.3.4 Construction Phase Activities

The construction phase is brief and will entail the construction and placement of new pipelines, a main pump station, water infrastructure and electricity reticulation will be constructed. The pump station infrastructure will be located in the south-eastern corner of 2L24, 2L20 and 2L21, 2A8, 2L16 and 2A6. The pump stations will be located on the western-end of dump 2L17 and 2L18. Conveyors and or a Hopper for the reclamation of sand dump 2A6 and 2A8 will be placed within the 0.5 ha development footprint.

During the construction phase of the project the environmental aspects of land transformation and sterilisation, 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 and flora) of the project areas.

2.3.5 Operational Phase Activities

Mining will start on the dump 2L24 on Portion 1 of the Farm Vlakfontein 238 IQ. This dump is comprised of slime material and will be reclaimed via hydraulic monitoring. Mining will progress in a northerly direction from the southern boundary. Concurrent rehabilitation will be performed during the operational phase; see Section 1.1.1 for details.

During reclamation of Dump 2L24, reclamation will begin at site 2 followed sequentially by reclamation at Site 3. The full operational and production of the Soweto Cluster mine dumps will comprise mining by hydraulic monitoring for the slimes dams whereas the sand dumps will be mined via front end loaders.

2.3.6 Decommissioning Phase Activities

The slimes dam 2L24 will be the first dump to be reclaimed and is the focus of efforts in the start of the project. The dumps will be mined at a later stage and this is likely to commence before 2L24 is fully reclaimed. This will be the case for all the other mine dumps, as mining will still be continuing at the other dumps when 2L24 is complete, not all the infrastructure will be removed from 2L24 as Crown Gold may keep the main pump station *in situ* in the southeast corner of the 2L24 area. Additional pipelines may be installed to service the operations of the other dump clusters.

Once the full reclamation processes have been completed on all of the dumps, decommissioning will commence with the removal of all associated vehicles and plant equipment from the site as well as the removal of berms, paddocks, diversion trenches, infrastructure, pipelines and anything else installed during construction. The slimes dam will be mined to topsoil level, as mentioned above, concurrent rehabilitation will take place during the operational phase to appropriate environmental standards.

2.3.7 Post Decommissioning Activities

Post-decommissioning activities will entail the assessment of the concurrent rehabilitation of the footprint areas and will address any further rehabilitation requirements. Monitoring must occur for at least two years after decommissioning and rehabilitation, or until satisfactory results are achieved.

2.3.7.1 Maintenance and Aftercare

Maintenance will specifically need to focus on vegetation on the rehabilitated areas and the management of alien vegetation. Furthermore, groundwater monitoring will have to take place surrounding the footprint of the reclaimed dump. It has been recommended that the groundwater is monitored for at least a period of five years on a quarterly basis after closure. The monitoring process will be used to assess whether the rehabilitation process has been successful or not and to indicate that no further deterioration on groundwater quality is foreseen.

Maintenance will specifically focus on the rehabilitated in accordance with the approved EMPr. Continuous erosion monitoring of rehabilitated areas and slopes should be undertaken and zones with excessive erosion should be identified. The cause of the erosion should be identified, and rectified. Zones with erosion will need to be repaired with topsoil.

2.4 Layout Selection Process

An environmental sensitivity map which illustrates potentially sensitive areas identified in the project site was compiled for the project as part of the scoping phase (Figure 2-5). The detail was based on desktop review of the available baseline information for the study area and specialist input.

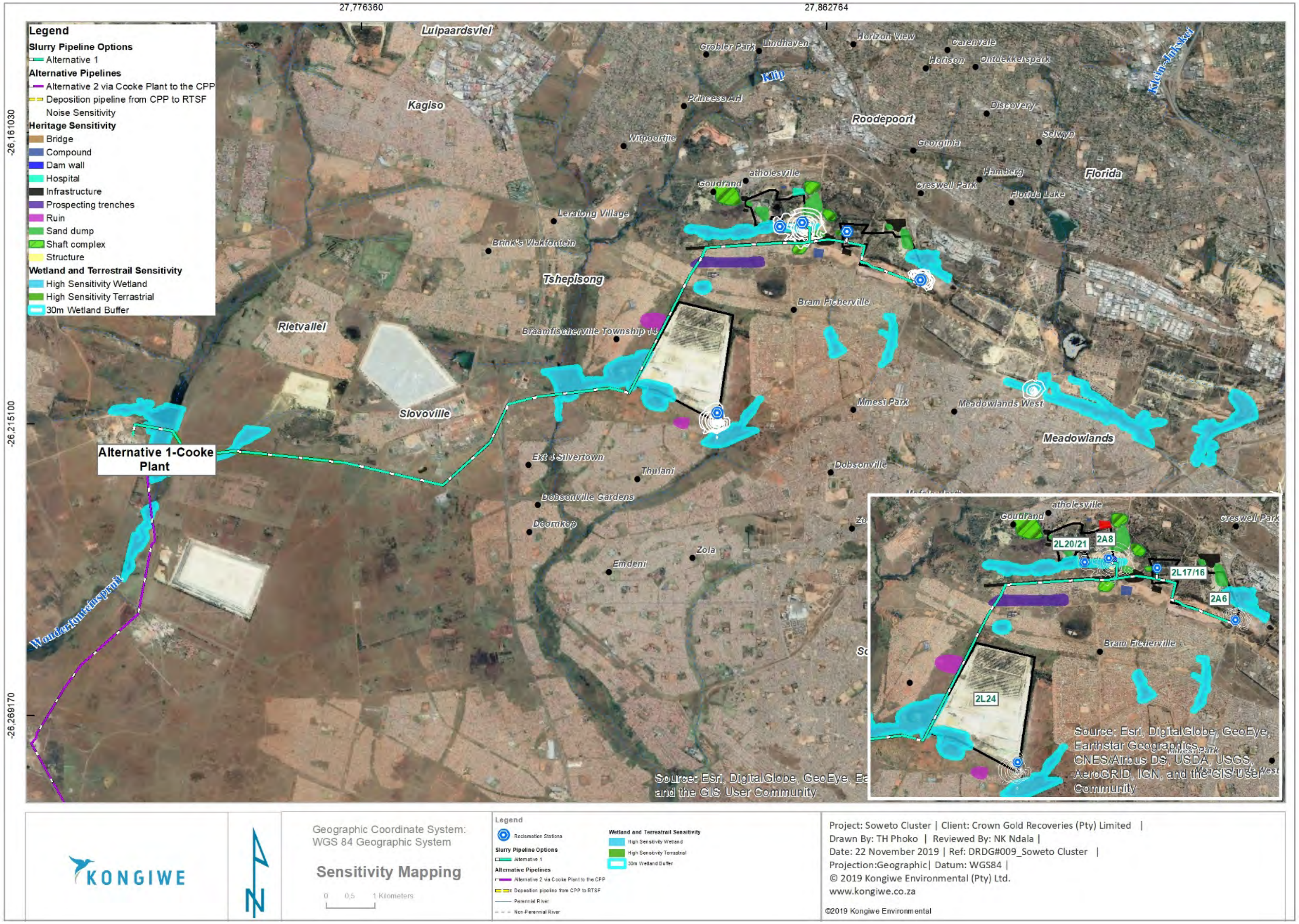

Figure 2-5: Sensitivity Map based on Heritage, Noise, Health, Biodiversity and Wetland sensitive receptors.

The sensitivity map was based on the scoping phase alternatives assessed and was used to inform this EIA phase project design and layout to avoid areas flagged to be of potentially high sensitivity. Specific sensitivities identified within the Scoping phase are summarised below:

- Pipeline Alternative 2 intersects Maxam Dantex explosives with high noise sensitivity.
- Pipeline Alternative 2 crosses 4 High Sensitivity Wetland Areas.
- There are structures, a bridge and a dam wall located at the area earmarked for the infrastructure area of 2A8.

While the findings of the desktop Scoping study indicated that no Environmental Fatal Flaws are associated with the Proposed Project, the recommendation was made to exclude Alternative 2 from the Project going into the EIA phase. Removing Alternative 2 from the original Scoping phase project description and scope will mean minimising the impact of the reclamation and reprocessing project on the environment.

The detailed specialist studies which have been concluded as part of the EIA phase are in line with the Plan of Study. Specialist recommendations are included in Section, as well as within specialist reports contained in Appendix D of this EIA. Specialists recommendations for the mitigation and management measures which would be applicable to the final preferred layout, and which are required to ensure it retains an acceptable level of environmental impact have also been incorporated into the EMPr prepared for this project and attached as Appendix E of this EIA report.

CHAPTER 3: CONSIDERATION OF ALTERNATIVES

In accordance with the requirements of Appendix 3 of the 2014 EIA Regulations (GNR 983) as amended, an EIA report must contain a consideration of the alternatives, which can include activity alternatives, site alternatives, location alternatives and the "do-nothing" alternative. Alternatives are required to be assessed in terms of social, biophysical, economic and technical factors.

For applications submitted to the DMRE for environmental authorisation in terms of the NEMA and NEM:WA, in respect of listed activities that have been triggered, the project is expected to assess alternative properties, the type of activity, the design and layout of the activity, technologies, operational aspects and the "do-nothing" alternative.

When assessing alternatives, they should be "practical", "feasible", "relevant", "reasonable" and "viable".

In this instance, this chapter provides an overview of the deviations that have been made from the FSR to this DEIAr in terms of alternatives that have been considered.

3.1 Deviation from the Scoping Report

3.1.1 Scoping Phase Project Alternatives

Originally, three operational alternatives were considered for the transport of slurry and return water, the processing plant to be used for gold recovery, and the related depositional facility for unprocessed tailings material.

- **Alternative 1:** Soweto Cluster is reclaimed, and slurry is transported through new pipelines from 2L24 to the Cooke Plant, south of the Soweto Cluster. Deposition will take place on the Cooke TSF which is adjacent to the plant or into the old mining pits.
- **Alternative 2:** Soweto Cluster is reclaimed, and slurry is transported through a new pipeline which will run east of dump 2L24 where it will connect to an existing pipeline network currently being utilised for other reclamation projects. The existing pipeline will then transport the slurry to the Ergo Plant at Brakpan in the East Rand. Deposition will take place on the Brakpan/Withok TSF, south of the Ergo Plant.
- **Alternative 3:** Soweto Cluster is reclaimed, and slurry is transported though new pipelines to the Cooke Plant (as per Alternative 1), and then to the Central Processing Plant (CPP), with the option to bypass the Cooke Plant in the future. The pipeline from Cooke Plant to CPP has been authorised already but is not existing. Deposition will then take place on the RTSF, which is authorised but not yet constructed.

Alternative 3 was authorised on the **11 May 2018 (Reference: GP 30/5/1/2/3/2/1 (66) EM and 30/5/1/2/3/2/1 (51) EM)** as part of a separate Environmental Process. A detailed impact assessment was undertaken and the main activities pertaining to the Environmental Authorisation are:

- The construction and operation of:
  - The Central Processing Plant (CPP);
  - The Regional Tailings Storage Facility (RTSF);
  - The Return Water Dam (RWD);
  - The Advanced Water Treatment Facility (WTP); and
  - Roads, powerlines, pipelines and pump stations associated with the above listed infrastructure.

Specialist were commissioned to consider Alternative 1 and Alternative 2 as Alternative 3 has already been authorised.

Upon considering specialist recommendations, comments received during ongoing stakeholder engagement and the practical implementation of constructing, operating and managing **Alternative 2, this option will no longer be considered for the project going forward.**

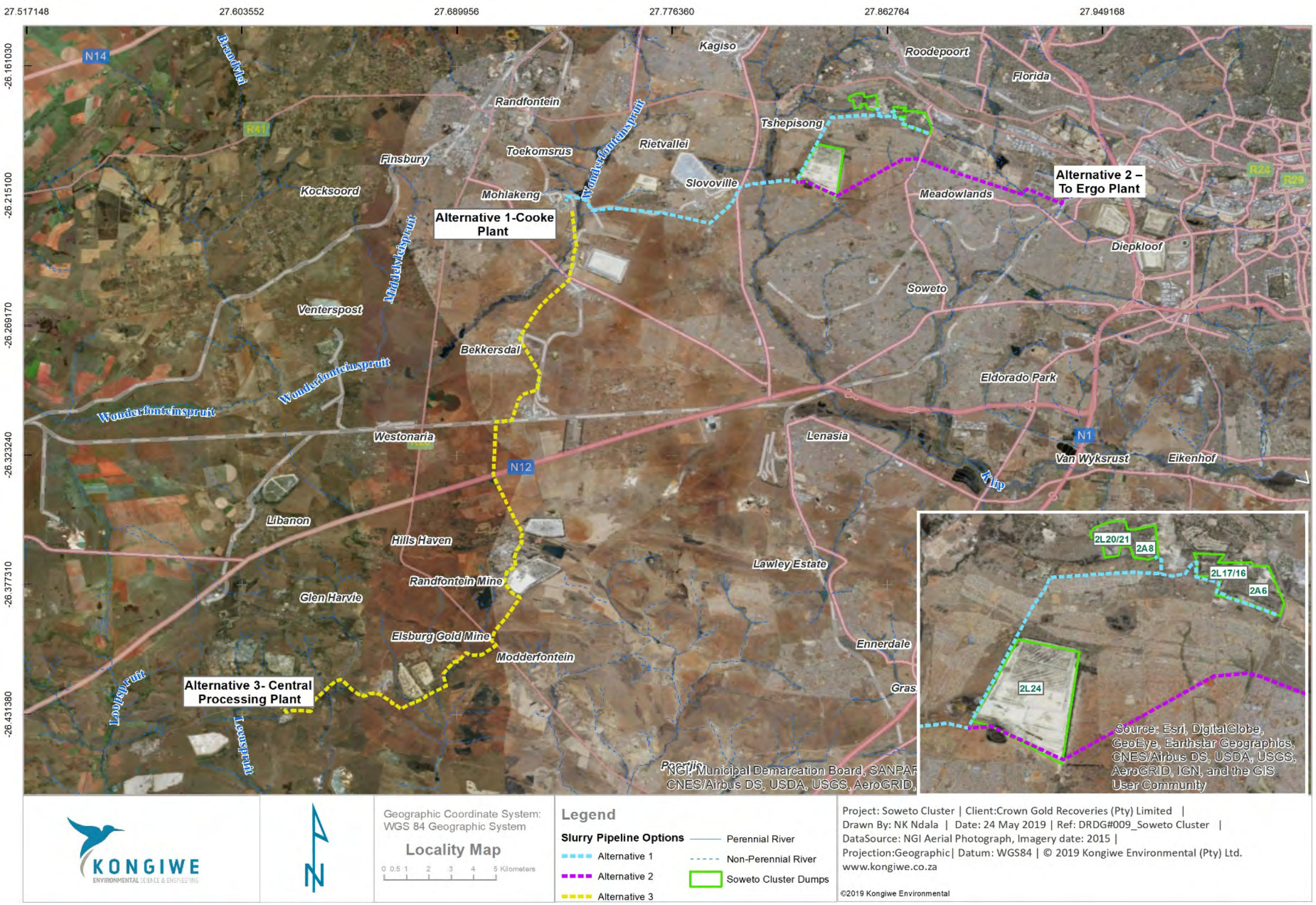

Figure 3-1: Scoping Phase alternatives investigated

3.1.2 Impact Assessment Phase Project Alternatives

The project will now consider the following alternatives during the impact assessment phase (Figure 3-2):

- **Alternative 1:** Soweto Cluster is reclaimed, and slurry is transported through new pipelines from 2L24 to the Cooke Plant, south of the Soweto Cluster. Deposition will take place on the Cooke TSF which is adjacent to the plant or into the pits. In view of the limited capacity of the Cooke TSF, this alternative is no longer favoured and only Alternative 2 will be pursued. This alternative was assessed as part of the EIA process.
- **Alternative 2:** This is the Preferred Alternative. Soweto Cluster is reclaimed, and slurry is transported though new pipelines to the Cooke Plant (as per Alternative 1), and then to the CPP, with the option to bypass the Cooke Plant in the future. The pipeline from Cooke Plant to CPP has been authorised already but is not existing. Deposition will then take place on the RTSF, which is authorised but not yet constructed.

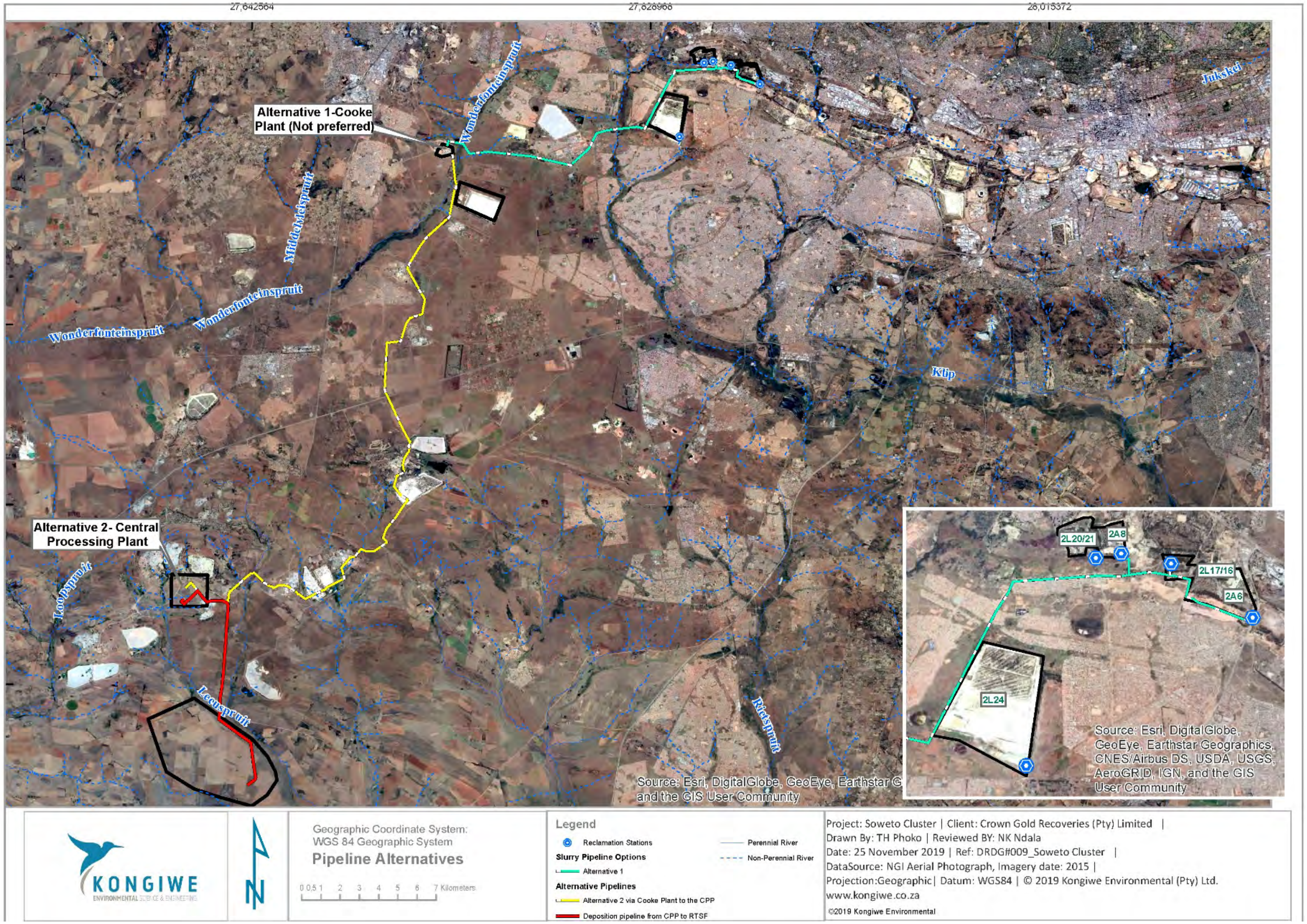

Figure 3-2: Alternatives considered during this EIA Phase

3.1.2.1 The __property__ on which or location where it is proposed to undertake the activity

The Proposed Project is the reclamation and reprocessing of already existing dumps (2L24; 2L20; 2L21; 2L16; 2L17; 2L18; 2A6 and 2A8). Therefore, there can be **no alternative sites**.

Currently the slimes dams and sand dumps are passive mineral disposal areas with no other land use or development associated with them. Since the Soweto Cluster dumps are situated in an area earmarked for development, it is anticipated that the land could be made available for future developments.

3.1.2.2 The __type of activity__ to be undertaken

The only optional activity for Crown Gold is to reclaim and reprocess the existing Soweto Cluster dumps. Currently the dumps are not managed, and Crown Gold will take responsibility for removing the current pollution point sources to unlock land for future development.

Table 3-1: The advantages and disadvantages of reclaiming and reprocessing Soweto Cluster – Preferred:

OPTION	ADVANTAGE	DISADVANTAGE
Reclaiming and reprocessing of the Soweto Cluster Dumps (Preferred)	❖ Low-technical-risk nature of tailings retreatment. ❖ Not labour intensive. ❖ Minimal safety issues. ❖ Easy access to surface tailings, as well as lower labour and operating costs. ❖ Boost to local economy. ❖ Removal of pollution source after rehabilitation and cessation of project. ❖ Liberating land for further development.	❖ Potential profits rely on substantial volumes of material to be reclaimed. ❖ Potential negative environmental ❖ effects during construction and operational phase of the project. ❖ Not labour intensive. ❖ Potential short-term environmental impacts such as dust generation

3.1.2.3 The Design and Layout of the Activity

The current layout plan for Soweto Cluster is indicated in Figure 3-2. The layout plan is dictated by the existing location of Soweto Cluster and the associated infrastructure, including new (proposed) and existing pipelines. The routes of these pipelines are limited to existing servitude routes or wayleaves in favour of Crown Gold or its associates, where not existing, new servitudes or wayleaves will be sought.

Paddocks will be reinstated around the dumps. The paddocks are provided to capture stormwater overflow from the dumps in the event of a rain event, and for pump station overflows. If water accumulates within the paddocks below the pump stations it will be pumped back into the reticulation circuit.

The alternative layout plans for all other ancillary infrastructure will be assessed by specialist studies and will be addressed in the EIA phase.

3.1.2.4 The Technology to be Used in the Activity

The reclamation of the Soweto Cluster is the "Preferred Activity", however there are two different methods of reclamation that should also be considered as two different materials are going to be reclaimed. The reclamation methods that exist are the Hydraulic Mining for the removal of slimes dams; and the Mechanical removal of the sand dumps. These technology alternatives are discussed in greater detail below.

Hydraulic Mining:

Refer to Section 1.1.1.

Hydraulic mining is a method which uses a mobile, high-pressure water monitor to erode the slime dams in sections, washing the unconsolidated tailings material downstream (slurry) which is collected in a sump. Slimes dams are generally segregated by the coarseness of the material and grade of gold, and if a particular area of a dam is too coarse for pumping then blending is required. Once the required slurry density is obtained in the sump, and screening has prevented large objects from passing, the slurry is then pumped to thickeners and the underflow is reprocessed in a licenced processing plant. Waste material , after processing is then deposited onto a licenced TSF. A typical flow sheet for the reprocessing of a slimes dam is shown below:

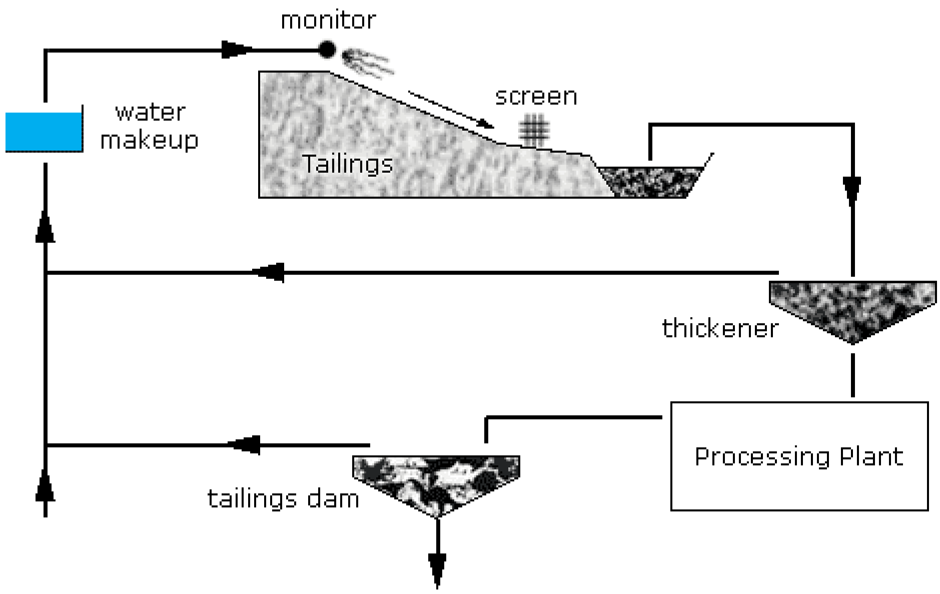

Figure 3-3: A typical flow sheet for the reprocessing of a slimes dam

Mechanical Removal:

Refer to Section 1.1.1

The sand dumps will be mined via front-end loaders. Two options have been investigated for the method of mechanical removal and slurry pumping. The preferred option will be determined by Crown Gold during the pre-construction phase of the project. Both alternatives have similar impacts.

- **Alternative 1:** The front-end loader will dump the sand tailings onto a conveyer belt from where the material will first be screened to separate rocks, roots and other large waste material. All material larger than 2 mm (e.g. wood fibre, ash, quartz, grit larger and rocks) will be stockpiled. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the gold plant via pipelines. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the CPP.
- **Alternative 2:** A hopper has been investigated as a potential alternative for pre-processing the sand dumps. Sand will be mixed with water and passed over a finger screen at the hopper. The resultant slurry will then be pumped a short distance from the hopper at the sand dumps to a point of connection with the slimes dam's slurry pipeline. The pipelines are envisioned to have sufficient capacity to pump the required slurry. The material will then be stirred up into suspension in an agitator and pumped from a pump station to the CPP.

The concept of this method of reclamation is simple, but practical difficulties have arisen due to a variety of compounding factors. Firstly, the dumps have been used in the past for disposal of all sorts of refuse. Metallic scrap in the form of drill steel, rails and metal sleepers has been a major cause of belt damage, and coarse rock and vegetation have caused blocked chutes and damage to plant equipment when introduced to the system, resulting in operating problems, delays and additional costs. Secondly, the nature of the deposit further complicates reclamation such that where a dump has alternating layers of sand and slime, the footing required for the placement of equipment is not stable.

Crown Gold believes that it will implement the best available technology in the best possible combination, in a way which is cost effective for this specific project. Best practices (as utilised in the industry) have been selected and, where applicable, SANS standards and legislative requirements will be followed in design, construction and management of infrastructure and activities on site.

Table 3-2: The advantages and disadvantages of hydraulic mining and mechanical removal

OPTION	ADVANTAGE	DISADVANTAGE
Hydraulic Mining	❖ Cost effective ❖ Easier to transport slurry for processing. ❖ Compatible with existing infrastructure. ❖ Lowered risks when compared to other methods of reclamation.	❖ Dust emissions which are to be mitigated ❖ Not very labour intensive, thus new employment opportunities are limited ❖ May cause environmental impacts if not done responsibly.
Mechanical Removal	❖ Effective for short distances ❖ Low rates for re-mining ❖ Suited to short-life projects ❖ Does not carry high capital costs ❖ Ability for more employment opportunities.	❖ Dust emissions with sand reclamation ❖ Stability of the dump ❖ Not considered effective for long haul trips to the plant

OPTION	ADVANTAGE	DISADVANTAGE
	❖ Best used in combination with Hydraulic mining operations	

3.1.2.5 The *Operational Aspects* of the activity

Two operational alternatives are being considered for the transport of slurry and return water, the processing plant to be used for gold recovery, and the related depositional facility for unprocessed tailings material. These alternatives have been described in detail below, with Figure 3-2 above, to visualise the alternative concepts.

- **Alternative 1:** Soweto Cluster is reclaimed, and slurry is transported through new pipelines from 2L24 to the Cooke Plant, south of the Soweto Cluster. Deposition will take place on the Cooke TSF which is adjacent to the plant or into the pits.
- **Alternative 2 – PREFERRED ALTERNATIVE:** Soweto Cluster is reclaimed, and slurry is transported though new pipelines to the Cooke Plant (as per Alternative 1), and then to the CPP (with the option to bypass the Cooke Plant in the future). The pipeline from Cooke Plant to CPP has been authorised already but is not existing. Deposition will then take place on the RTSF, which is authorised but not yet constructed.

Table 3-3: The advantages and disadvantages of each operational alternative considered

OPTION	ADVANTAGE	DISADVANTAGE
Alternative 1: Cooke Plant, Cooke TSF and associated slurry and return water pipeline (s)	❖ Near the Soweto Cluster. ❖ The plant and deposition facility are existing. ❖ Welded, HDPE lined steel pipelines. ❖ The pipelines do not traverse a great distance.	❖ There is an existing watercourse which runs between Cooke Plant and Cooke TSF. ❖ Potential for tampering with infrastructure which could lead to mechanical failures and spillages. ❖ No capacity to hold more tailings material
Alternative 3: Central Processing Plant (CPP), the RTSF and associated slurry and return water pipeline(s) ***THE PREFERRED ALTERNATIVE***	❖ The plant and depositional facility are not located within populated areas ❖ The CPP and RTSF will be designed according to the latest design standards	❖ Transport of slurry will be over a great distance ❖ Multiple watercourses would be crossed ❖ The plant and deposition facility are not yet constructed, thus existing infrastructure cannot be utilised

3.1.2.6 The "No-Go" option

The Option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. As such, the short-term negative impacts on the environment would not transpire; equally so, the long-term positive impacts such as environmental pollution source removal, economic development, skills development, and the availability of land for re-development would not occur. The only alternative land use is to leave the dumps as they stand; there is no other potential use of the space as the project area is a cluster of polluting historic mine dumps that impact upon the surrounding biophysical and social environment.

The "No-Go" Option also assumes the continuation of the current land use, implying the absence of any reclamation activities and associated infrastructures. The means that the attraction of the gold reserves located within the dumps could potentially enhance Illegal mining, and if left as is, population settlement on or around the dumps could occur.

The 'No Project' alternative is not preferred due to the anticipated benefits of the proposed reclamation project. The expected indirect benefits resulting from the reclamation of the Soweto Cluster include:

- Removal and remediation of existing tailings deposits currently located on sensitive dolomitic aquifers, reducing future environmental liability and risk.
- Removal of tailings facilities, reducing health risks for surrounding communities from possible exposure to dust.
- Re-use of currently impacted mine water in the hydraulic mining process.
- Removal of a source of pollution and radiation in the area.
- The potential to unlock land for redevelopment, as read in the Metropolitan Spatial Development Vision.
- Continued supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), as well as the GDARD, the City of Johannesburg Strategic Development Framework and the Mining Belt West Framework. The reclamation and rehabilitation of the Soweto Cluster dumps will mitigate the current environmental, health and social impacts, as well as unlock land for potential future development.

3.1.3 Motivation for the Final Proposed Facility Alternative

The factors below have been used to determine the final preferred alternatives for the Soweto Cluster Project:

- Financial feasibility;
- Logistical feasibility – raw material supply, market proximity and utilities;
- Environmental impacts;
- Socio-economic impacts including comments received from I&AP's;
- Land use planning and future spatial development considerations;
- Proximity to sources of human resource; and,
- Proximity to other mining related projects (cumulative impacts).

The reclamation and reprocessing of the Soweto Cluster dumps will remove a source of air, surface and groundwater pollution, and will liberate the land to be used for future urban/residential development. The layout of the surface infrastructure and pipelines has been planned to avoid sensitive areas as far as feasible and is presented in Figure 2-5. Crown Gold will have to follow the rehabilitation, monitoring programmes and EMPr strictly to ensure that environmental impacts are minimised and mitigated appropriately.

3.2 Motivation where No Alternatives have been considered

The No-Go option has been considered as a project alternative. Motivations against this option are detailed in Section 3.1.2.6.

Alternative 1 is an Operational Alternative. This alternative is not preferred as read in Section 3.1.2.5.

CHAPTER 4: POLICY AND LEGISLATIVE CONTEXT

This chapter provides an overview of the policy and legislative context relevant to the reclamation project. It identifies all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to the planned activities and are to be considered in the assessment process which may be applicable or have relevance to the reclamation project.

The foundation for Environmental Preservation is entrenched in the **Constitution of South Africa, 1996 (Act No. 108 of 1996).** Following the birth of Democracy in South Africa, legislative and environmental policies and regulations have undergone a large transformation, and various laws and policies were promulgated with a strong emphasis on environmental concerns and the need for sustainable development. The Constitution provides environmental rights (contained in the Bill of Rights, Chapter 2 (Section 24)) and includes implications for environmental management. The environmental rights are guaranteed in Section 24 of the Constitution, and state that:

"Everyone has the right –

- *To an environment that is not harmful to their health or well-being and*
- *To have the environment protected, for the benefit of present and future generations, through reasonable legislative and other measures that*
  - *Prevent pollution and ecological degradation;*
  - *Promote conservation and*
  - *Secure ecologically sustainable development and use of natural resources while promoting justifiable economic and social development."*

To ensure that the various spheres of the social and natural environmental resources are not over-looked, additional legislation and regulations have been promulgated in addition to those contained within the Constitution. The additional legislature and regulations ensure that there remains a key focus on various industries or components of the environment, and to ensure that the objectives of the Constitution are effectively implemented and upheld on an on-going basis. In terms of Section 7, a positive obligation is placed on the State to give effect to the environmental rights.

4.1 Listed Activities

Listed activities are activities identified in terms of Section 24 of NEMA which are likely to have a detrimental effect on the environment, and which may not commence without an EA from the Competent Authority (CA). An EA is required for any listed activity and is subject to the completion of an environmental process, either a Basic Assessment (BA) or a S&EIA.

Table 4-1 below contains all the listed activities identified in terms of NEMA, NEM:WA, and the EIA Regulations of 2014 (GN R982 of December 2014, as amended by GNR 326 of April 2017) and Listing Notices 1, 2 and 3 (GN R983, GN R984 and GN R985 of December 2014, as amended by GNR 327, GNR 325, and GNR 324 of April 2017, respectively) which may be triggered by the Proposed Project, and for which an application for EA has been submitted. The table also includes a description of those project activities which relate to the applicable listed activities.

The **DMRE** will act as the CA on the project.

The Commenting Authorities for the Soweto Cluster Dumps Reclamation Project are:

- Gauteng Department of Agriculture and Rural Development (GDARD);
- Department of Human Settlements, Water and Sanitation (DHSWS);
- Department of Environment, Forestry and Fisheries (DEFF);
- Department of Public Works;
- National Nuclear Regulator (NNR);
- Department of Health (DoH);
- South African Heritage Resource Agency (SAHRA), and;
- City of Johannesburg Metropolitan Municipality (CoJMM).

Table 4-1: Listed Activities Triggered by the Proposed Project.

Name of activity *Mining (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, stormwater control, berms, roads pipelines, power lines, conveyors, etc.)*	Aerial extent of the activity (ha)[3] *Ha or m^2* *Expressed in m^2 unless otherwise stated*	Listed activity *Mark with an X where applicable or affected.*	Applicable listing notice GNR 983, 984 and 985 as amended by *GNR 327, GNR 325 or GNR 324*	Waste management authorisation *(Indicate whether an authorisation is required in terms of the Waste Management Act).* *(Mark with an X)*	Water use license authorisation[4]
Access roads routed from existing entry points.		X	**GNR 983 – 24** **GNR 985 – 4**		
Temporary Site infrastructure (offices, change house, workshops).		X			
Reclamation of historic mineral deposits				**GNR 921 – B (2)**	**21(c) & (i)**
Satellite pump station / Reclamation Station		X	**GNR 984 – 6**	**GNR 921 -B (2)**	**21(c) & (i)**
Slurry receiving facility		X	**GNR 983 – 12; 13** **GNR 984 – 6** **GNR 985 – 2;14**	**GNR 921 -B (1)**	

[3] The total area of the mining and associated areas is approximately 430.36 hectares.

[4] Water use licences in terms of Section 21 of that National Water Act, 1998, will be required for various of the Listed Activities. These have not been specifically listed in this Application, but the necessary application will be submitted to the Department of Water and Sanitation

Name of activity *Mining (E.g. Excavations, blasting, stockpiles, discard dumps or dams, Loading, hauling and transport, Water supply dams and boreholes, accommodation, offices, ablution, stores, workshops, processing plant, stormwater control, berms, roads pipelines, power lines, conveyors, etc.)*	Aerial extent of the activity (ha)[3] *Ha or m^2* *Expressed in m^2 unless otherwise stated*	Listed activity *Mark with an X where applicable or affected.*	Applicable listing notice GNR 983, 984 and 985 as amended by *GNR 327, GNR 325 or GNR 324*	Waste management authorisation *(Indicate whether an authorisation is required in terms of the Waste Management Act).* *(Mark with an X)*	Water use license authorisation[4]
Screening facility at the pump station		X	**GNR 984 – 6**	**GNR 921 -B (2)**	
Storage		X	**GNR 984 – 6**	**GNR 921 -B (2)**	
Transfer pumps in series		X	**GNR 984 – 6**	**GNR 921 -B (2)**	
Power supply (Substations, transformers and 11kV powerlines)					
Stormwater systems, including:					**21(c) & (i)**
Paddocks					**Pre-existing water use**
Process water pipeline		X	**GNR 983 – 9;19**		**21(c) & (i)**
Overland slurry pipeline		X	**GNR 983 – 10;19** **NR 984 – 7**		**21(c) & (i)**

Table 4-2: Applicable National Legislation and Guidelines.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
The Constitution of South Africa, 1996 (Act 108 of 1996) Section 24 of the Act states that everyone has the right to an environment that is not harmful to their health or well-being; to have the environment protected for the benefit of present and future generations, through reasonable legislative and other measures that prevent pollution and ecological degradation; promote conservation; and secure ecological sustainable development and use of natural resources while promoting justifiable economic and social development. Section 32 of the Act states that every person has a right to information held by the State and to information held by other people that is required in the exercise or protection of a right. Lastly, Section 33 of the Act states that everyone has a right to just and procedurally fair administrative action.	As per the Requirements of NEMA and the NEMA EIA Regulations, alternative activities that are less taxing on the environment and resources must be investigated where possible. The Draft EIA Report will be made available for public review (as per the PPP section of this report). The Appeal Process will be described to all stakeholders through the EA notification described in the PPP section of this report.
Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002) (MPRDA). The mineral resources sector is primarily regulated by statute and in terms of the Mineral and Petroleum Resources Development Act. Any person that wishes to conduct mining activities must first apply for and obtain a mining right under the MPRDA. A mining right entitles the holder to the exclusive right to mine for prescribed minerals over a prescribes area of land. A mining right may be granted for a period of up to 30 years.	The proposed projects entails the reclamation and reprocessing of gold from six historic slimes dams: 2L24; 2L20; 2L21; 2L16; 2L17 and 2L18 as well as two historic sand dumps 2A6 and 2A8. These dams and dumps are referred to collectively as the “Soweto Cluster” and were all created prior to the Mineral and Petroleum Resources Development Act, 2002 (MPRDA) which came into force in 2004. A Mining Right is not a prerequisite to reclaim historic Tailings Storage Facilities (TSF). Listed activities applied for are indicated in Table 4-1. Crown Gold has applied for an Environmental Authorisation for activities triggered by the National Environmental Management Act (Act 107 1998)

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
The One Environmental System In terms of the One Environmental System established by the NEMLAA, an EA in respect of a reclamation operation must be issued within 300 days of the application being submitted. This system aims to streamline the licensing processes for environmental authorisations and water use.	Crown Gold proposes to reclaim the Soweto Cluster dumps and submit the required documents within the prescribed timeframes.
Mine Health and Safety Act (MHSA), Act 29 of 1996 (as amended): Although the Mineral and Petroleum Resources Development Act, 2002, does not apply to this project, Crown Gold operates in accordance to the MHSA and associated regulations. This includes creating a safe and healthy work environment and providing the necessary protection and training to staff to ensure their health and safety is not compromised. Hazardous substances will be adequately stored and labelled. All regulations pertaining to safe use, handling, processing, storage, transport and disposal of hazardous substances; protection of equipment, structures and water sources and the surface of land; dumps and structures connected to reclamation operations; the monitoring and control of those environmental aspects which may affect the health and safety of persons will be applied on site. Regulations pertaining to provision of water, ablution facilities and staff health and safety will be applied on site.	Although not strictly addressed in the Scoping Report or EMPr, protecting the environment contributes to a safe working environment. MHSA regulations will be worked into the mine's Code of Practice (COP) and Standard Operating Procedures (SOPs).
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) The overarching principle of the NEMA is sustainable development. It defines sustainability as meaning the integration of social, economic and environmental factors into planning, implementation and decision making to ensure the development serves present and future generations. Section 2 of NEMA provides for the NEMA principle which apply throughout the Republic to the actions of all organs of state that may significantly affect the environment and in conjunction with other appropriate and relevant considerations. The NEMA principles serve as the general framework within which environmental management and implementation plans must be formulated and serve as a guideline by reference to which any organ of state must exercise any function when taking any decision in terms of the NEMA or any statutory provision concerning the protection of the environment.	It is the objective of this application to align to NEMA. The NEMA is the overarching Act governing sustainable development and the NEMA principles apply to all prospecting and mining operations (which included reclamation activities) and any matter or activity relating to such operation. Listed activities as per the EIA 2014 Regulations, as amended, have been identified (refer to Table 4-1)

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
NEMA authorises the Minister of the DEFF to issue Regulations relating to the administration of the Act[5], which has been done with the publication of the EIA 2014 Regulations, as amended. Section 24(2) allows the Minister to identify activities which may not commence without environmental authorisation from the competent authority. This identification has been done in accordance with listing notices referred to as Listing Notice 1, Listing Notice 2 and Listing Notice 3. The NEMA also allows the Minister to determine which authority will be the competent authority to receive and evaluate applications for EAs. Listing Notice 1 identifies activities of limited scale and effect, which need to be assessed by a fairly simple process referred to as a BA, where after a Basic Assessment Report (BAR) is submitted to the competent authority. Listing Notice 2 identifies activities of significantly greater magnitude, which require evaluation through an initial Scoping Phase followed by an EIA and an EMPr. This process is generally referred to as the S&EIR process. Listing Notice 3 relates to activities limited to specified geographical areas and matters of concern to the various provinces which require a BAR process to be dealt with by the provincial authority concerned. Regulation 16(1) prescribes the general application requirements and states that an application for an EA must be made on the official application form obtainable from the DMRE (the competent authority) and must, amongst others, include proof of payment of the prescribed application fee. Regulation 21 provides for the submission of the Scoping Report to the DMRE (the CA) for consideration and states that the scoping report must contain all the information set out in Appendix 2 to the EIA 2014 Regulations, as amended. In terms of regulation 22, the DMRE must, after considering the Scoping Report, either accept the report, with or without conditions and advise the applicant to proceed with the plan of study for EIA or refuse the EA. Once the Scoping Report is accepted by the DMRE, the applicant must submit the EIA Report inclusive of specialist reports and an EMPr which have been subjected to a PPP. The timeframes for submission of the Scoping Report and the EIA	

5 Sections 24(5) and Section 44

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
Report inclusive of the timeframes within which the DMRE must consider the reports and approve the EA are prescribed in regulations 21 to 24 of the EIA 2014 Regulations. Once a decision on the EA application has been reached, the DMRE (the competent authority) must notify the applicant in writing of the decision and give reasons for the decision.	
National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA) As part of the waste management matters dealt with in the NEM: WA, waste activities have been identified in GN 921 of 29 November 2013[6]: List of Waste Management Activities that have, or are likely to have, a Detrimental Effect on the Environment. GN R921 provides that the waste management activities listed in Category A and B thereof may not commence, be undertaken or conducted without a Waste Management Licence (WML). Activities listed in Category C of GN 921 may only be commenced with, undertaken or conducted in accordance with the National Norms and Standards published in terms of the NEM: WA.[7] Category A activities require a BAR process while Category B Activities require a S&EIR process. It should be noted that although previously residue deposits and residue stockpiles were regulated in terms of the MPRDA Regulations and in particular Regulation 73, the National Environmental Laws Amendments Act 25 of 2014 (NEMLAA) deleted section 4(b) from the NEM:WA and residue stockpiles and residue deposits therefore fall within the ambit of the NEM:WA and its various regulations. Activity B 4(11) of GN 921, as amended by GN 633 of 24 July 2015 now refers to "the establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002)". Since the Soweto Cluster is comprised of historic mineral deposits, the MPRDA does not apply and Activity B4(11) will likewise not apply. However, it must be noted that Schedule 3, Category A (Hazardous Waste) of NEM:WA itself adopts a definition for residue stockpiles precisely similar to the definition	Listed activities as per the NEM: WA regulations have been identified (Table 4-1).

6 Published in Government Gazette 37083

7 The following National Norms and Standards have been published: Norms and Standards for Storage of Waste, 2013 (GN 926 of 29 November 2013); Standards for Extraction, Flaring or Recovery of Landfill Gas, 2013 (GN 924 of 29 November 2013); and Standards for Scrapping or Recovery of Motor Vehicles, 2013 (GN 925 of 29 November 2013

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
proposed for the MPRDA 3rd Amendment which never came into force. Accordingly, the Soweto Cluster must be regarded as waste accordingly and recovery operations would require a waste management licence, but in terms of Section 20 of the NEM:WA, not Activity B 4(11). In addition to the requirement for a WML for the mine discard dump (historic mineral deposits), the mine is likely to trigger the following waste activities, all of which require a Category B WML: 1) The storage of hazardous waste in lagoons excluding storage of effluent, wastewater or sewage; 2) The establishment or reclamation of a residue stockpile or residue deposit resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA. The EA and WML are being dealt with as an integrated application.	
National Water Act, 1998 (Act No. 36 of 1998) (NWA) In terms of the NWA, the national government, acting through the Minister of Water and Sanitation, is the public trustee of South Africa's water resources, and must ensure that water is protected, used, developed, conserved, managed and controlled in a sustainable and equitable manner for the benefit of all persons (section 3(1)). In terms of the NWA a person may only use water without a license if such water use is permissible under Schedule 1 (generally domestic type use) if that water use constitutes a continuation of an existing lawful water use (water uses being undertaken prior to the commencement of the NWA, generally in terms of the Water Act of 1956), or if that water use is permissible in terms of a general authorisation issued under section 39 (general authorisations allow for the use of certain section 21 uses provided that the criteria and thresholds described in the general authorisation is met). Permissible water use furthermore includes water use authorised by a license issued in terms of the NWA. Section 21 of the NWA defines water uses which are governed in terms of the Act and for which a WUL is required. In terms of section 40(1) of the NWA "a person who is required or wishes to obtain a licence to use water must apply to the relevant responsible authority for a licence." These water uses, in terms of Section 21, are as follows: (a) taking water from a water resource;	An IWULA and IWWMP will be required for the reclamation of the Soweto Cluster and is being prepared.

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(b) storing water; **(c) impeding or diverting the flow of water in a watercourse;** (d) engaging in a stream flow reduction activity contemplated in Section 36; (e) engaging in a controlled activity identified as such in Section 37(1) or declared under Section 38(1); (f) discharging waste or water containing waste into a water resource through a pipe, canal, sewer, sea outfall or other conduit; (g) **disposing of waste in a manner which may detrimentally impact on a water resource**; (h) disposing in any manner of water which contains waste from, or which has been heated in, any industrial or power generation process; **(i) altering the bed, banks, course or characteristic of a watercourse;** (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; and (k) using water for recreational purposes. It is not likely that sub-sections **(a), (b), (d), (e), (f), (h), (j) or (k)** will apply to the Proposed Project. Water uses associated with the reclamation activities, **<u>may</u>** include the development of Pollution Control Dams (paddocks), dust suppression and the storage and use of process and potable water. These water uses will require an IWUL and will be reassessed once final placement and conceptual designs have been completed. The IWULA must be prepared and submitted in accordance with the Water Use Licence Application and Appeals Regulations 2017 published in GNR 267 on 24 March 2017 and must generally be supported by a Technical Report and Integrated Water and Waste Management Plan (IWWMP) with conceptual design drawing of all water related infrastructure including infrastructures that could potentially contaminate the receiving environment.	
<u>National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEM:BA)</u> The NEM:BA provides for the management and conservation of South Africa's biodiversity within the framework of NEMA, as well as the protection of species and ecosystems that warrant national protection and the sustainable use of indigenous biological resources. SANBI website and GIS tools were utilised to determine whether any nationally protected and threatened ecosystems occur on site. Therefore, NEMA Listing Notice 3 activities have been included	NEM:BA was used to inform the activities triggered by Listing Notice 3 (Table 4-1).

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
in the EA application. The Proposed Project falls within the Gauteng Province, which has a provincial Biodiversity Assessment Protected Area Expansion Strategy. This strategy has been incorporated and considered throughout the compilation of this report.	
National Environmental Management: Protected Areas Act (NEM:PAA), Act 57 of 2003 as amended The National Environmental Management Protected Areas Act (No. 57 of 2003) (NEM:PAA) concerns the protection and conservation of ecologically viable areas representative of South Africa's diversity and its natural landscapes and seascapes, and includes *inter alia*: ❖ The establishment of a national register of all national, provincial and local protected areas; ❖ The management of those areas in accordance with national standards; and ❖ Inter-governmental co-operation and public consultation in matters concerning protected areas. Sections 48 to 53 of the NEM:PAA lists restricted activities that may not be conducted in a protected area. Section 48 states that no person may conduct commercial prospecting or mining activities in a: ❖ Special nature reserve or nature reserve; ❖ Protected environment without the written permission of the Minister and the Cabinet member responsible for minerals and energy affairs; and Protected area referred to in Section 9: ❖ (b) world heritage sites; and (d) specially protected forest areas, forest nature reserves and forest wilderness areas declared in terms of the National Forests Act (No. 84 of 1998);	SANBI website and GIS tools were utilised to determine if the project area overlaps with CBAs. Some sections of the project area were rated as Critical Biodiversity Area (CBA); Protected Area (PA) and Ecological Support Area (ESA); Parts of the pipeline routes traverse areas of biodiversity importance. Therefore, it is anticipated that some restrictions will apply to the reclamation in terms of protected areas (pending ground truth verification). The Regulations were utilised to determine the need for any additional listed scheduled activities under GNR 985.
National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)	A Heritage Impact Assessment has been undertaken as part of this EIA Phase and the assessment will be

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The NHRA aims to promote good management of cultural heritage resources and encourages the nurturing and conservation of cultural legacy so that it may be bestowed to future generations. The Act requires all developers (including mines) to undertake cultural heritage studies for any development exceeding 0.5 ha. It also provides guidelines for impact assessment studies to be undertaken where cultural resources may be disturbed by development activities. ❖ The South African Heritage Resources Agency (SAHRA) will need to approve the heritage assessment undertaken as part of the impact assessment process.	uploaded on the SAHRA web site along with the EIA Report.
Conservation of Agricultural Resources Act (No. 43 of 1983) The Conservation of Agricultural Resources Act (No. 43 of 1983) (CARA) includes the use and protection of land, soil, wetlands and vegetation and the control of weeds and invader plants. This is the only legislation that is directly aimed at conservation of wetlands in agriculture. The Act contains a comprehensive list of species that are declared weeds and invader plants dividing them into three categories. These categories are as follows: ❖ Category 1: Declared weeds that are prohibited on any land or water surface in South Africa. These species must be controlled, or eradicated where possible; ❖ Category 2: Declared invader species that are only allowed in demarcated areas under controlled conditions and prohibited within 30m of the 1:50 year floodline of any watercourse or wetland; and ❖ Category 3: Declared invader species that may remain but must be prevented from spreading. No further planting of these species is allowed. In terms of the Act, landowners are legally responsible for the control of alien species on their properties. Failure to comply with the Act may result in various infringement consequences and in some instances imprisonment and other penalties for contravening the law.	The protection of land, soil, wetlands and vegetation and the control of weeds and invader plants will be contained within the EIA Report.
The South African National Roads Agency Limited and National Roads Act, 1998 (Act No. 7 of 1998) The National Road Traffic Regulations, 2000 places specific duties on the consignor and consignee of dangerous goods.	The requirements of the Act and Regulations will be considered when assessing the project impacts and developing the associated mitigation measures in the

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
A consignor means the person who offers dangerous goods for transport (i.e. hazardous waste) and a consignee is the person who accepts dangerous goods, which have been transported in a vehicle. Both consignor and consignee must comply with the requirements of several SANS standard specifications and codes of practice relevant to dangerous goods which have been incorporated into the regulations. The mine owner is responsible for: ❖ Offloading of the dangerous goods; ❖ Providing the dangerous goods offloading supervisor; and ❖ Ensuring that the loading and offloading are carried out by qualified employees trained in the relevant procedures. Crown Gold must, in line with Section 54 of the Act and GN R225, provide evidence that the company has appointed responsible personnel to oversee the off-loading of dangerous goods at its operations. A driver of a vehicle transporting dangerous goods is required to undergo training at an approved training body.	EIA Phase.
<u>Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA)</u> The SPLUMA was promulgated in May 2015. SPLUMA is a framework act for all spatial planning and land use management legislation in South Africa. It seeks to promote consistency and uniformity in procedures and decision-making in this field. SPLUMA will also assist municipalities to address historical spatial imbalances and the integration of the principles of sustainable development into land use and planning regulatory tools and legislative instruments.	The Soweto Cluster Dumps are already in existence and falls within an Urban development Zone. The project directly contributes to the liberation of land for future development and is in line with the City of Johannesburg's IDP for 2018/2019
<u>Hazardous Substances Act, 1973 (Act No. 15 of 1973)</u> The Regulations for Hazardous Chemical Substances apply to an employer or a self-employed person who carries out work at a workplace which may expose any person to the intake of hazardous chemical substances at that workplace. Regulations 14 and 15 provide for the labelling, packaging, transportation and storage and the disposal of hazardous chemical substances respectively. These regulations set out specific requirements which form part of an employer's duty to provide and maintain, as far as reasonably practicable, a working environment that is safe and without risk to the health of his or her employees.	The requirements of the Act and Regulations will be considered when assessing the project impacts and developing the associated mitigation measures in this EIA Phase.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
The National Development Plan, 2030 The NDP strives to ensure a tightening of the accountability chain, where, in relation to this EIP, environmental noncompliance in terms of Section 16(1)(b) of NEMA is addressed at all levels of government. The environmental sustainability and resilience objectives include, inter alia: ❖ Implementing a set of indicators for natural resources, accompanied by publication of annual compliance reports; ❖ Achieving the peak (in 2025) plateau and decline trajectory for greenhouse gas (GHG) emissions coupled with the entrenchment of an economy-wide carbon price; ❖ Improving disaster preparedness for extreme climate events. Gauteng is severely affected by drought; and Increasing investment in new agricultural technologies, research and the development of adaptation strategies for the protection of rural livelihoods and expansion of commercial agriculture.	The requirements of this Plan have considered when assessing the project impacts and developing the associated mitigation measures in this EIA Phase.
Action Plan of the Environmental Initiative of the New Partnership of Africa's Development, 2003. This Action Plan was established with the aim of encouraging sustainable development, conservation and acceptable use of biodiversity in Africa. It has been recognised that a healthy and productive environment is a prerequisite for the success of New Partnership of Africa's Development (NEPAD), together with the need to systematically address and sustain ecosystems, biodiversity and wildlife. Six areas have been identified: ❖ Combating land degradation, drought and desertification; ❖ Conserving Africa's wetlands; ❖ Preventing and controlling invasive alien species; ❖ Conservation and sustainable use of coastal and marine resources; ❖ Combating climate change in Africa; and ❖ Cross-border conservation and management of natural resources.	As the Proposed Project may affect the local biodiversity, this action plan will be considered.

<table>
<tr><th>APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.</th><th>REFERENCE WHERE APPLIED</th></tr>
<tr><td><u>Mining and Biodiversity Guideline, 2013.</u>

This guideline is founded on six fundamental principles:

❖ Apply the law;
❖ Use the best available biodiversity information;
❖ Engage relevant stakeholders thoroughly;
❖ Use best practice in EIA to identify, assess and evaluate impacts on biodiversity;
❖ Apply the mitigation hierarchy when planning any mining-related activities and develop robust EMPrs; and
❖ Ensure effective implementation of EMPrs, including adaptive management.
❖ The guideline stipulates the requirements for both utilising and integrating biodiversity information and informants into the assessment of impacts (i.e. this S&EIA process) of mining (and reclamation) on biodiversity and ecosystem services and recommends good practice throughout the project's life cycle.</td><td>As the Proposed Project may affect the local biodiversity, this guideline document has assisted the specialist in forming their Specialist Impact Reports as part of this EIA Phase.</td></tr>
<tr><td><u>South Africa's National Biodiversity Strategy and Action Plan</u>

The National Biodiversity Strategy and Action Plan (NBSAP) sets out a framework and a plan of action for the conservation and sustainable use of South Africa's biological diversity and the equitable sharing of benefits derived from this use. The NBSAP was prepared by the former Department of Environmental Affairs and Tourism (DEAT), during the period May 2003 to May 2005. The goal of the NBSAP is to conserve and manage terrestrial and aquatic biodiversity to ensure sustainable and equitable benefits to the people of South Africa, now and in the future. In support of this goal, five key strategic objectives (SOs) have been identified, each with a number of outcomes and activities. The schematic below represents the objectives and their interconnection in achieving the NBSAP "Goal", although the project is related to reclamation, the following would still apply:</td><td>The Proposed Project is cognisant of the obligation to protect and preserve the integrity of the environment as well as its biodiversity. Principles of this plan have been taken into consideration during the EIA Phase.</td></tr>
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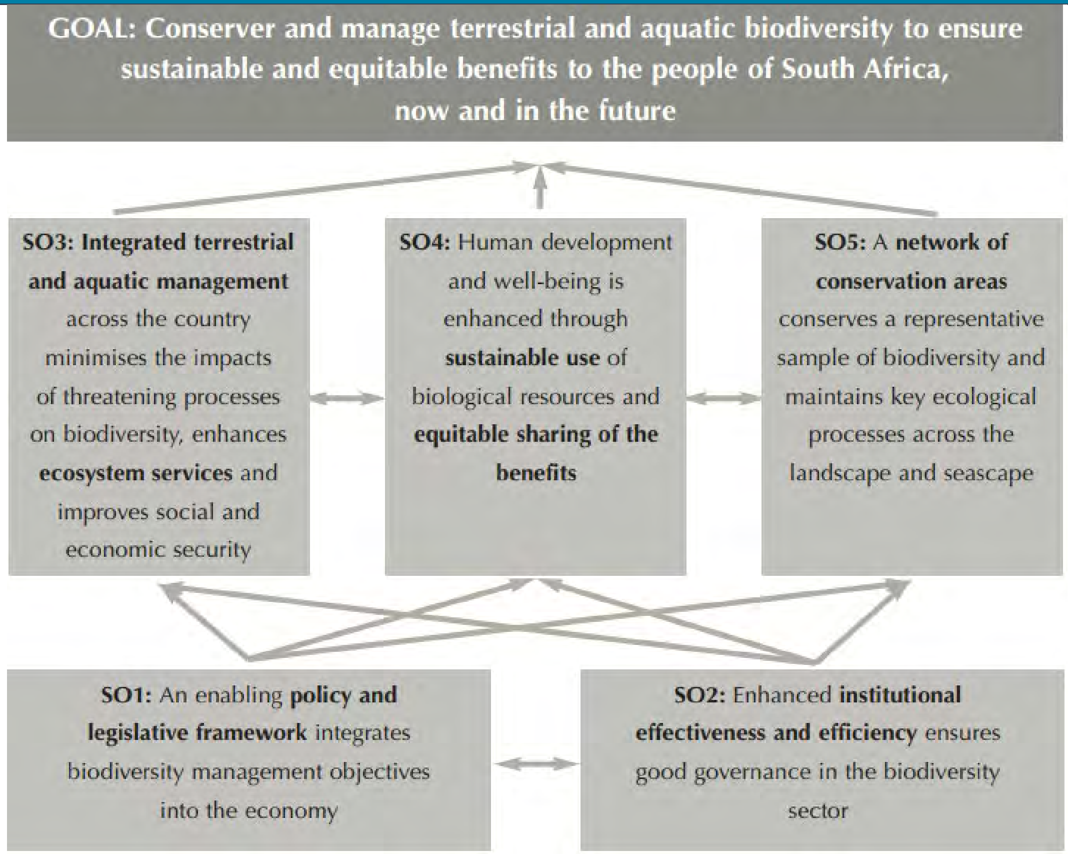
APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
 Through the NSBA, it is recognised that biodiversity cannot be conserved through protected area networks only. All stakeholders, from private landowners and communities to business and industry must get involved in biodiversity management. NBSAP further identified mining as one of the activities that causes habitat transformation and degradation, and seriously threatens aquatic and terrestrial biodiversity. The strategy therefore promotes the inclusion of biodiversity considerations in mining regulations, guidelines and best practice codes to mitigate negative impacts and encourage sustainable mining practices through partnerships.	

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT.	REFERENCE WHERE APPLIED
Best Practice Guideline Series The DHSWS has developed a number of best practice guidelines for water resource protection in the South African mining industry. The best practice guidelines include international principles and approaches towards sustainability. There best practice guidelines include *viz.:* ❖ A water management hierarchy; ❖ General water management strategies, techniques and tools; and Guidelines for mining related activities and aspects.	The guidelines define and document best practices for water and waste management associated with reclamation project and have been considered throughout the S&EIA process and reporting.
Promotion of Access to Information Act, 2000 ❖ The PAIA gives effect to the constitutional right of access to any information held by the state and any information that is held by another person and that is required for the exercise or protection of any rights; and to provide for matters connected therewith.	The requirements of the Act have been considered when assessing and involving the public and registered interested and affected parties.
National Environmental Management Act; National Appeal Regulations, 2014 The purpose of these regulations is to regulate the procedure contemplated in section 43(4) of the National environmental management act relating to the submission, processing and consideration of a decision on an appeal. This Act is used to help guide and understand the appeal process and the procedures may follow.	The requirements of the Act will be considered if an appeal may need to be or is lodged for the project.

Table 4-3: Applicable Provincial and Local Policies, Guidelines and By-Laws

POLICIES, GUIDELINES AND BY-LAWS	
Gauteng Mine Residue Areas Strategy, 2012 The aim of the project as a whole is to make more land available from the mine dumps in Gauteng to be used for other purposes, in line with government priorities. The objectives for the project are as follows:	The Proposed Project is in line with the objectives of the Strategy. The guidelines of the Strategy have been considered throughout the S&EIA process and reporting.

POLICIES, GUIDELINES AND BY-LAWS	
❖ To evaluate current pollution problems caused by mining activities and suggest how they should be addressed; ❖ To quantify the amount of land under mining activities and classify them in terms of impacts and potential for reclamation; ❖ To investigate which mining areas could be made available to be used for other purposes; and ❖ To provide preliminary and conceptual recommendations on the short-term priorities for the reclamation of the mining sites which could be economically sustainable.	
<u>Gauteng Nature Conservation Bill, 2014</u> The Bill was established in 2014, and contains the following objectives: ❖ To provide for the sustainable utilization and protection of biodiversity within Gauteng; ❖ to provide for the protection of wild and the management of alien animals; protected plants; aquatic biota and aquatic systems; ❖ To provide for the protection of invertebrates and the management of alien invertebrates; ❖ To provide for professional hunters, hunting outfitters and trainers; ❖ To provide for the preservation of caves, cave formations, cave biota and karst systems; ❖ To provide for the establishment of zoos ❖ To provide for the powers and establishment of Nature Conservators; ❖ To provide for administrative matters and general powers; and to provide for matters connected therewith.	Aspects of this Bill are applicable to the Proposed Project. Where applicable, these will be considered throughout the S&EIA process and have been included within the reporting documents.
<u>Gauteng Conservation Plan Version 3.3</u> The main purposes of C-Plan 3.3 are: ❖ To serve as the primary decision support tool for the biodiversity component of the Environmental Impact Assessment (EIA) process; ❖ To inform protected area expansion and biodiversity stewardship programmes in the province; ❖ To serve as a basis for development of Bioregional Plans in municipalities within the province. C-Plan 3.3 is a valuable tool to ensure adequate, timely and fair service delivery to clients of GDARD, and is critical	Aspects of this Plan are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.

POLICIES, GUIDELINES AND BY-LAWS	
in ensuring adequate protection of biodiversity and the environment in Gauteng Province.	
Gauteng Environmental Implementation Plan, 2016 The purpose of the EIP is to: ❖ Coordinate and harmonise environmental policies, plans and programmes and decisions to (i) minimise the duplication of procedures and functions; and (ii) promote consistency in the exercise of functions that may affect the environment; ❖ Give effect to the principle of cooperative governance in Chapter 3 of the Constitution; ❖ Secure the protection of the environment across the country as a whole; ❖ Prevent unreasonable actions in respect of the environment that is prejudicial to the economic or health interests of other provinces or the country as a whole; and ❖ Enable monitoring of the achievement, promotion and protection of a sustainable environment.	Aspects of this Plan are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
Gauteng Growth and Development Agency Strategic Plan 2014-2019 The main purpose of the GGDA Strategic Plan is: ❖ Addressing the persistent racial imbalances regarding ownership and general configuration of Gauteng's economy; ❖ Addressing the spatially distorted economic development legacy of apartheid rule; ❖ Broadening the base of economic development beyond the Province's dominant metropolitan municipal areas; ❖ The socio-economic transformation envisaged for the second phase of transition to a national democratic society; and ❖ Achieving the outcomes of creating decent work, economic inclusion and equality.	The Proposed Project will contribute towards employment creation within the Province and will also contribute positively towards economic growth within the region through both its development and operation.
Johannesburg Spatial Development Framework, 2040 The Spatial Development Framework thus seeks to address five major issues in Johannesburg's spatial and social	Where applicable, this document has been considered and consulted throughout the S&EIA process and will be included within the reporting documents.

POLICIES, GUIDELINES AND BY-LAWS	

landscape:
 	
❖ Increasing pressure on the natural environment and green infrastructure.
❖ Urban sprawl and fragmentation.
❖ Spatial inequalities and the job-housing mismatch.
❖ Exclusion and disconnection emanating from:
    • high potential underused areas (the mining belt and the Modderfontein area);
    • securitisation and gated developments, and disconnected street networks (high cul-de-sac ratios and low intersection densities).
❖ Inefficient residential densities and land use diversity.	

<u>Mining Belt West Framework</u> To attain this overall vision of a restructured urban space, the City is committed to concentrating capital funding and a range of interventions over the medium to long term in the Corridors of Freedom. The detailed planning for this has been captured in Strategic Area Frameworks for Louis Botha, Empire-Perth and Turffontein Corridors as well as precinct plans for Jabulani, Nancefield Station, Kliptown, Orlando Ekhaya and Orlando East within the Soweto Corridor. Planning for the Mining Belt is currently underway. The Strategic Area Framework provides 1) the desired spatial response to the intent of the Corridors of Freedom vision by providing development guidelines and parameters such as housing typologies, development controls, densities and land use mix and 2) the projects and programs required to realise this spatial vision. In short, the Strategic Area Frameworks: ❖ Provide spatial context for future development ❖ Guide investment decisions ❖ Identify requirements and opportunities for transformation. ❖ The Corridors of Freedom represent a significant key opportunity to address and successfully implement the developmental goals of the City as outlined in the Joburg Growth and Development Strategy 2040. The approach outlined in the Strategic Area Framework	The removal and reclamation of the Soweto Cluster dumps will unlock land for future development. This is in line with the Mining Belt West Framework as well as the Corridor's of Freedom Strategic Framework.

POLICIES, GUIDELINES AND BY-LAWS	
Therefore recognises the potential of the Corridors to realise a number of high level outcomes and long-term benefits: ❖ Improved urban efficiencies ❖ Viable public transport service ❖ Reduced car dependency and shorter trip lengths ❖ More people closer to work, shopping and leisure opportunities ❖ Lower per capita infrastructure cost ❖ Efficient service provision ❖ Accessibility to economic and social opportunities ❖ Economic, social and environmental sustainability ❖ Reduced energy consumption and carbon emissions – environmental benefit and improved health and quality of life ❖ Neighbourhoods supported with full range of social amenities ❖ Higher land productivity ❖ Residents will have a wider range of choices of housing – more rental in well located areas ❖ Residential and economic activities in areas where public transport is present ❖ Solid basis and support for long-term investment ❖ Increased land value and social value in critical areas of the city ❖ Enhanced liveability of neighbourhoods with improved public spaces ❖ Spatial and social transformation ❖ Housing options for range of income group ❖ Connected neighbourhoods ❖ Curtailed urban sprawl, with densification and infill-development overcoming the burden of fragmentation of urban areas ❖ Restructuring (Spatially and economically) the apartheid city toward a more integrated city form, which seeks to make the city more accessible to disadvantaged groups ❖ More efficient relationship between low-income housing, informal economies and public transport	

POLICIES, GUIDELINES AND BY-LAWS	
❖ Integrative development that can benefit areas beyond the limit of the study area	
<u>The Centre for Environmental Rights - Mining and your Community: Know your Environmental Rights</u> To exploit a mineral, mining companies must get permission to mine from the government. This is known as an Environmental Authorisation. To get permission, the mining company is required to assess the environment and learn about the community and consult with everyone who will be affected by the proposed mining. The Guide published in 2014 by the CER discusses what rights communities and individuals who are affected by mining have, and what laws and processes must be followed by a mining company before it can start mining.	Even though the recovery of the Soweto Cluster is not mining governed by the MPRDA, this DEIAr incorporates the recommendations and guidelines listed in the guide when undertaking PP. All PP is implemented according to the requirements listed in the NEMA EIA Regulations of 2017. Refer to Chapter 6 for an overview of Public Participation to be undertaken.
<u>The Gauteng Province Environmental Management Framework, 2014</u> The Gauteng Department of Agriculture and Rural Development (GDARD) decided to produce an Environmental Management Framework for the whole of Gauteng. The objective of the GPEMF is to guide sustainable land use management within the Gauteng Province. The GPEMF, inter alia, serves the following purposes: ❖ To provide a strategic and overall framework for environmental management in Gauteng; ❖ Align sustainable development initiatives with the environmental resources, developmental pressures, as well as the growth imperatives of Gauteng; ❖ Determine geographical areas where certain activities can be excluded from an EIA process; and ❖ Identify appropriate, inappropriate and conditionally compatible activities in various Environmental Management Zones in a manner that promotes proactive decision-making.	Aspects of this management framework are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and will be included within the reporting documents.
<u>The Public Participation Guidelines in terms of the National Environmental Management Act, 1998 Environmental Impact Assessment Regulations, 2017</u> This document aims to assist with the participation process of all interested and affected parties regarding any proposed project. This guideline provides information and guidance for proponents or applicants, interested and affected parties, competent authorities and environmental assessment practitioners on the public participation requirements of the act, as well as provides information on the characteristics of a vigorous and inclusive public	This guideline was used to ensure that all of the required steps are followed to ensure that a complete and successful public participation process is conducted.

POLICIES, GUIDELINES AND BY-LAWS	
participation process.	
Integrated Environmental Management Guideline on Need and Desirability, 2017 This document assists Environmental assessment practitioners on the best practice as well as how to meet the peremptory requirements prescribed by the legislation as well as sets out both the strategic and statutory context for the consideration of the need and desirability of a development involving any one of the NEMA listed activities. This document further sets out a list of questions which should be addressed when considering need and desirability of a proposed development.	This guideline was used to ensure that the need and desirability of the project was correctly considered and that the need and desirability of the project was thoroughly considered.

CHAPTER 5: THE NEED AND DESIRABILITY OF THIS PROJECT

While the DMRE has primarily focused on reducing the environmental and health liabilities pertaining to abandoned and derelict coal and asbestos mines, very little has been publicised on the department's plan to address abandoned gold tailings. Mining companies, including Crown Gold, hold the rights to several gold tailings dams; however, many more are ownerless and have thus become a liability. It is for this reason that Crown Gold Recoveries wish to take responsibility for reclaiming, reprocessing and rehabilitating the Soweto Cluster Dumps.

As see in Figure 5-1 it is Crown Gold's intention to reclaim the existing Soweto Cluster dumps, thereby liberating land for future development – much like Figure 5-1 below.

Figure 5-1: Progress of reclaiming a dump, where land was liberated for industrial development.

The Integrated Environmental Management Guideline of the Department of Environmental Affairs, Forestry and Fisheries on need and desirability, indicates that by addressing the need and desirability of a development, sustainable development is promoted. This guideline ensures that environmental reports answer questions relating to the ecological sustainability and justifiable economic as well as social development that may arise from the proposed projects

5.1 Environmental Pollution

Historic Tailings are known to cause air and water pollution, as well as soil contamination. The impacts on soil are typically localised to the confines of the TSF's. However, the particulate matter associated with these areas can travel for kilometres, and pollution caused by Acid Mine Drainage (AMD) can also be far reaching.

Dust is a human health risk for several reasons. The dust usually contains fine particulate matter, which can be inhaled, causing damage to lung tissues. The dust also potentially contains hazardous substances that can result in chemical toxicity. Tailings with high level of radioactive material can cause radiological pollution. Collectively, the dust problem poses a significant health risk and reduces the quality of life for many citizens. Furthermore, this undermines the credibility of the mining industry as a responsible corporate citizen (GDARD, 2012, p16). The approval of this project would eliminate the Soweto Cluster dumps as a source of air and water pollution upon rehabilitation.

According to the Gauteng Department of Agriculture and Rural Development (GDARD, 2011), water pollution from abandoned mines is commonly associated with the problem of AMD, which usually refers to the 'point source' of pollution produced by the decant of contaminated water from shafts or inclines connecting the mine void to the surface. Since TSF's are closely associated with these underground mine voids, the issue of water ingress into those voids, via fissures arising from the geotechnically unstable surface, is of great importance. Unfortunately, many older tailing dams were placed in riverbeds or over dolomites which allowed seepage directly into groundwater. The decanting of AMD is a high-profile media issue, which is now driving investment decisions by a range of local and international investors, and which has been raised to the level of a national priority by the recently released AMD report. Possibly more important, however, is the broader issue of 'diffuse sources' of pollution represented by the dumps and slimes dams and their possible interactions with precipitation, seepage, surface-water runoff and shallow groundwater. The long-term sustainable solution is needed for both, AMD and historic TSF problems. This project would contribute in finding a solution to these problems.

Soil contamination, including the mere presence of dumps, tailings and slimes dams in the surface environment, constitutes a pollution hazard through the direct access pathway. This occurs where people are contaminated by, or externally exposed to elevated levels of pollution after unauthorised entry to a mine site, by living in settlements directly adjacent to mines or in some cases, living in settlements on the contaminated Mine Residue Areas of abandoned mines. Direct access to mine sites may also expose the public to risk due to direct external gamma radiation, radon exposure, inhalation and ingestion of radionuclides and chemotoxic metals, as well as the physical dangers inherent to mining sites (GDARD, 2012, pg16).

The reclamation and reprocessing of the Soweto Cluster dumps aims to address the influence of historical underground mining operations that occurred within Soweto on the Witwatersrand plateau. These historic operations have littered the greater Witwatersrand area with mine dumps (slimes dams and sand dumps) and other accumulations of slimes. These mine dumps have become pollution sources, safety risks to surrounding communities and a limitation to spatial development.

5.2 Safety and Security

According to GDARD (2012), most historic mine dumps have an element of lawlessness to them and should be considered as badlands where state penetration is minimal. Apart from theft, other issues that are commonly associated with the historic mine dumps include illegal mining (so-called Zama-Zamas) and illegal settlements near the unsupervised properties. Furthermore, it is well documented that these dumps (as they stand) pose safety risks for law enforcement, affected landowners and adjacent communities. The proposed project will assist with managing the area leading to a safer and more controlled site.

5.3 The Gold Industry of South Africa

South Africa has been undergone a long-term decline in gold output, the share of South Africa's world gold production decreased from 14% to about 5%. This trend continued in 2018. The overall decrease of gold production may be as a result of unreliable electricity-supply constraints, rising administered prices, labour issues, as well as waning productivity rates impeding its operational performance. The reprocessing and reclamation of the Soweto Cluster dumps will retrieve gold from the sand dumps and slime dams. The revival of gold processing and recovery will add valuable tonnage into a declining market and promote economic growth and sustainability for the local economy.

5.4 The Limitation of Spatial Development

Gauteng is South Africa's smallest but most densely populated province, housing 24% of the country's population. 97% of the province's population is urbanised, which has resulted in an increased requirement for land in urban spaces (GSDF, 2016). Significant areas of land in Gauteng are devoted to and/or impacted upon by current and historical mining activities. The main 'gold mining belt' stretches from east to west across the centre of the province. However, gold mining has declined over the past few decades, leaving behind a legacy of TSF's. According to the Gauteng Strategic Development Framework (GSDF) one of the solutions to an ever-growing demand for spaces in the province is by unlocking the mining belt and using these areas for their development potential.

The Soweto Cluster project will liberate potential land for development in line with the 'Corridors of Freedom' and 'Mining Belt West' framework.

5.5 Need and Desirability

The overall objective of this project is to recover residual gold from tailings within eight existing deposits spread across three sites (2L24; 2L20; 2L21; 2L16; 2L17; 2L18; 2A6 and 2A8). The resultant slurry from the reprocessing plant will be deposited on one of two TSF (Cooke TSF or Pits, the West Rand Regional TSF which is still to be constructed). This will allow for the rehabilitation and clearance of land currently occupied by the Soweto Cluster Dumps.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of the mine dumps is extremely important and a positive benefit. It is envisioned that the removal of these dumps could significantly reduce a source of water, land and dust pollution, as well as costs associated with the dumps' maintenance. The land would be cleared to ground level and thereafter be available for future use. The proposed project would also directly and indirectly contribute to the Country's Gross Domestic Product (GDP), as well as enhance and further support workers and contractors employed or contracted to Crown Gold.

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), as well as the GGDA, the City of Johannesburg Strategic Development Framework and the Mining Belt West Framework. The reclamation and rehabilitation of the Soweto Cluster dumps will mitigate the current environmental, health and social impacts, as well as unlock land for potential future development.

CHAPTER 6: APPROACH TO UNDERTAKING THE EIA PROCESS

An EIA process refers to a process undertaken in accordance with the requirements of the relevant EIA Regulations (i.e. the 2014 EIA Regulations, as amended (GNR 326)), which involves the identification and assessment of direct, indirect, and cumulative environmental impacts associated with a proposed project or activity. The EIA process culminates in the preparation and submission of a Final EIA Report (including an EMPr) to the competent authority for decision-making. The EIA process is illustrated in Figure 6-1.

Figure 6-1: The Phases of the EIA process

The reclamation and reprocessing of the Soweto Cluster dumps requires EA in accordance with the requirements of Section 24 of NEMA and the 2014 EIA Regulations (GNR 326) (as amended). The applicant has appointed Kongiwe Environmental (Pty) Ltd, as the independent environmental consultants responsible for undertaking the EIA process required in support of the application for EA. An application for EA was prepared and submitted to DMRE, and the project was assigned Application Reference number: GP/5/1/1/2 (000002) BP.

6.1 Relevant Legislative Permitting Requirements

6.1.1 National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA)[8]

Table 4-1 contains all the listed activities identified in terms of NEMA, the 2014 EIA Regulations (GNR 982), and Listing Notice 1 (GNR 983), Listing Notice 2 (GNR 984), and Listing Notice 3 (GNR 985) which may be triggered by the proposed development of the Proposed Project, and for which EA has been applied.

6.1.2 National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA)

The National Heritage Resources Act, 1999 (Act No. 25 of 1999) (NHRA) provides an integrated system which allows for the management of national heritage resources and to empower civil society to conserve heritage resources for future generations. Section 38 of the NHRA provides a list of activities which potentially require the undertaking of a Heritage Impact Assessment.

<u>Section 38: Heritage Resources Management</u>

[8] The Minister of Environmental Affairs has, on the 7th April 2017, published the following amendments to the NEMA EIA Regulations of 2014: EIA Regulations of 2014 (GNR 326) and the 3 Listing Notices (GNR 324, 325 & 327).

1. Subject to the provisions of subsections (7), (8) and (9), any person who intends to undertake a development categorised as –
    a. the construction of a road, wall, power line, pipeline, canal or other similar form of linear development or barrier exceeding 300m in length;
    b. the construction of a bridge or similar structure exceeding 50m in length;
    c. any development or other activity which will change the character of a site –
        i. exceeding 5 000m² in extent; or
        ii. involving three or more existing erven or subdivisions thereof; or
        iii. involving three or more erven or divisions thereof which have been consolidated within the past five years; or
        iv. the costs of which will exceed a sum set in terms of regulations by SAHRA or a provincial heritage resources authority;

Must at the very earliest stages of initiating such a development, notify the responsible heritage resources authority and furnish it with details regarding the location, nature and extent of the proposed development.

In terms of Section 38(8), approval from the heritage authority is not required if an evaluation of the impact of such development on heritage resources is required in terms of any other legislation (such as NEMA), provided that the consenting authority ensures that the evaluation of impacts fulfils the requirements of the relevant heritage resources authority in terms of Section 38(3) and any comments and recommendations of the relevant resources authority with regard to such development have been taken into account prior to the granting of the consent. However, should heritage resources of significance be affected by the proposed development, a permit is required to be obtained prior to disturbing or destroying such resources as per the requirements of Section 48 of the NHRA, and the SAHRA Permit Regulations (GNR 668).

6.1.3 National Water Act, 1998 (Act No. 36 of 1998) (NWA)

In accordance with the provisions of the NWA all water uses must be licenced by the competent Authority (CA). The pipelines will require authorisation in terms of theNWA for Section 21 water uses (refer to Table 4-1). A pre-application meeting was held with the DHSWS on the 10th of September 2019. The purpose of this meeting was to introduce the project, and discuss the proposed water uses that will be triggered by the project. Notes of this meeting have been added to Appendix C.

Once a site visit has been conducted, and the way forward has been determined, a Technical Report and Integrated Water and Waste Management Plan (IWWMP) will be compiled and submitted. This report is subject to a 60-day public review.

6.2 Overview of the Scoping and EIA process being undertaken

The Scoping Phase of the EIA process refers to the process of identifying potential issues associated with the proposed project and defining the extent of studies required during the EIA Phase. This is achieved through an evaluation of the proposed project, involving the project proponent and a public consultation process with key stakeholders (including government authorities) and Interested and Affected Parties (I&APs).

6.2.1 Tasks completed during the EIA phase

The EIA Phase for the Soweto Cluster project has been undertaken in accordance with the 2014 EIA Regulations (as amended) published in terms of Section 24(5) of NEMA. Key tasks undertaken during the EIA Phase to date include:

- Consultation with relevant decision-making and regulating authorities (at national, provincial and local levels).
- Undertaking a public participation process throughout the EIA process in accordance with the requirements of Regulations 39 to 44 of the 2014 EIA Regulations (as amended) in order to identify any additional issues and concerns associated with the proposed project.
- Preparation of a Comments and Response Report detailing key issues raised by I&APs as part of the EIA Process (in accordance with the requirements of Regulation 44 of the 2014 EIA Regulations (as amended).
- Undertaking independent specialist studies in accordance with the requirements of Regulation 23(5) and Appendix 6 of the 2014 EIA Regulations (as amended).
- Preparation of an EIA Report in accordance with the requirements of Regulation 23 and Appendix 3 of the 2014 EIA Regulations (as amended).

The following subsections outline the Public Participation activities within the EIA process that have been undertaken to date.

6.2.2 Public Participation Process

The public Participation Process (PPP) offers stakeholders a fair opportunity to be informed about the Proposed Project, to raise issues of concern and to make suggestions for enhanced project benefits. The project team will consider relevant issues and suggestions during the EIA process.

The PPP has four phases of consultation with I&APs during the environmental regulatory process. These are presented in Table 6-1 below:

Table 6-1: Activities undertaken and to be undertaken during the public participation process

PROJECT PHASE	DESCRIPTION OF ACTIVITIES
Pre-scoping Phase	❖ Identification of stakeholders; ❖ Providing project information to stakeholders; ❖ Consultation with stakeholders; and ❖ Obtaining comments, suggestions and concerns from stakeholders.
Scoping Phase	❖ Distribution and placement of project announcement materials; ❖ Consultations with the directly affected landowners ❖ Updating of the stakeholder database; ❖ Availability of the Scoping Report for public review and comment;

PROJECT PHASE	DESCRIPTION OF ACTIVITIES
	❖ Providing stakeholders with further details on the Proposed Project and associated specialist studies; ❖ Consultation with stakeholders; ❖ Obtaining further comments, suggestions and concerns from stakeholders; and ❖ Inform specialists and the applicant about stakeholder comments.
EIA Phase	❖ Provide feedback about the specialist studies conducted and mitigation measures proposed by means of consultation with stakeholders; ❖ Make the relevant environmental reports available for public review and comment; ❖ Consultation with key stakeholders; ❖ Provide opportunity for stakeholders to comment on specialist findings, impacts assessments and recommendations; ❖ Verify that comments raised by stakeholders have been accurately recorded; and ❖ Inform specialists and the applicant of stakeholder comments.
Decision Making Phase	❖ Once the competent authority has come to a decision regarding the authorisation of the project, all registered stakeholders will be notified of the decision made and the appeal process to be followed.

6.2.2.1 Summary of Issues Raised by I&AP's

For a comprehensive recording of comments and responses, please refer to Comments and Responses Report (CRR) (**Appendix C9**).

Section 1.4 provides a high-level overview of the main issues raised by I&APs.

6.2.2.2 Submission of the Application

An application for an Environmental Authorisation for the proposed reclamation of the Soweto Cluster Dumps was submitted to the Department of Mineral Resources on 22 October 2019. An acknowledgement letter from the DMRE was received on 23 July 2019 and the following reference number (GP 30/5/1/1/2 (000002) BP was assigned to the proposed project-Please see (Appendix C7) for a copy of an acknowledgement letter.

6.2.2.3 Identification of Stakeholders

To ensure representation of stakeholders, the methods below were utilised to develop a comprehensive stakeholder database.

- ❖ WinDeed searches were undertaken for farm portions in and around the project site to verify land ownership and obtain contact details;
- ❖ Desktop and online research;
- ❖ Stakeholder networking and discussions to source additional stakeholder details:
    - o This entailed telephonic consultations and meetings with landowners, National, Provincial

and Local Government, key Non-Governmental Organisations (NGOs) and other representatives; and
   - A site visit was undertaken to identify I&APs for which no contact details could be obtained;
   - Queries to the Surveyor General and Deeds office.

Stakeholders identified who are affected by or interested in the Proposed Project are grouped into the following broad categories:

- Government: National, Provincial, District and Local Authorities;
- Parastatals: Various semi-Government entities, Organs of State;
- Landowners: Directly or indirectly affected and adjacent;
- Land occupiers: Directly or indirectly affected and adjacent;
- Surrounding communities;
- Non-Governmental Organisations (NGOs): Environmental organisations, community-based organisations;
- Business and industry: small to medium enterprises, mines, industrial and large business organisations; and
- Nature Reserves.

A stakeholder database has been compiled and has been updated throughout the environmental regulatory process (**Appendix C1**).

6.2.2.4 Land Claims

A formal enquiry, which contained a list of all the directly and indirectly affected land portions for the project, was submitted to the Gauteng Department of Rural development and Land Reform (DRDLR), Land Claims Commission, on **Thursday, 30 May 2019 (refer to Appendix C2)**. Feedback was received by means of letters dated **18 June 2019** (**refer to Appendix C2)** which indicated that there are land claims on some of the directly affected properties as follows.

- Portion 38, 39, 130 (RE), 131 (RE), of the farm Doornkop 239 – Registration Division IQ, Gauteng.
- Portion 1 (RE), 5 (RE), 14 (RE), 401 (RE) and 495 of the farm Roodepoort 237 – Registration Division IQ, Gauteng.
- Portion 1 (RE), 4, 92 & 94 (RE) of the farm Vlakfontein 238 – Registration Division IQ, Gauteng.
- Portion 38 & 46 of the farm Vogelstruisfontein 233 – Registration Division IQ, Gauteng.

6.2.2.5 Public Participation Materials

Considering the legislative requirements and good practice, the following documents below have been developed and distributed to stakeholders. The various PPP information materials which were used as part of the Environmental Impact Assessment (EIA) process are included as appendices to this report.

Background Information Document: The BID **(Appendix C3)** provided important information regarding the following:

- A project description of the proposed reclamation of the Soweto Cluster dumps;
- The Environmental Impact Assessment and the Public Participation Process to be undertaken in support of the reclamation process and relevant contact details of the public participation practitioners;
- An Integrated Water Use Licence Application process;
- Details about how stakeholders can register as an Interested and Affected party (I&AP) and be kept informed about the project developments;
- The public review and comment period for the Draft Scoping Report (DSR); and
- Invitation to attend the public meeting.

The BIDS were emailed, and hand delivered to the affected and surrounding landowners. The BID is available on Kongiwe's website (under public documents).

Newspaper advertisements: A newspaper advert (**Appendix C4**) was placed in ***The Star**,* on **Monday, 3 June 2019**. The advert included the following details:

- Brief project description;
- Legal framework, the competent authorities and details of the appointed EAP;
- The venues where the DSR could be accessed;
- The details of the public meeting;
- Registration as Stakeholders;
- The contact details of the stakeholder engagement office.

Site notice: Similar to the advertisement, the site notice provided an overview of the project, and highlighted the applicable legislation for the EIA process. It also stipulated the PPP to be followed and where relevant information could be obtained from. Moreover, the site notice invited stakeholders to formally register as an Interested and Affected Party on the project. Site notices were placed at prominent places in and around the project area. See **(Appendix C5)** for the site notice report and site notice map.

Notification Letter with a Comment and Registration Form: An email was sent to stakeholders on **Friday, 31 May 2019** to inform them about the proposed project, applicable legislation and competent authorities. The email also shared details of the public meeting and invited stakeholders to register formally as Stakeholders. A Comment and Registration Form was also provided for stakeholders to use for formal registration as Stakeholders or to submit comments. (See **Appendix C6**). A second notification was emailed on **Wednesday, 19 June 2019** to the full stakeholder database, to remind stakeholders of the availability of the Daft Scoping Report for public review and about the public meeting, which was held on **Thursday, 20 June 2019**.

Telephonic discussions: Stakeholders were also consulted by means of telephonic discussions. Furthermore, these discussions aided with the process of invitations to the Public Meeting.

6.2.2.6 Draft Scoping Phase Consultation

Pre-Application Meeting

Pre-application meetings consultation was aimed at engaging with key stakeholders (Competent and Commenting authorities) regarding the proposed project to obtain initial comments which informed specialist studies and project planning. The project team presented an overview of the proposed project, locality and land tenure maps were distributed as part of the meetings. Furthermore, meetings were also held with directly affected landowners on a one-on-one basis. Refer to (**Appendix C8)** for a list of meetings and consultations that were undertaken. Minutes of these meetings have been compiled and distributed to stakeholders **(Appendix C8)**.

All comments raised by stakeholders during these meetings have been captured into the Comment and Response Report (CRR) **(Appendix C9)**. Responses to comments were provided in line with the overall project scope and available information.

Public Meeting

The aim of consultation during the Scoping Phase was focused on the formal EIA process, specialist impact studies terms of reference and addressing stakeholder comments already submitted. A public meeting was held on **Thursday, 20 June 2019 at 10H00 at the at the Bramfischerville Multipurpose Centre, Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville.** The purpose of the meeting was to discuss the proposed project, contents of the Draft Scoping Report and also to provide stakeholders with an opportunity to raise their concerns/comments. Minutes from the public meeting have been compiled and distributed to all stakeholders **(See appendix C8).**

Mobilisation of stakeholders was done for Authorities, NGOs, Landowners / land occupiers and community members to promote attendance, by means of telephonic consultation and distribution of emails and Short Message Service (SMS) prior to the public meeting.

Figure 6-2: Public Meeting held on Thursday, 20 June 2019

A Power Point presentation was used at the public meeting to present the information regarding the proposed project. BIDs, Registration sheets and electronic copies (CDs) of the Draft Scoping Report were made available at the public meeting.

All comments raised by stakeholders were captured in the CRR **(Appendix C9)**. Stakeholder comments were closely considered and addressed, where applicable, by the project team to ensure that the scope for specialist studies to be undertaken was well defined. Responseswere provided to the comments raised by stakeholders and included in the CRR throughout the PPP.

The Draft Scoping Report (DSR) was made available to stakeholders on the Kongiwe Environmental website and in public places for a 30-day comment period from **Tuesday, 4 June 2019 to Monday, 8 July 2019.** Notification of the availability of the documentation for review was distributed on **Friday, 31 May 2019.**

Table 6-2: Public places where the Draft Scoping Report could be accessed

LOCATION	PHYSICAL ADDRESS	CONTACT PERSON
Hard copies		
Bramfischerville Public Library	Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville	Ms Patricia Mathe Tel: (011) 765 4025
Roodepoort Public Library	Cnr Berlandina & Hodgson Streets	Ms Monique Ramabulana Tel: (011) 763 1031
Electronic copies		
Kongiwe Environmental website	www.kongiwe.co.za/publication-view/public-documents	Sibongile Bambisa / Vanessa Viljoen
For a CD copy please contact the stakeholder engagement team (Sibongile Bambisa/ Vanessa Viljoen), Tel: (012) 003 6627, Email: stakeholders@kongiwe.co.za		

Key Commenting Authorities that have received copies of the DSR were as follows:

- Department of Human Settlements, Water and Sanitation;
- National Nuclear Regulator;
- City of Johannesburg Metropolitan Municipality;
- Gauteng Department of Agriculture and Rural Development (GDARD);
- National Department of Health;
- Johannesburg Health District;
- South African Heritage Resources Agency (SAHRA);
- Department of Public Works and Infrastructure; and
- Department of Environment, Forestry and Fisheries (DEFF)

Table 6-3 below provides details of the activities that formed part of the Draft Scoping Phase.

Table 6-3: Summary of PP activities during the Draft Scoping Phase

ACTIVITY	DETAILS	REFERENCE IN THE SCOPING REPORT
PRE-SCOPING PHASE		

ACTIVITY	DETAILS	REFERENCE IN THE SCOPING REPORT
Identification of stakeholders	Stakeholders, were identified by means of WinDeed searches, stakeholder networking and research for the compilation of a stakeholder database.	Appendix C1 Stakeholder database
Identification of land claims	A formal enquiry, which contained a list of all the directly affected land portions for the project, was submitted to the **Land Claims Commission Gauteng Regional Office** at the Department Rural development and Land Reform (DRDLR), on **Thursday, 30 May 2019.** Feedback was received by means of letters dated **18 June 2019 (refer to Appendix C2)** which indicated that there are land claims on some of the directly affected properties.	Appendix C2 Land claims letters
Development of the Background Information Document	The BID was developed and emailed to the full stakeholder database on **Friday, 31 May 2019.** The BID was also distributed at stakeholder meetings and is available on Kongiwe's website. A second announcement letter was emailed on **Wednesday, 19 June 2019** to the full stakeholder database, to remind stakeholders of the availability of the Daft Scoping Report for public review and about the public meeting, which was held on Thursday, 20 June 2019.	Appendix C3 BID
Placement of media advertisements	An advertisement was placed in *The Star* (Regional Newspaper) on **Monday, 3 June 2019.**	Appendix C4 Advertisements
Placement of site notices	Site notices were put up in publicly accessible places within proximity of the project area on **Tuesday, 04 June 2019**. A copy of a Site Notice was also placed at the ❖ Bramfischerville Public Library ❖ Roodepoort 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.	Appendix C5 Site notice report and placement map

ACTIVITY	DETAILS	REFERENCE IN THE SCOPING REPORT
Announcement of the project and Draft Scoping Report	A notification email was sent to the full database on **Friday, 31 May 2019** to: ❖ Announce availability of the Scoping Report; ❖ Share details of the public meeting; ❖ Indicate where the Scoping Report was made available for public review and comment; and ❖ Communicate the public review and comment period. The Draft Scoping Report and the BID were made available on Kongiwe's website www.kongiwe.co.za/publication-view/public-documents Copies of the DSR were submitted to the Competent authority and relevant Commenting Authorities for their review and comment.	Appendix C6 Announcement Letter Appendix C3 BID
Stakeholder meetings	One-on-one meetings were held with Authorities and Directly Affected Landowners throughout the scoping phase. Minutes from these meetings have been compiled and distributed to all stakeholders. An overview of the Proposed Project was discussed, and stakeholder comments were captured and responded to in the CRR.	Appendix C7 and C8 List of meetings & Meeting Minutes Appendix C9 Comment and Response Report
Public Meeting	A Public meeting was held with stakeholders on **Thursday, 20 June 2019 at 10H00 at the at the Bramfischerville Multipurpose Centre, Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville.** Minutes of this meeting have been distributed to all stakeholders who attended the meeting. Minutes of this meeting has been captured into to the Comments and Response (CRR) Report.	Appendix C8 Minutes of the Public Meeting Appendix C9 Comment and Response Report

6.2.2.7 Final Scoping Phase Consultation

The aim of consultation during the Final Scoping Phase was to focus on the formal EIA process, specialist impact studies, terms of reference and addressing stakeholder comments already submitted.

Stakeholders were notified that the Final Scoping Report was submitted to the Department of Mineral Resources and Energy on **Monday, 15 July 2019**. Stakeholders were provided the opportunity to verify that their comments which were captured during the draft Scoping phase, and to review responses provided by the project team. The Final Scoping Report was available on Kongiwe's website (under public documents).

Table 6-4: Summary of PPP activities that were undertaken during the Final Scoping Phase

ACTIVITY	DETAILS	REFERENCE
Update of stakeholder information	The stakeholder database has been updated with new stakeholders who formally registered, attended stakeholder meetings or submitted comments.	Appendix C1 Stakeholder database
Placement of the Final Scoping Report	The Final Scoping Report for the proposed project was made available on Kongiwe Environmental website www.kongiwe.co.za/publication-view/public-documents Copies of the Final Scoping Report were submitted to the Competent authorities as well as relevant commenting authorities.	
Announcement of the Final Scoping Report	Announcement letter of availability of the Final Scoping Report was emailed to the full stakeholder database on **Thursday, 25 July 2019.**	Appendix C6 Announcement letter

6.2.2.8 Impact Assessment Phase Consultation

Consultation with stakeholders during the EIA Phase revolved around stakeholders providing comments on specialist study findings, recommendations and mitigation measures proposed. These studies and recommendations are included as part of the Environmental Impact Assessment Report and the Environmental Management Programme EIA/EMPr.

The Draft EIR/EMPr was made available for a 30-day public review period from **Thursday, 24 October 2019 to Friday, 22 November 2019.** Notification of the availability of the documentation for public review and comment was distributed on **Thursday, 17 October 2019** to all stakeholders on the database to notify them of the availability of the DEIR/EMPr and the Open Day. A reminder email was sent on **Wednesday, 30 October 2019** to all the stakeholders on the database. The reports were made available at the locations indicated in Table 6-5 below:

Table 6-5: Public places where the Draft EIA/EMPr could be accessed

LOCATION	PHYSICAL ADDRESS	CONTACT PERSON
Hard copies		
Bramfischerville Public Library	Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville	Ms Patricia Mathe Tel: (011) 765 4025
Roodepoort Public Library	Cnr Berlandina & Hodgson Streets	Ms Monique Ramabulana Tel: (011) 763 1031
Electronic copies		

Kongiwe Environmental website	www.kongiwe.co.za/publication-view/public-documents	Sibongile Bambisa/ Vanessa Viljoen), Tel: (012) 003 6627
For a CD copy please contact the stakeholder engagement team (Sibongile Bambisa/ Vanessa Viljoen), Tel: 010 140 6508, Email:stakeholders@kongiwe.co.za		

The Draft EIR/EMPr was distributed to the Competent Authority and key Commenting Authorities. Refer to **(Appendix C7)** for proof of delivery. Key Commenting Authorities that received copies of the reports are as follows:

- Department of Human Settlements, Water and Sanitation (DHSWS);
- National Nuclear Regulator;
- City of Johannesburg Metropolitan Municipality;
- Gauteng Department of Agriculture and Rural Development (GDARD);
- National Department of Health;
- Johannesburg District Health;
- Johannesburg Health District;
- South African Heritage Resources Agency (SAHRA);
- Department of Public Works and Infrastructure; and
- Department of Environment, Forestry and Fisheries (DEFF)

Open Day

An Open Day was held on Saturday, 2 November 2019. Details of the Open Day are indicated below in Table 6-6. Stakeholders were invited to the Open Day by means of a notification letter which was sent by email. An SMS was sent to stakeholders who did not have email access. The purpose of this Open Day was to provide feedback on the findings from the specialist studies undertaken and to obtain comments. All comments raised were captured into the Comment and Response Report and were responded to.

Table 6-6: Details of the public meeting

DATE	VENUE	TIME
Saturday, 02 November 2019	The Moses Kotane Primary School - Phase 1, Braamfischer, Roodepoort, 1724	Between 10h00 to 15h00

Figure 6-3: Open Day held on Saturday, 2 November 2019

6.2.2.9 Public Participation Materials: EIA phase

Notification Letter: a letter **(Appendix C6)** which provided details about the availability of the Draft EIR/EMPr for public comment and an invitation to the public meeting was sent to the full stakeholder database.

Newspaper advertisements: A newspaper advert **(Appendix C4)** was placed in ***The Star*** on ***18 October 2019***. The advertisement provided details about the public review period for the DEIR/EMPr and how the public could access the draft reports for their review and comment. The advert also provided information about the Open Day details.

Telephonic Discussions: Stakeholders were invited to the Open Day by means of telephonic discussions.

Maps: Various maps which are part of the DEIR/EMPr and were on display during the Open Day.

PowerPoint Presentation: A presentation was compiled and used at the Open Day. The following aspects were covered in the presentation below:

- Project Overview;
- EIA process and legislative timeframes;
- Specialist findings, impacts and proposed mitigation measures; and
- PPP undertaken to date and next steps

Table 6-7: Summary of PPP activities - Draft Environmental Impact Assessment Phase

IMPACT ASSESSMENT PHASE		
Activity	**Details**	**Reference in DEIR/EMPr**
Announcement of the availability of the Draft EIA/EMP and IWULA Reports	A Notification letter announcing the availability of the Draft EIR/EMPr and IWULA for public review and comment was emailed to the full database.	Appendix C6 Announcement of the Draft EIR/EMPr and IWULA

IMPACT ASSESSMENT PHASE		
Activity	**Details**	**Reference in DEIR/EMPr**
	(Public comment period for Draft EIR/EMPr (30 days): Thursday, 24 October 2019 to Friday, 22 November 2019.	
Placement of Draft EIA/EMP Report for public review and comment	The Draft EIR/EMPr was made available to stakeholders at the following public places: ❖ Bramfischerville Public Library, Cnr Loerie Blaar & Methlokgo Phase 2, Bramfischerville ❖ Roodepoort Public Library, Cnr Berlandina & Hodgson Streets. An electronic copy of the Draft EIR/EMPr was made available on Kongiwe's website www.kongiwe.co.za/publication-view/public-documents A copy of the Draft EIR/EMPr was also be made available at the Open Day. Copies of the Draft EIR/EMPr were sent to the DMRE and various Commenting Authorities for review and comment.	-
Open Day	An Open Day was held with all stakeholders on **Saturday, 02 November 2019** between 10h00 and 15h00 at the Moses Kotane Primary School - Phase 1, Braamfischer, Roodepoort, 1724. All comments provided at this Open Day were captured into the Comment and Response Report	Appendix C9 Comment and Response Report
Placement of media advertisement for the EIA	An advertisement was be placed in *The Star* (Regional Newspaper) on **18th October 2019.**	Appendix C4 Advertisements

Table 6-8: Summary of the PPP activities - Final EIA phase

ACTIVITY	DETAILS
Announcement of the Final EIR/EMPr and IWULA	A notification letter announcing the availability of the FEIR/EMPr was emailed to the full database **Friday, 6 December 2019**. The FEIR/EMPr has been made available on Kongiwe's website.
Submission to the Authorities	The FEIR/EMPr has been submitted to the DMRE and key Commenting Authorities on **Friday, 6 December 2019**.

6.2.2.10 Consultation during the decision-making phase

Once the competent authority has come to a decision regarding the authorisation of the project, all registered stakeholders will be notified of the decision made and the appeal process to be followed.

6.2.3 Assessment of issues identified as part of the EIA phase

In accordance with the approved Plan of Study for EIA, issues which required investigation during the EIA Phase, as well as the specialists involved in the assessment of these impacts are indicated in Table 6-9. Section 1.4 details, on a high-level, the issues raised by stakeholders during the Scoping phase of the project.

Table 6-9: Specialist team members.

SPECIALIST STUDY	SPECIALIST COMPANY	SPECIALIST NAME	PEER REVIEWER
Biodiversity (Fauna, Flora, Wetlands and Aquatics)	The Biodiversity Company	Andrew Husted (Pr.Sci.Nat)	Anita Rautenbach (Pr.Sci.Nat)
Surface Water	HydroSpatial	Andy Pirie (Pr.Sci.Nat)	Sivan Daher (Pr.Sci.Nat)
Groundwater	Groundwater Abstract	Lucas Smith (Pr.Sci.Nat)	Irene Lea (Pr.Sci.Nat)
Air Quality	Gondwana Environmental Solutions	Anja van Basten	Dr Martin van Nierop
Heritage	PGS Heritage	Wouter Fourie (APASA) (APHP)	Jaco van der Walt (ASAPA) (SAHRA) (AMAFA)
Social	Kongiwe Environmental	Sibongile Bambisa	Gerlinde Wilreker (Pr.Sci.Nat)
Noise	Enviro Acoustic Research	Morné de Jager	Johan Maré (Pr.Sci.Nat)
Traffic	EDL Consulting Engineers	John v Rooyen	Eben D. Kotze (Pr.Tech.Eng)
Health	Kongiwe Environmental	Gerlinde Wilreker (Pr.Sci.Nat)	Natasha Taylor-Meyer

CHAPTER 7: THE BASELINE ENVIRONMENT AND SPECIALIST FINDINGS

This Chapter provides a description of the environment that may be affected by reclamation and reprocessing of the Soweto Cluster dumps. The information is provided in order to assist the reader in understanding the receiving environment within which the project is proposed, and features of the biophysical, social, and economic environment that could be directly or indirectly affected by, or alternatively could impact on, the proposed development. This information has been sourced from existing available information and the on-site specialist investigations conducted as part of the EIA and aims to provide the context within which this EIA is being conducted. The full impact assessments undertaken by the independent specialists, including detailed descriptions of the affected environment, are attached as Appendices D of this EIA Report.

7.1 Climate

Refer to Specialist Study: Appendix D2 – Surface Water

Refer to Specialist Study: Appendix D4 – Air Quality

The study area is characterised by a typical Highveld climate, with summer rainfall in the form of convectional downpours of high intensity (promoting runoff) (Davidson 2003). Mean maximum temperatures average 26°C in January dropping to an average maximum of around 16°C in June. The summer months (September to April) are characterised by hot days, summer thunderstorm activity and cool evenings. Winter (May to August) days are dry and nights are cold. Rain hardly falls in winter and the temperature occasionally drops to below freezing at night, causing frost.

The summer rainfall aids in removing pollutants through wet deposition. In summer, unstable atmospheric conditions result in mixing of the atmosphere and rapid dispersion of pollutants. In contrast, winter is characterised by atmospheric stability caused by a persistent high pressure system over South Africa.

The closest weather station to the Soweto Cluster with recent rainfall and evaporation data, was the DHSWS station C2E007. The station is located 10 km south-west of the Soweto Cluster. Monthly rainfall and evaporation data was downloaded from the DHSWS website and was used to describe the climate of the area. A summary of the station details is provided in Table 7-1.

Table 7-1: Closest and recent weather station to the Project

STATION NUMBER	DISTANCE & DIRECTION FROM SOWETO CLUSTER	AVAILABLE RECORD	MAP (MM)	S-PAN MAE (MM)	LATITUDE*	LONGITUDE*
C2E007	10 km south-west	February 1959 – June 2019	697	1 515	26.30°	27.81°

7.1.1 Rainfall

The mean monthly rainfall is indicated in Figure 7-1. The area has a Mean Annual Precipitation (MAP) of 697 mm. The wettest months occur from October through to April, with the driest months occurring over the period of May to September. Rainfall is mostly in the form of convective thunderstorms, which are often brief, but regularly high in intensity. Tropical and frontal rainfall systems also occur in the region but are not as common.

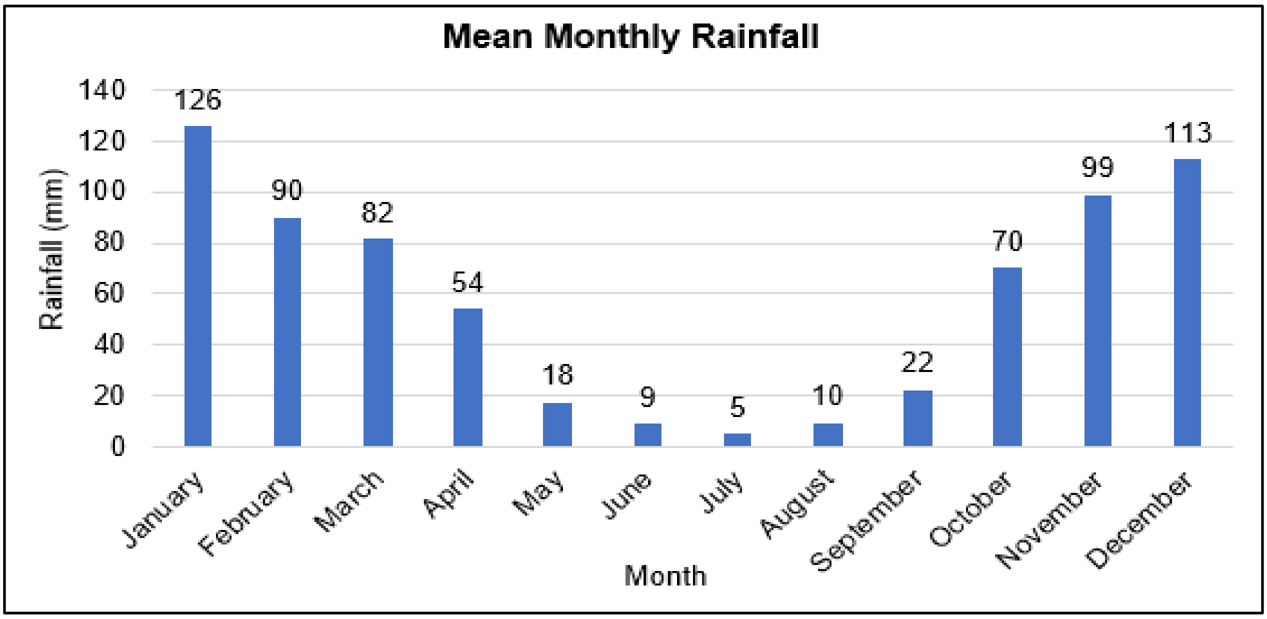


Figure 7-1: Average monthly rainfall totals for the project (Soweto weather station)

7.1.1.1 Storm Rainfall Depths

The storm rainfall depths for the centre position of the Project were extracted from the Design Rainfall Estimation in South Africa software programme (Smithers and Schulze, 2002). The programme uses the six closest rainfall stations to a user specified coordinate, to calculate the storm rainfall depths. The extracted storm rainfall depths for the Project are indicated in Table 7-2.

Table 7-2: Storm rainfall depths for the Project

STORM DURATION	RETURN PERIOD / STORM RAINFALL DEPTH (MM)						
min / hr / day	1:2 yr	1:5 yr	1:10 yr	1:20 yr	1:50 yr	1:100 yr	1:200 yr
5 min	9	13	15	18	22	26	30
10 min	13	18	22	26	32	37	42
15 min	16	22	27	32	39	45	52
30 min	21	29	35	41	51	58	67
45 min	24	33	40	48	59	68	78
1 hr	27	37	45	53	65	75	86
1.5 hr	31	43	52	62	76	87	100
2 hr	35	48	58	68	84	97	111
4 hr	42	58	70	83	102	118	135

STORM DURATION	RETURN PERIOD / STORM RAINFALL DEPTH (MM)						
6 hr	47	65	79	93	114	132	151
8 hr	51	70	85	101	123	143	164
min / hr / day	**1:2 yr**	**1:5 yr**	**1:10 yr**	**1:20 yr**	**1:50 yr**	**1:100 yr**	**1:200 yr**
10 hr	54	75	91	107	131	152	174
12 hr	57	79	95	113	138	160	183
16 hr	62	85	103	122	150	173	198
20 hr	66	91	110	130	159	184	211
24 hr	69	96	115	137	168	194	222
1 day	60	83	100	118	145	168	192
2 day	74	102	123	146	179	207	237
3 day	84	115	140	165	202	234	268
4 day	91	126	153	180	221	256	293
5 day	98	135	163	193	237	274	314
6 day	104	143	173	205	251	290	333
7 day	109	150	181	215	263	304	349

7.1.2 Evaporation

The DHSWS weather station C2E007 measures evaporation using a Symon's Pan (S-Pan). S-Pan evaporation measurements are not a true reflection of evaporation from natural open water bodies, as the water temperatures in the S-Pan are higher, resulting in higher evaporation rates. In order to convert S-Pan measurements to open water evaporation, monthly open water evaporation conversion factors were used, which were obtained from the WR2012 study. The adopted monthly evaporation for the Project is indicated in Table 7-3. Evaporation is highest over the months of September to March, and lowest over the cooler months of April to August.

Table 7-3: Symons Pan and open water evaporation for the project

MONTH	SYMONS PAN EVAPORATION (MM)	OPEN WATER EVAPORATION FACTOR	OPEN WATER EVAPORATION (MM)
January	169	0.84	142
February	138	0.88	122
March	129	0.88	113
April	102	0.88	89
May	85	0.87	74
June	68	0.85	57
July	75	0.83	63
August	106	0.81	86
September	145	0.81	117
October	163	0.81	132
November	166	0.82	136
December	170	0.83	141
Total	**1 515**	N/A	**1 272**

7.1.3 Wind Direction

Wind roses graphically present wind conditions over a period at a specific location. Wind roses for the project are presented in Figure 7-2 to Figure 7-4 below. In the wind roses, the length of each spoke represents the percentage of time that the wind blew from that direction during the period. The percentage scale is presented on the concentric grey lines (the circle scale increment is indicated on each of the wind roses). Each spoke is divided by colour into wind speed ranges.

The predominant winds at the Soweto Cluster project sites (as given by the WRF data for the period from 2016 to 2018) are from the north-north-westerly, northerly, south-south-easterly and south-easterly directions for approximately 9 % of the time from each of these four directions (Figure 7-2). However, the highest number of winds with speeds greater than 6.5 m/s are expected from the north-north-westerly direction, followed by winds from a north-westerly direction. The average hourly wind speed predicted by the WRF model is approximately 2.48 m/s. Calm conditions (wind speeds below 0.5 m/s) are predicted for approximately 1.4 % of the time.

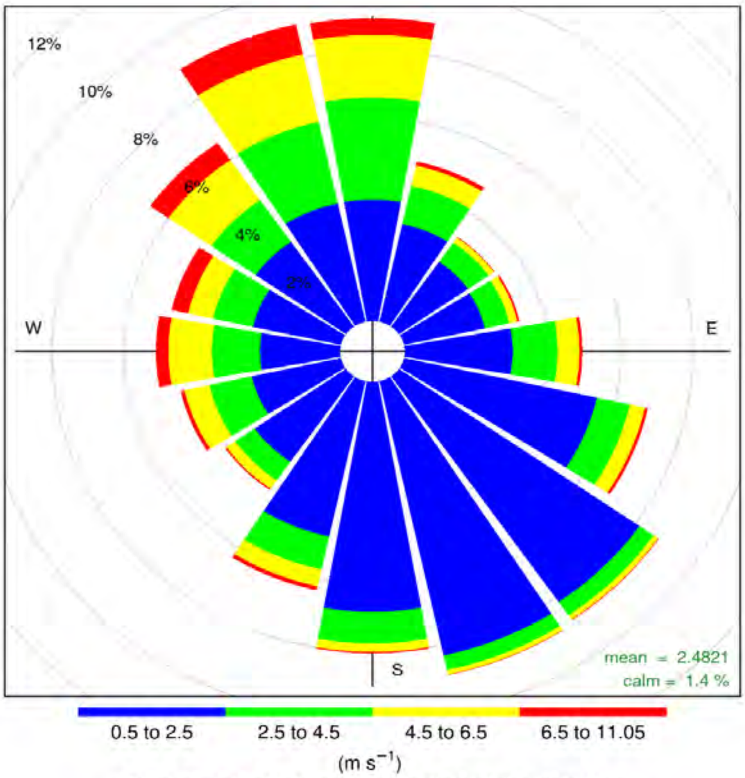


Figure 7-2: Wind rose of the average winds produced by the WRF model for the Soweto Cluster Project site for the years 2016-2018.

The seasonal variations in wind direction for the Soweto Cluster Project site are illustrated in Figure 7-3. The highest number of wind speeds above 6.5 m/s are experienced in Spring. The maximum number of calm conditions are experienced in Autumn.

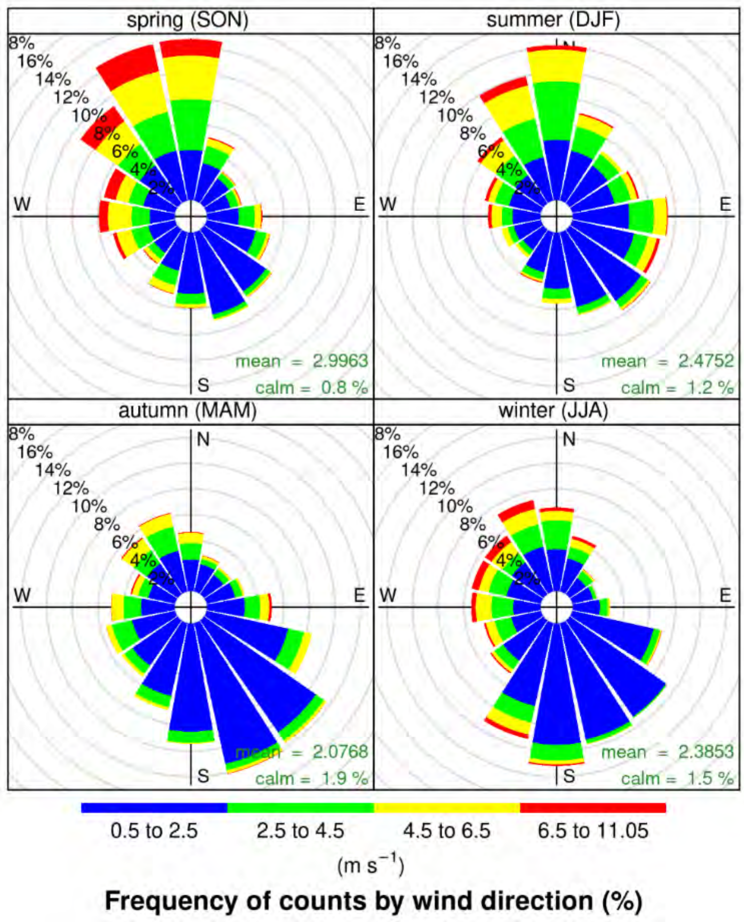


Figure 7-3: Seasonal wind roses of winds predicted by the WRF model for the Soweto Cluster Project site for the years 2016-2018.

There is a clear diurnal variation in both wind speed and wind direction at the Soweto Cluster Project site. During the warmer hours of the day, calm conditions are expected for approximately 2.4 % of the time, and average wind speeds are approximately 3 m/s. Wind speeds above 6.5 m/s are expected for approximately 6 % of the time. The most frequent wind directions are from the north-north-westerly direction. During the night, calm conditions are expected for approximately 0.3 % of the time, and average wind speeds are approximately 1.9 m/s. The winds tend to blow more from the southerly to south-easterly quadrant Figure 7-4.

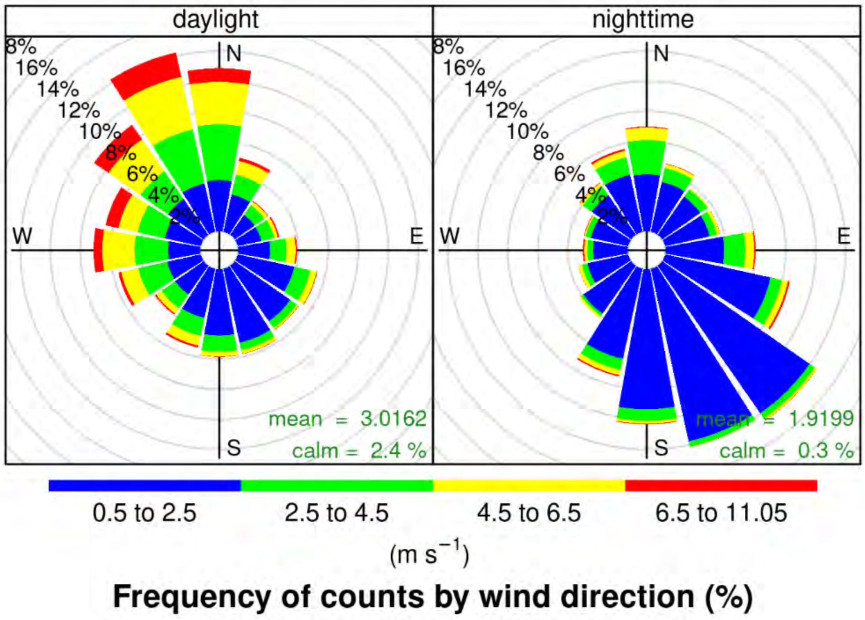


Figure 7-4: Diurnal wind roses predicted by the WRF model for the Soweto Cluster Project site for the years 2016-2018.

7.2 Topography

The Highveld inland plateau has an elevation varying from 1 400 m above mean sea level in the north to 1 800 m (Johannesburg 1 757 m) in the northwest. The prominent morphological features in the area include historic mine dumps which rise to about 50 - 60 m above ground. The local terrain morphology has been classified as undulating plains There is a ridge line that runs from southeast to northwest. The project area is situated on top of the ridge and as a result, the ridge line does not act as a screening factor to the areas surrounding the study area.

The majority of the receiving environment has gentle slopes of between 0° and 7°. Slopes of between 8° and 51° occur in isolated areas along the ridge line and on the sides of several old sand dumps and slimes dams from historical mining in the area. The slope aspect/direction on the northern side of the ridge line is generally in a northerly and north-easterly direction while the slope aspect/direction on the southern side of the ridge line is generally in a southerly and south-westerly direction.

7.3 Geology

Refer to Specialist Study: Appendix D3 - Groundwater

The Witwatersrand Basin lies on the Kaapvaal Craton and is one of the world's largest gold placer deposits. The basin stretches over an arc of roughly 400 km, traversing across the Free State, North West and Gauteng Provinces. The gold occurs in coarse-grained conglomerates, forming the upper portions of the Witwatersrand Supergroup. It is found in association with uranium, quartz, carbon seams, phyllo-silicates and pyrite. The mineralisation of the Witwatersrand reefs is extensive and approximately 70 ore minerals, including diamonds, have been documented from the Witwatersrand conglomerates. After 120 years of mining, operations in this area have reached depths of approximately 4,000 metres (m) (Minerals Council of SA, 2019).

Gold-bearing reefs within the Witwatersrand sediments have been mined from the Far West Rand to the East Rand, and these operations yielded the mine dumps that are currently being reclaimed by Crown Gold.

The Soweto Cluster is underlain by geological formations of the Transvaal Sequence, Ventersdorp Supergroup and the Witwatersrand Supergroup (Figure 4). Majority of the Soweto Cluster dumps are directly underlain by shale, quartzite and conglomerate of the Witwatersrand Supergroup, Central Rand Group. These include slimes dams 2L16, 2L17/ 18 and 2L20/ 21 and sand dumps 2A6 and 2A8 (Figure 5).

The Lower Witwatersrand is composed mainly of argillaceous clays and shale, with occasional banded ironstone, tillite and intercalated lava flow, while the Upper Witwatersrand consists almost entirely of quartzite and conglomerate.

Slimes dam 2L24 is located on Malmani Sub-group dolomite, Chuniespoort Group, Transvaal Sequence. This circular pocket of dolomite is an isolated deposit, bounded by Black Reef quartzite and underlain by basaltic lava of the Klipriviersberg Group, Ventersdorp Supergroup (Figure 4).

The Chuniespoort sediments alternate between chert-rich and chert-poor dolomite. Based on the information presented by Barnard (2000) the chert-poor Oaktree Formation is adjacent to the Black Reef quartzite, followed by the chert-rich Monte-Christo Formation; then the Lyttleton, Eccles and lastly the Frisco Formations. A drilling programme by Intraconsult (2000) to investigate the area east of 2L24 (for residential development) indicates the presence of chert-poor Oaktree dolomite and chert-rich Monte-Christo dolomite. The dolomite dips towards the centre of the circular body (south in this area), at approximately 30° to 45°. The Black Reef Formation is composed of quartzite, conglomerate, grit and shale, with the whole sequence approximately 30 m in thickness.

The Black Reef formation is located along the northern boundary of 2L24 and dips steeply (30° to 75°) towards the south, towards the centre of the basin.

There is a circular shaped, magnetic feature (derived from airborne magnetic survey data) that occupies a large portion of the central and southern portion of the dolomite deposit. Intraconsult identified the circular feature as an igneous plug; also known as the Vogelstruisfontein gabbroid. The area presents a series of cross-cutting faults and dykes. Fault appearance varies from small localised fractured zones to large breccia filled zones and are commonly filled with intrusive material. The composition ranges from diabase to norite (Biccard Jeppe, 1946). The dolerite dykes divide the dolomite into characteristic groundwater compartments.

The Soweto Cluster is associated with the Zuurbekom Compartment, and to a lesser degree the Upper Klip River dolomitic compartment. The Klip River Dyke runs from Roodepoort, across the centre of the dolomitic inlier and south towards Lenasia. The dolomitic compartment to the east of the dyke is known as the Upper Klip River Compartment and to the west as the Zuurbekom Compartment.

The Intraconsult study found that the shale formations (to the east of 2L24) are thickest to the north and thin out towards the south and southwest. In places, the shale is up to 60 m in thickness. Dolomite was intersected between 17 m and 58 m on this site. Red brown silty sand and clay cover the residual soils (Intraconsult, 2000).

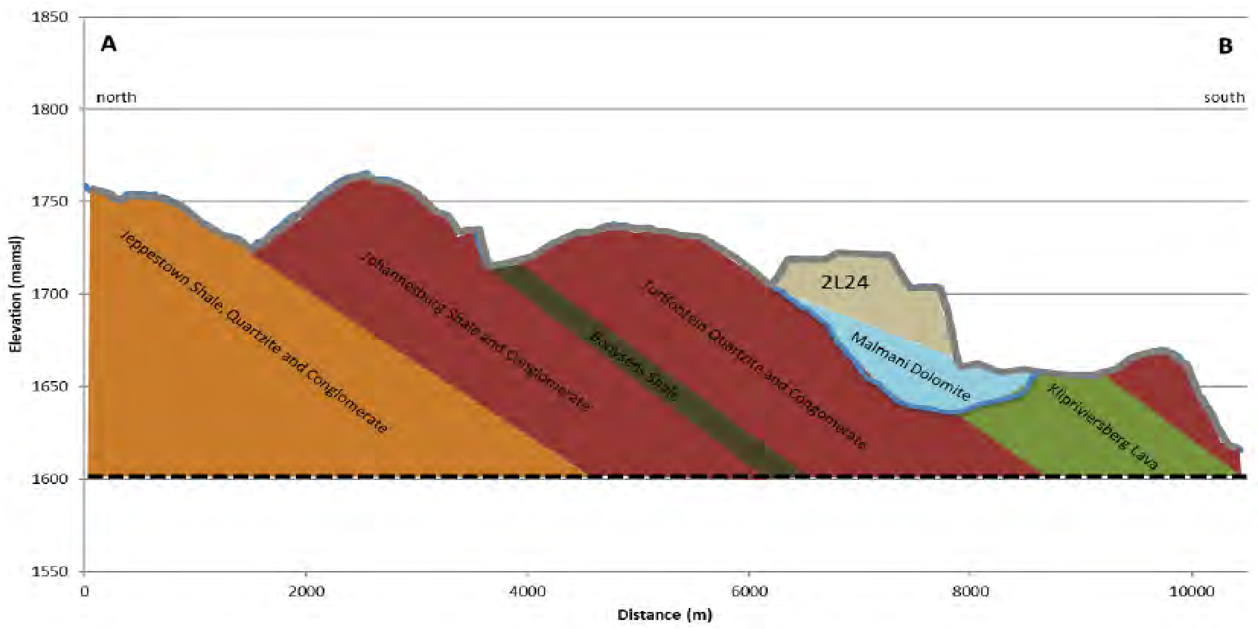


Figure 7-5: Simplified Geology of the project area

7.4 Soils, Land Use, and Land Capability

Refer to Specialist Study: Appendix D1 – Biodiversity Impact Assessment and Wetland Assessment

7.4.1 Soils

As mentioned in Geology above, the project is situated in a transitional area between Witwatersrand quartzites which predominate in the south-eastern regions and argillaceous and arenaceous rocks which predominate in the north and west. Both lithologies form part of the Central Rand Group.

The soils in the area are expected to be good deep red or yellow apedal soils; however, due to the mining infrastructure, historic TSFs and the close proximity of the community, these areas have been significantly modified and degraded. The dominant soils found at the 2L24 site are Hutton (Hu) and Clovelly (Cv) forms. These soils are deep and have a high to moderate agricultural potential. There is some subsistence farming taking place in these areas (mainly maize).

Of significance is the potential for some of the wetlands within the project area to harbour peat based on their size, location and general geomorphology. Closer inspection of the available research and data suggested that this may indeed be the case. Point locality data provided within the South African Peat Database (Grundling *et al*. 2017) reveals that peat has been sampled in the downstream reaches of the two large unchanneled valley bottoms in the far western regions of the project area associated with the Wonderfonteinspruit (HGM1) and Klipspruit respectively (HGM 2). Downstream reaches of the

Wonderfonteinspruit near Potchefstroom are well known for its peat where it is farmed, *inter alia*, to support the mushroom industry. Using this information these two wetlands were specifically sampled for peat and the samples sent to Nvirotek Labs for analysis of percentage organic carbon.

Samples from these wetlands are both characterised by a black, fibrous organic topsoil visibly resembling peat (Figure 7-6d) which gives way to a black alluvial subsoil below 40 cm. The laboratory results of the Carbon (Walkley Black) test revealed although a high carbon content is present in the soil 1.15 %. It is still below what normally constitutes peat, suggesting that peat may not occur at these locations, or, that the precise location and depth at which the samples were taken missed the main deposit. Nevertheless, the presence of peat within at these localities should not be conclusively ruled out.

Peatlands are under threat due to gold mining-related contaminants including AMD (Acid Mine Drainage), radiation and other toxic heavy metals and trace elements. Sampling in the rest of the project area revealed a high degree of anthropogenically transformed soils consisting of building rubble and other infill material. All wetlands sampled showed at least some evidence of tailings sediment deposition. In relatively less disturbed and more natural areas wetland soils typically comprised either a dark brown, sandy-loam orthic A-horizon underlain a deep soft plinthic B-horizon which was classified as a Westleigh soil form (Figure 7-6a) or a dark brown sand-clay-loam underlain by a clay rich G-horizon with prominent mottling which was classified as a Katspruit soil form (Figure 7-6b). Some of the larger, non-peat, systems are predominantly alluvial supporting Dundee soil forms. Terrestrial soils comprised mainly Clovelly soil forms (Figure 7-6c).

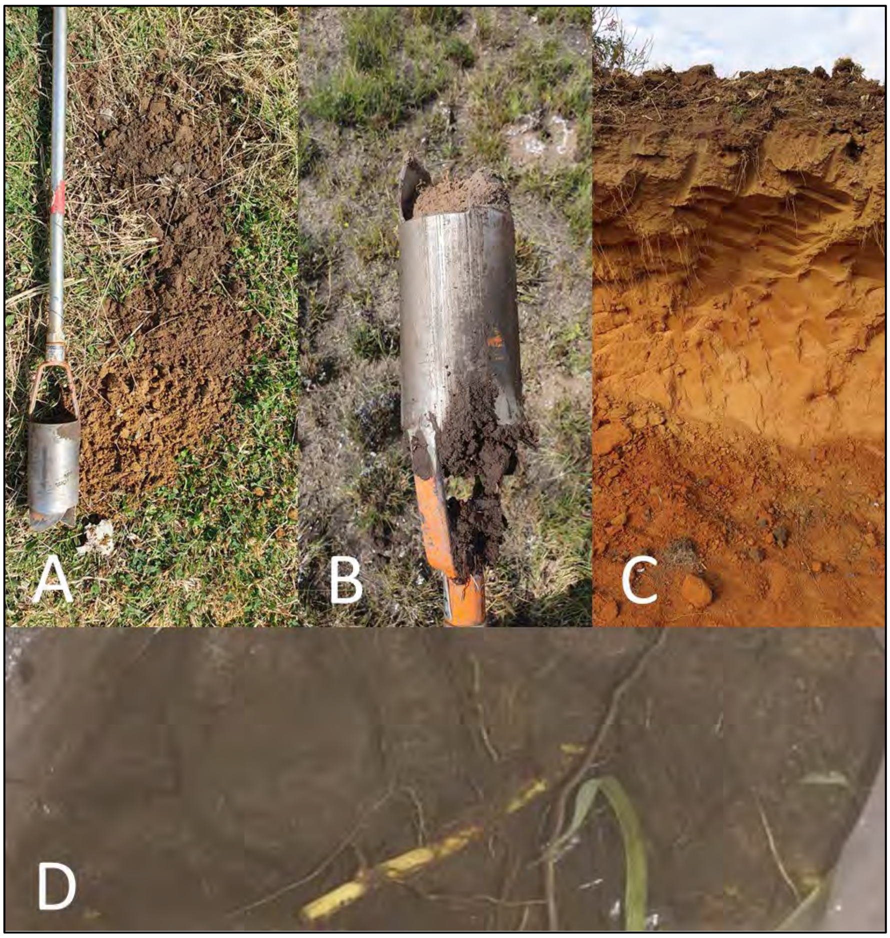


Figure 7-6: Soils identified within the project area; A) Westleigh soil form B) Katspruit soil form, C) Clovelly soil form and D) Fibrous organic material (likely peat sampled from the Wonderfonteinspruit)

7.4.2 Land Use and Land Capability

Existing Land Type data was used to obtain generalised soil patterns and terrain types for the Soweto Cluster project site. Land Type data exists in the form of published 1:250 000 maps, which indicate delineated areas of similar terrain types, pedosystems (uniform terrain and soil pattern) and climate (Land Type Survey Staff, 1989).

At a finer scale the project area traverses three land types namely Ab7 (south-west), Ba35 (north) and Ba36 (central) which suggests that areas on hillcrests / higher up on the catena are dominated by Mispah and Glenrosa soil forms while those lower down on the catena are characterised by Hutton, Katspruit, Longloads, Dundee Rensburg soil forms (Land Type Survey Staff, 1972 – 2006).

Land type Ba35 and part of slimes dams 2L20/21 and 2L16/17/18. The dominant soil form expected in this land type is the deep well drained Hutton (Hu), Clovelly (Cv), and the Glencoe (Gc) soil forms, which comprises of about 45 % of the area, with the shallow Mispah (Ms) soil form occurring on about 27 % of the area. These soils are expected to have depths to deeper than 600 mm, with the exception of the Mispah (Ms).

Land type Ba36 is very similar to Ba35 and forms part of the land associated with the project slimes dams 2L24, 2L20/21 and 2L16/17/18; underneath these surface dump structures. The dominant soil forms expected in this land type are deep well drained Hutton (Hu), Clovelly (Cv), and the Glencoe (Gc) soil forms, which comprises of about 45 % of the area, with the shallow Mispah (Ms) soil form occurring on about 30 % of the area. These soils are expected to have depths to deeper than 600 mm, with the exception of the Mispah (Ms).

The land capability shows that all sites fall within the Class III (3) capability which is a moderate agricultural class. However the dominant land use is old mine dumps and as a result the land capability has little significance in this case. The land use map below shows that most of the area is classified as mined land, with small portions of natural and cultivated areas. This will most likely change after the completion of this project.

7.5 Biodiversity

Refer to Specialist Study: Appendix D1 – Biodiversity Impact Assessment and Wetland Assessment

Environmental features relevant to the project area are listed in Table 7-4.

Table 7-4: Summary of Desktop spatial features examined

DESKTOP INFORMATION CONSIDERED	RELEVANT/NOT RELEVANT
2011 Gauteng Conservation Plan 3.3 (C-Plan 3.3)	Multiple sections of the proposed development intersects with CBA: Important and ESA.
Rocky Ridges	A Class 3 ridge occurs in one of the proposed reclamation areas.
Ecosystem Threat Status	Falls within ecosystems which are listed as CR, VU and LT.
Ecosystem Protection Level	The ecosystem of the project area is rated as *not protected* and *poorly protected*
NFEPA Rivers and Wetlands	The project area does not overlap with a true FEPA river nor does it overlap with a true FEPA wetland. It does however overlap with a number of unclassified FEPA rivers and wetlands.
Protected Areas	The project area is found 4.2 km south of the Kloofendal Municipal Nature Reserve
Mining and Biodiversity Guidelines	According to these guidelines, the project area falls within an area which is considered to be ‘highest risk for mining’, ‘high risk for mining’’ and ‘moderate risk for mining’
Important Bird and Biodiversity Areas	Irrelevant: Closest IBA (Magaliesburg IBA) is 12 km North of the project area.

At the time of undertaking the Biodiversity Field Surveys, the project area, including a 100 m (wide) survey corridor was ground truthed on foot, which included spot checks in pre-selected areas to validate or refute desktop data. Photographs were recorded during the site visits and some are provided under the results section in this report.

7.5.1 The Habitat Assessment

Habitats identified during the field visit can be seen in Figure 7-7 to Figure 7-9. Four primary habitats were delineated for this assessment, namely: Degraded Grassland, Natural grassland habitat, Transformed habitat and Wetlands.

The degraded grassland habitats are fragmented areas which have been disturbed by historic mining practises and development, as well as by the ongoing impact received from unregulated agriculture and informal settlement. Due to the extent of the previous and current disturbance, the area is in a degraded state. This area does however host small green islands which acts as refuge for the urban dwelling faunal species.

The natural grassland habitat is considered to be areas in a natural ecological state, albeit currently and historically somewhat disturbed by the surround land use. This area serves as vital habitat for all fauna within the area and in this case considered to be viable CBA habitat as identified by the conservation plan. Within a local context, habitats like this function as an island for fauna and flora to survive within the ever-expanding human environment. This habitat has a high sensitivity.

The transformed areas are the areas which have little to no natural areas left due to being transformed by the build-up informal and formal housing, roads, old mining practise and other infrastructure such as powerlines. Indirect impacts arise from the extensive anthropogenic presence from the current and historic land use. This habitat contributed to the high amount of alien vegetation recorded.

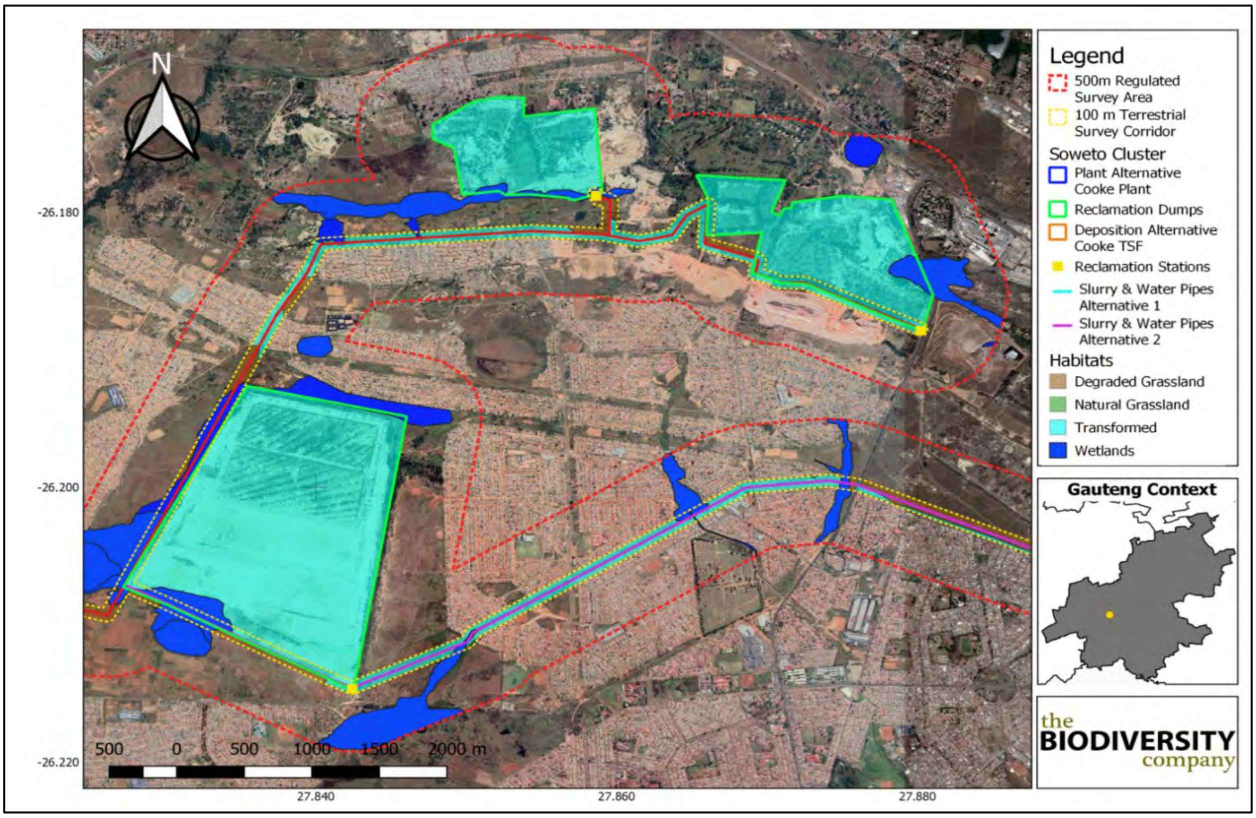


Figure 7-7: Habitats identified within the Soweto Cluster Dumps project area

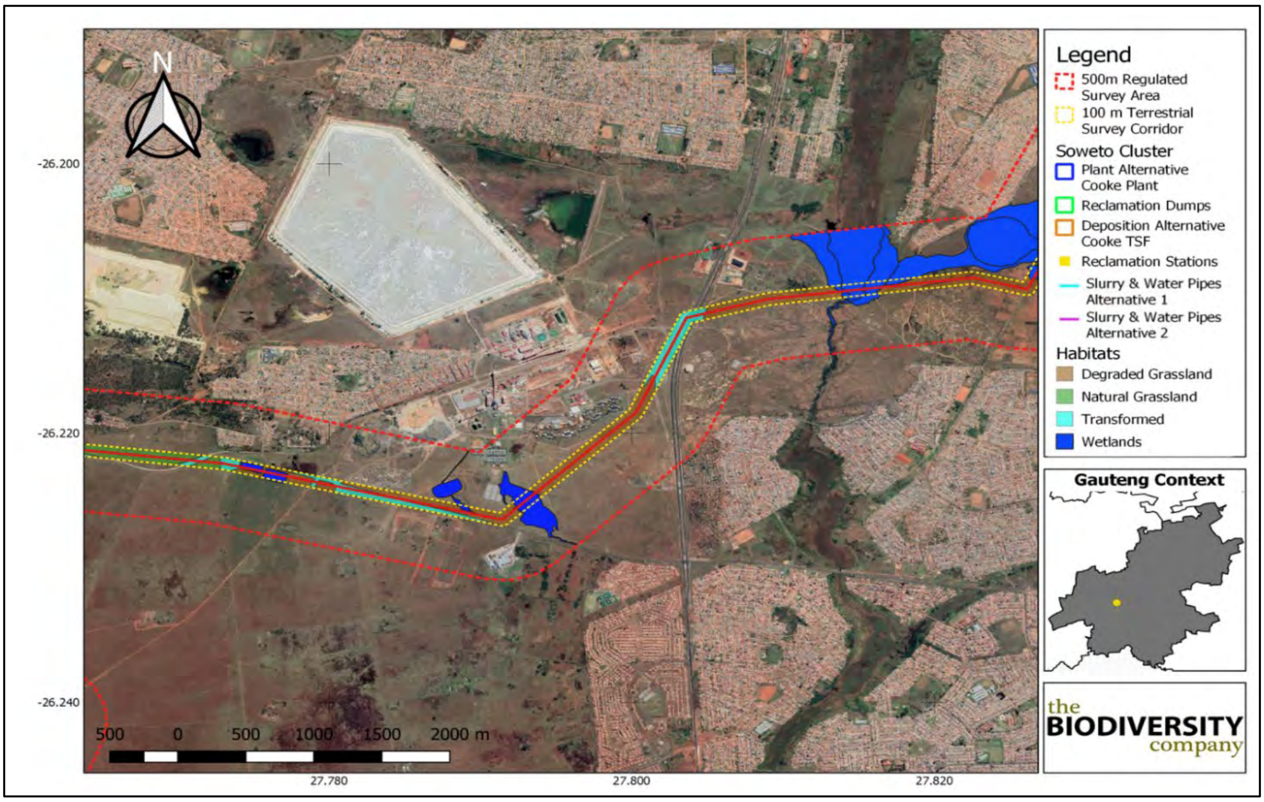


Figure 7-8: Habitats identified within the Soweto Cluster Dumps project area. Pipeline from Soweto Cluster to the Cooke Plant

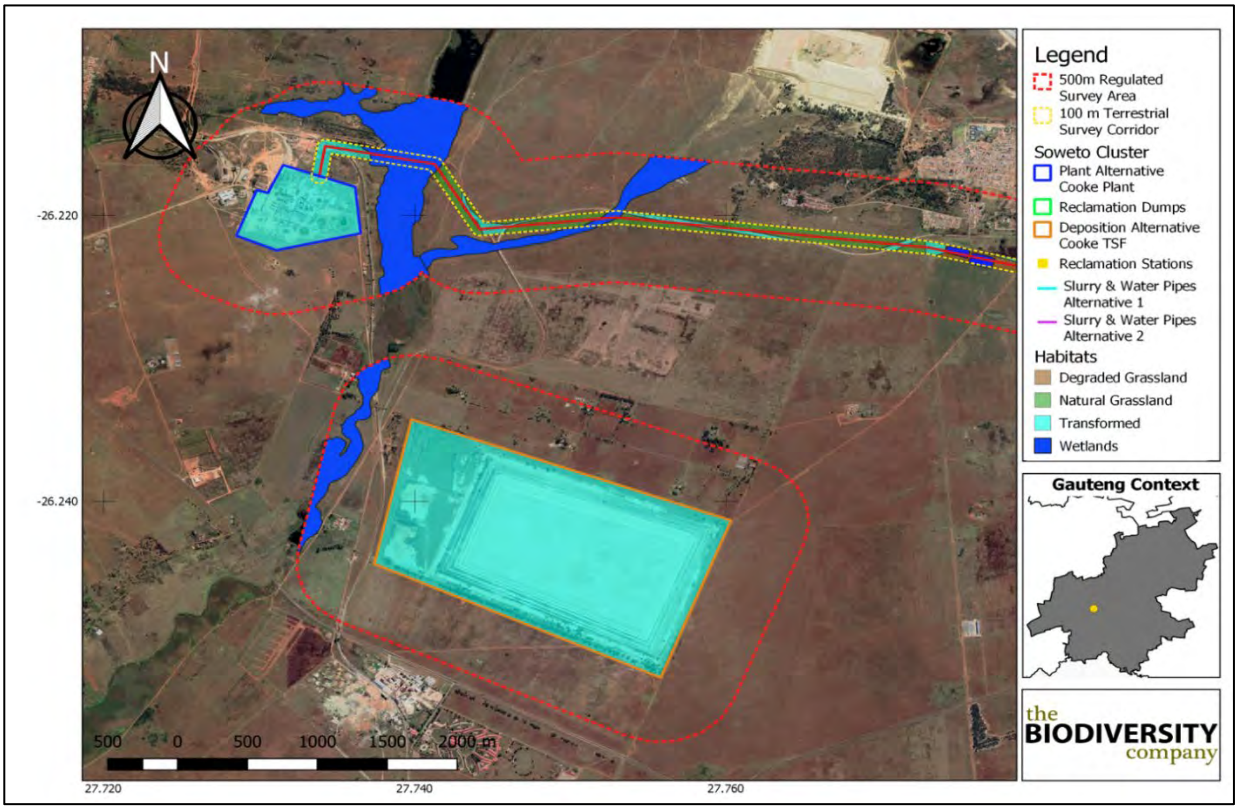


Figure 7-9: Habitats identified within the Cooke Plant and Cooke TSF project area

7.5.2 Gauteng Biodiversity Conservation Plan

The Gauteng Conservation Plan (Version 3.3) (GDARD, 2014) (Gauteng C-Plan) classified areas within the province based on its contribution to reach the conservation targets within the province. The Gauteng C-Plan uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- Critical Biodiversity Area (CBA);
- Ecological Support Area (ESA);
- Other Natural Area (ONA);
- Protected Area (PA); and
- Moderately or Heavily Modified Areas (MMA's or HMA's).

CBAs are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species (GDARD, 2014). Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses (SANBI-BGIS, 2017).

ESAs are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of Critical Biodiversity Areas and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).

ONAs consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs (SANBI-BGIS, 2017).

Moderately or Heavily Modified Areas (sometimes called 'transformed' areas) are areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets (GDARD, 2014). Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly, and in many cases irreversibly, compromised.

According to the Gauteng Terrestrial CBA Plan (C-Plan), multiple sections of the proposed development intersects with CBA: Important and ESA; a section of the pipeline to the west (purple) occurs within CBA: Important Area (Figure 7-10).

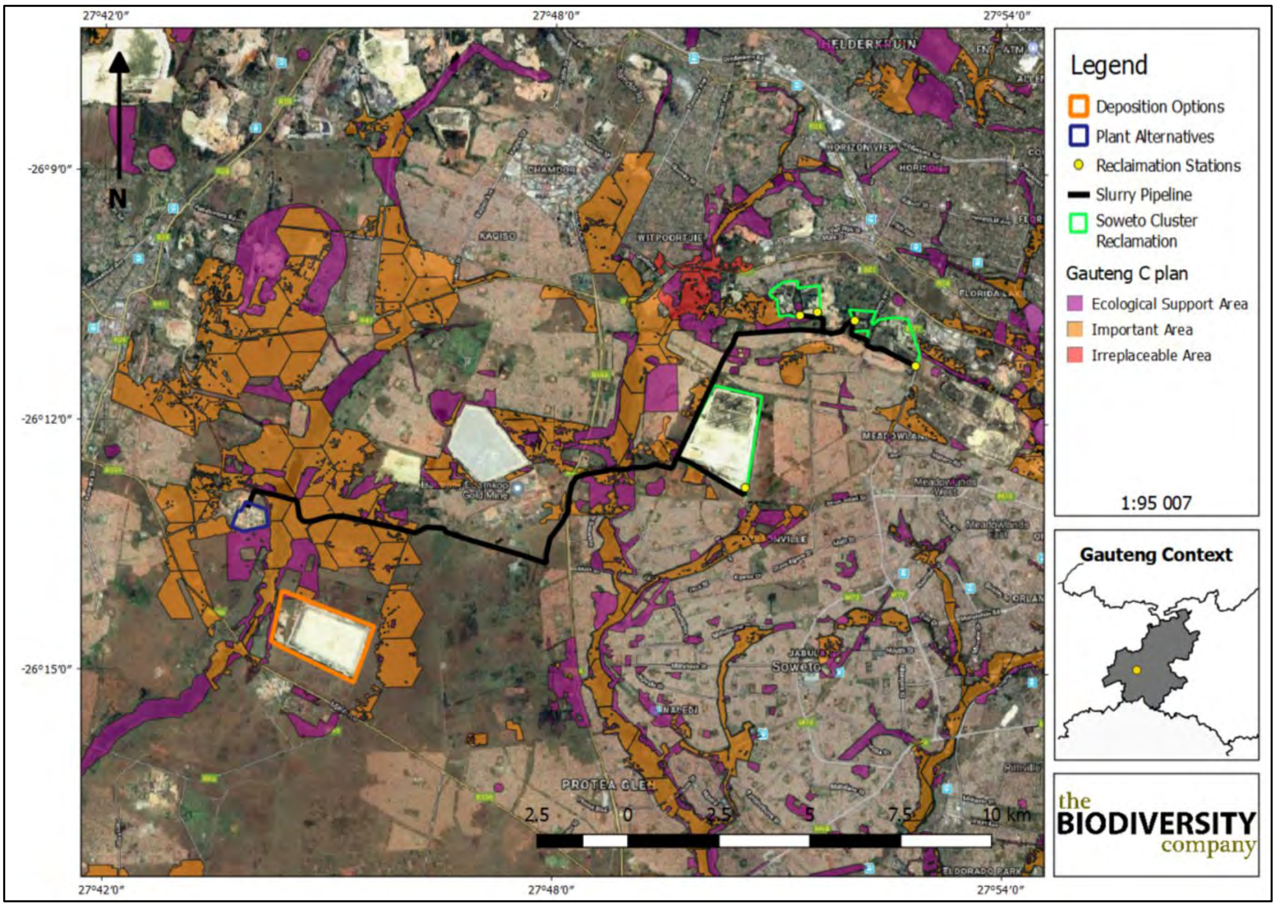


Figure 7-10: Gauteng C-Plan.

7.5.3 Gauteng Ridges

According to the Gauteng Conservation C-Plan (2014), ridges are characterized by high spatial heterogeneity due to the range of differing aspects, slopes and altitudes all resulting in differing soil, temperature, elevation, light and hydrological conditions. This variation is an especially important predictor of biodiversity.

It is common for high degree of biodiversity to be associated with ridges, and it follows that their protection will contribute significantly to the conservation of biodiversity in Gauteng. The ridges of Gauteng are vital habitat for many threatened plant species. Sixty-five percent of Gauteng's threatened plant species and 71% of Gauteng’s endemic plant species have been recorded on ridges. The different classifications mean that:

- Class 1: >= 95% natural;
- Class 2: >= 65% and < 95% natural;
- Class 3: >= 35% and < 65% natural; and
- Class 4: < 35% natural.

According to the spatial data the project area falls on a class 3 ridge and will thus affect the ridge (Figure 7-11). Class 3 ridges include ridges of which 35% or more, but less than 65%, of their surface area has been converted to urban development, quarries and/or alien vegetation. It appears that these areas which have been mapped as ridges are, however, entirely artificial (Figure 7-12).

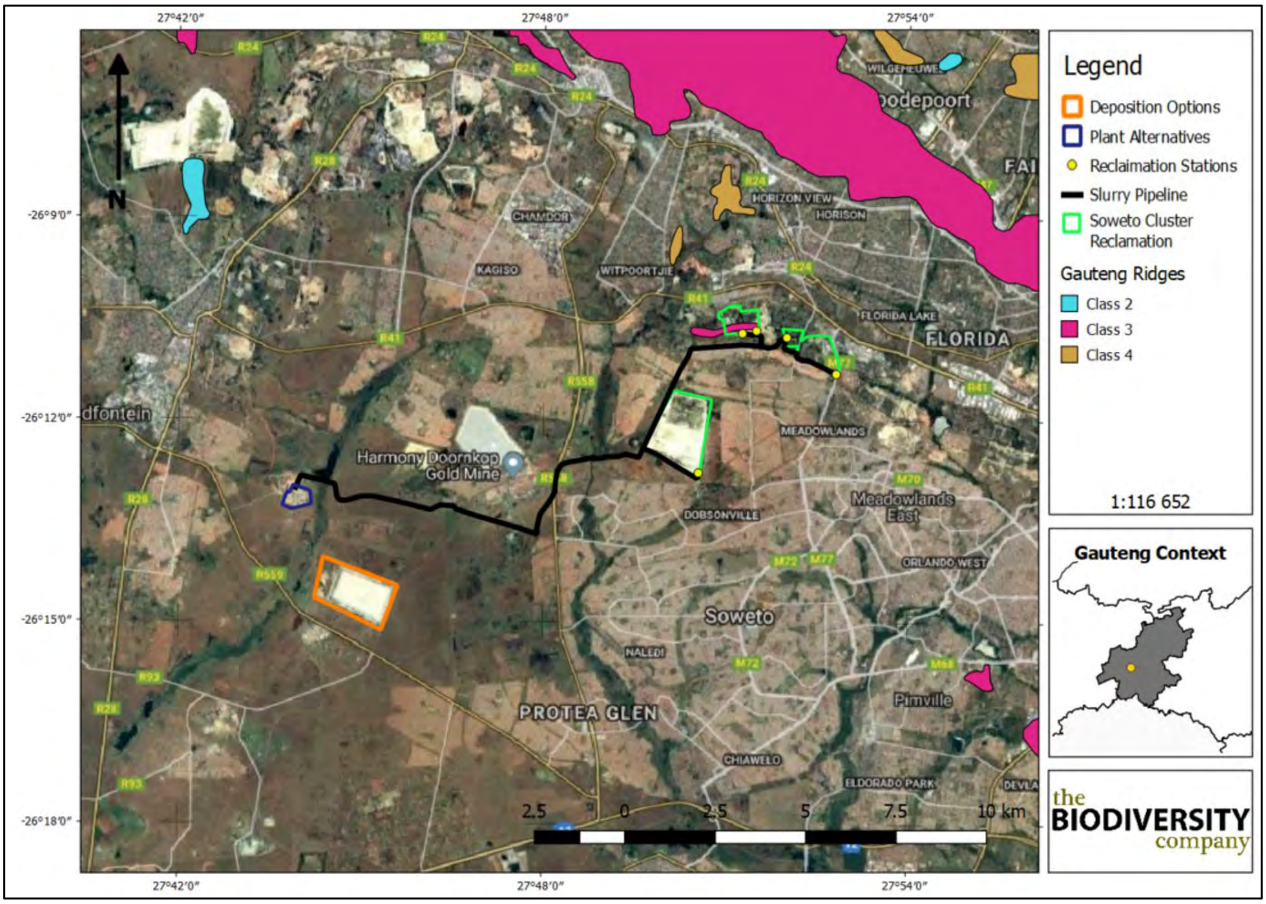


Figure 7-11: The project area superimposed on the Gauteng CBA dataset.

Figure 7-12: Mine dumps in the project area seen as possible ridges

7.5.4 National Biodiversity Assessment

The latest completed National Biodiversity Assessment (NBA) 2011 provides an assessment of South Africa's biodiversity and ecosystems, including headline indicators and national maps for the terrestrial, freshwater, estuarine and marine environments. The NBA 2011 includes a summary of spatial biodiversity priority areas that have been identified through systematic biodiversity plans at national, provincial and local level.

The NBA also provides standard national spatial data layers that can be used in other national, provincial and local planning projects, and an agreed set of national biodiversity targets. In the NBA 2011 these include the first national map of coastal and marine habitat types, and the first national spatial demarcation of the estuarine functional zone.

The two headline indicators assessed in the NBA are ecosystem threat status and ecosystem protection level (Driver et al., 2011).

7.5.4.1 Threatened Ecosystems

Ecosystem threat status outlines the degree to which ecosystems are still intact or alternatively losing vital aspects of their structure, function and composition, on which their ability to provide ecosystem services ultimately depends (Driver et al., 2011).

Ecosystem types are categorised as Critically Endangered (CR), Endangered (EN), Vulnerable (VU) or Least Threatened (LT), based on the proportion of each ecosystem type that remains in good ecological condition (Driver et al., 2011).

The project area was superimposed on the terrestrial ecosystem threat status (Figure 7-13). As seen in this figure, the project area FALLS within ecosystems which are listed as CR, VU and LT.

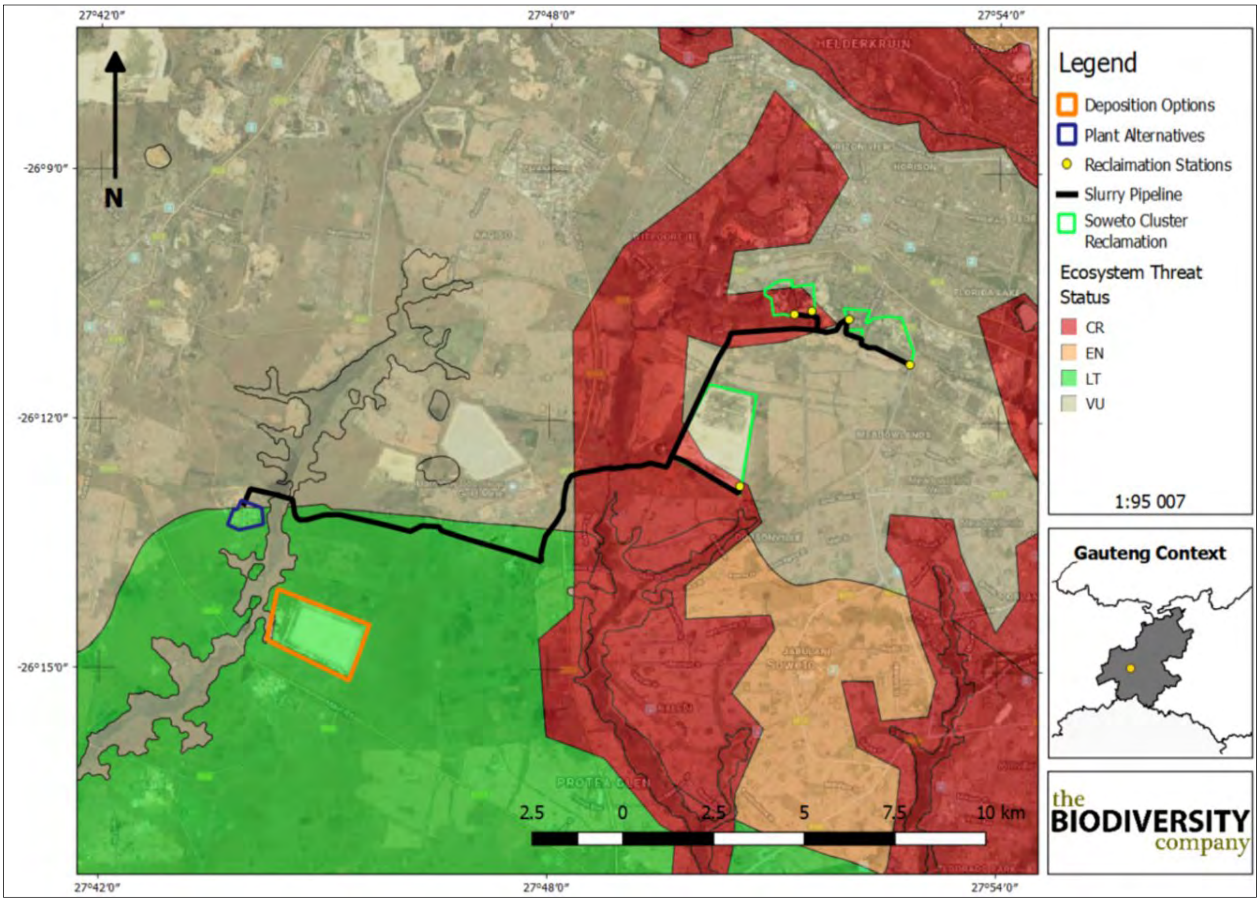


Figure 7-13: Soweto Cluster project area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2011)

7.5.4.2 Ecosystem Protection Level

Ecosystem protection level tells us whether ecosystems are adequately protected or under-protected. Ecosystem types are categorised as not protected, poorly protected, moderately protected or well protected, based on the proportion of each ecosystem type that occurs within a protected area recognised in the Protected Areas Act (Driver et al., 2011).

The Proposed Project area was superimposed on the ecosystem protection level map to assess the protection status of terrestrial ecosystems associated with the development (Figure 7-14). Based on Figure 7-14 the terrestrial ecosystems associated with the development are rated as *poorly protected* for majority of the project area, while the northern portion of the pipeline falls in an area rated as *not protected*.

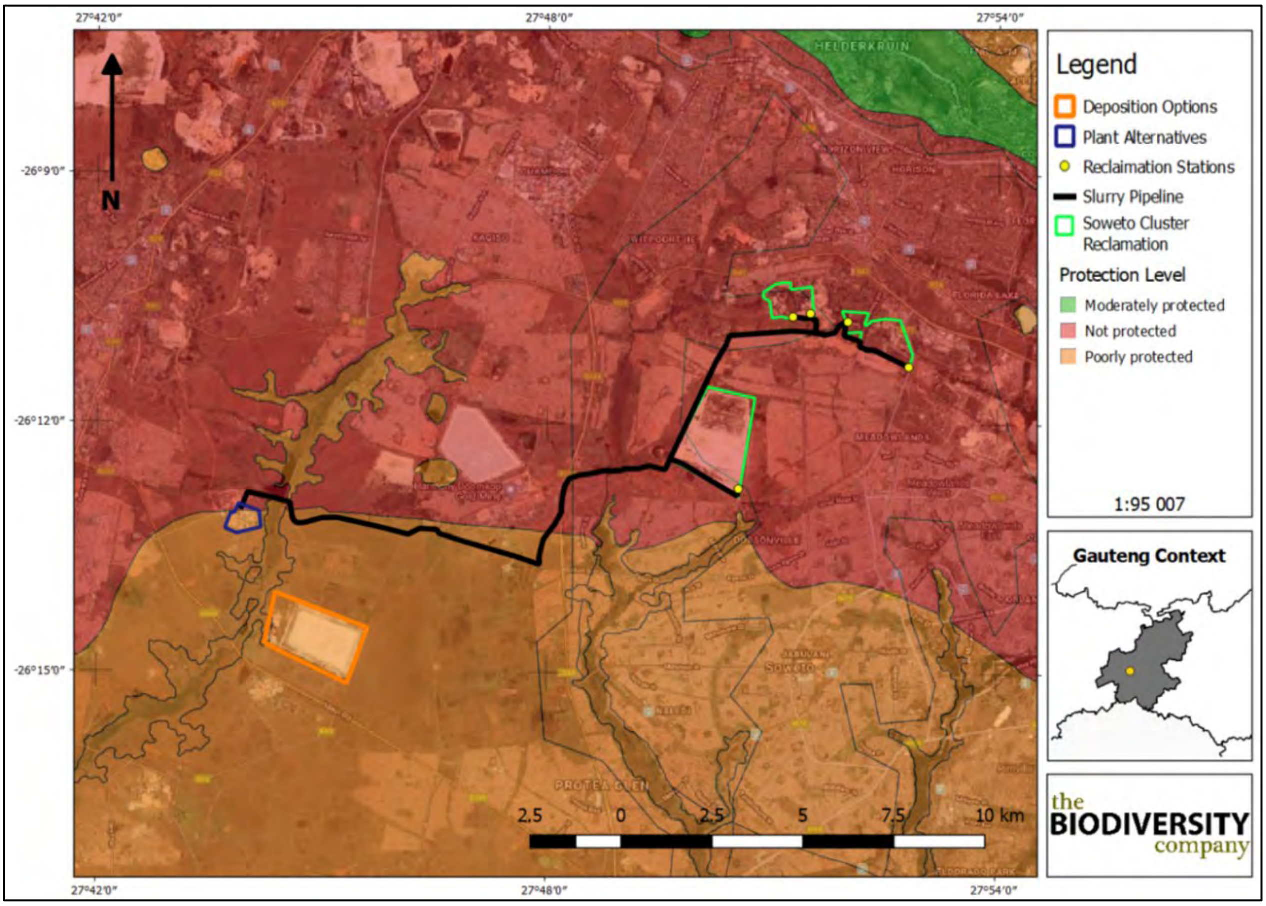


Figure 7-14: Proposed project area showing the level of protection of terrestrial ecosystems (NBA, 2011).

7.5.5 Project Area in relation to Protected Areas

Formally protected areas refer to areas protected either by national or provincial legislation. Based on the SANBI (2010) Protected Areas Map and the National Protected Areas Expansion Strategy (NPAES) the project area does not overlap with any formally or informally protected area, the closest protected area to the project area is found 4.2 km north which is the Kloofendal Municipal Nature Reserve.

7.5.6 National Freshwater Ecosystem Priority Area (NFEPA) Status

In an attempt to better conserve aquatic ecosystems, South Africa has recently categorised its river systems according to set ecological criteria (i.e. ecosystem representation, water yield, connectivity, unique features, and threatened taxa) to identify Freshwater Ecosystem Priority Areas (FEPAs) (Driver *et al*., 2011). The FEPAs are intended to be conservation support tools and envisioned to guide the effective implementation of measures to achieve the National Environment Management Biodiversity Act (NEM:BA) biodiversity goals (Nel *et al.,* 2011).

The project area does not overlap with a true FEPA river nor does it overlap with a true FEPA wetland. It does however overlap with a number of unclassified FEPA rivers and wetlands (Figure 7-15).

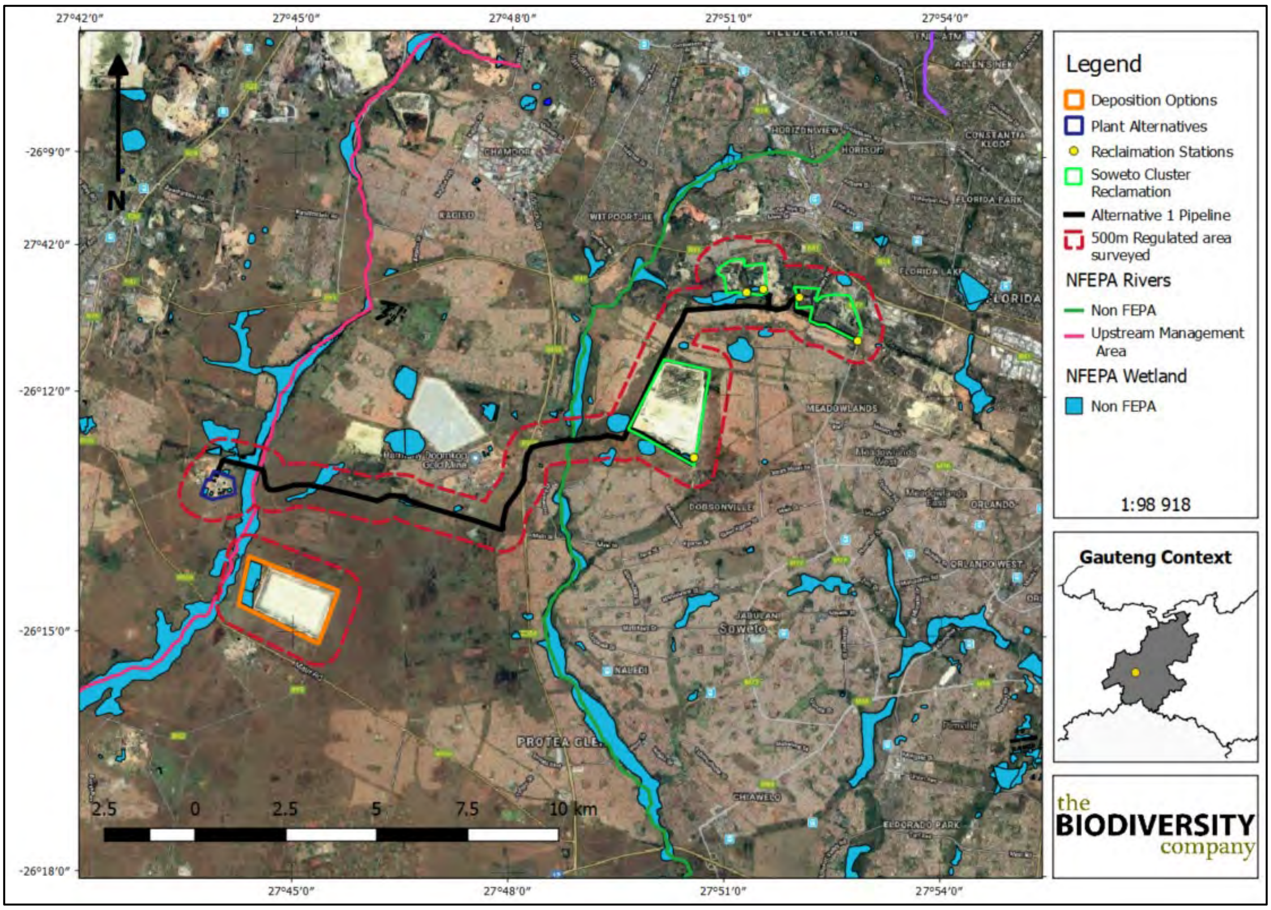


Figure 7-15: The project area in relation to the National Freshwater Ecosystem Priority Area.

7.5.7 Mining and Biodiversity Guideline

The Mining and Biodiversity Guidelines (2013) was developed by the Department of Mineral Resources, the Chamber of Mines, the South African National Biodiversity Institute and the South African Mining and Biodiversity Forum, with the intention to find a balance between economic growth and environmental sustainability.

The Guideline provides a tool to facilitate the sustainable development of South Africa's mineral resources in a way that enables regulators, industry and practitioners to minimise the impact of mining on the country's biodiversity and ecosystem services. It provides the mining sector with a practical, user- friendly manual for integrating biodiversity considerations into the planning processes and managing biodiversity during the operational phases of a mine, from exploration through to closure. The Guideline provides explicit direction in terms of where mining-related impacts are legally prohibited, where biodiversity priority areas may present high risks for mining projects, and where biodiversity may limit the potential for mining.

Since the historic mineral deposits that are intended to be reclaimed through this project are not governed by the Mineral and Petroleum Resources Development Act, 2002 (Act No 28 of 2002) (MPRDA), no mining right is required and the project proponent is applying only for an environmental authorisation. Nonetheless, the Guideline has some bearing on the project.

Table 7-5 shows the four different categories and the implications for mining within each of these categories.

According to these guidelines, the project area falls within an area which is considered to be 'highest risk for mining', 'high risk for mining'' and 'moderate risk for mining' (Figure 7-16). Refer to Table 7-5 for an explanation of limitations related to mining in these areas.

Table 7-5: The mining and Biodiversity guidelines categories

CATEGORY	BIODIVERSITY PRIORITY AREAS	RISK FOR MINING	IMPLICATIONS FOR MINING
A. LEGALLY PROTECTED	• Protected areas (including National Parks, Nature Reserves, World Heritage Sites, Protected Environments, Nature Reserves) Areas declared under Section 49 of the Mineral and Petroleum Resources Development Act (No. 28 of 2002)	Mining prohibited	Mining projects cannot commence as mining is legally prohibited. Although mining is prohibited in Protected Areas, it may be allowed in Protected Environments if both the Minister of Mineral Resources and Minister of Environmental Affairs approve it. In cases where mining activities were conducted lawfully in protected areas before Section 48 of the Protected Areas Act (No. 57 of 2003) came into effect, the Minister of Environmental Affairs may, after consulting with the Minister of Mineral Resources, allow such mining activities to continue, subject to prescribed conditions that reduce environmental impacts.
B. HIGHEST BIODIVERSITY IMPORTANCE	• Critically endangered and endangered ecosystems • Critical Biodiversity Areas (or equivalent areas) from provincial spatial biodiversity plans • River and wetland Freshwater Ecosystem Priority Areas (FEPAs) and a 1km buffer around these FEPAs • Ramsar Sites	Highest risk for mining	Environmental screening, environmental impact assessment (EIA) and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, and to provide site-specific basis on which to apply the mitigation hierarchy to inform regulatory decision-making for mining, water use licenses, and environmental authorisations. If they are confirmed, the likelihood of a fatal flaw for new mining projects is very high because of the significance of the biodiversity features in these areas and the associated ecosystem services. These areas are viewed as necessary to ensure protection of biodiversity, environmental sustainability, and human well-being. An EIA should include the strategic assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. This assessment should fully take into account the environmental sensitivity of the area, the

CATEGORY	BIODIVERSITY PRIORITY AREAS	RISK FOR MINING	IMPLICATIONS FOR MINING
			overall environmental and socio-economic costs and benefits of mining, as well as the potential strategic importance of the minerals to the country. Authorisations may well not be granted. If granted, the authorisation may set limits on allowed activities and impacts and may specify biodiversity offsets that would be written into license agreements and/or authorisations.
C. HIGH BIODIVERSITY IMPORTANCE	• Protected area buffers (including buffers around National Parks, World Heritage Sites* and Nature Reserves) • Transfrontier Conservation Areas (remaining areas outside of formally proclaimed protected areas) • Other identified priorities from provincial spatial biodiversity plans • High water yield areas • Coastal Protection Zone • Estuarine functional zone	High risk for mining	These areas are important for conserving biodiversity, for supporting or buffering other biodiversity priority areas, and for maintaining important ecosystem services for particular communities or the country as a whole. An EIA should include an assessment of optimum, sustainable land use for a particular area and will determine the significance of the impact on biodiversity. Mining options may be limited in these areas, and limitations for mining projects are possible. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.
D. MODERATE BIODIVERSITY IMPORTANCE	• Ecological support areas • Vulnerable ecosystems • Focus areas for protected area expansion (land-based and offshore protection)	Moderate risk for mining	These areas are of moderate biodiversity value. EIAs and their associated specialist studies should focus on confirming the presence and significance of these biodiversity features, identifying features (e.g. threatened species) not included in the existing datasets, and on providing site-specific information to guide the application of the mitigation hierarchy. Authorisations may set limits and specify biodiversity offsets that would be written into license agreements and/or authorisations.

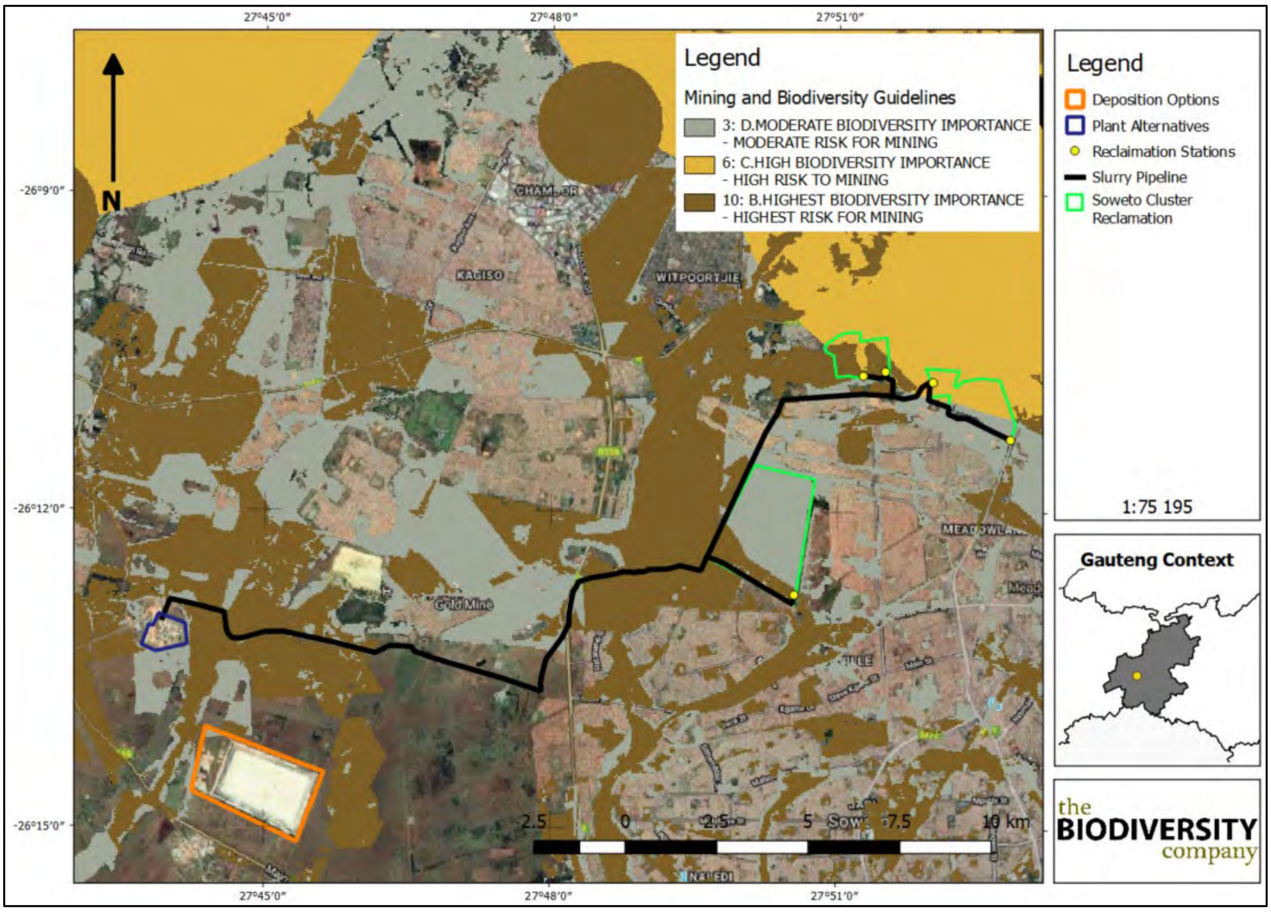


Figure 7-16: The project area superimposed on the Mining and Biodiversity Guidelines spatial dataset (2013)

7.5.8 Flora

7.5.8.1 Vegetation Assessment and Vegetation Types

The project area is -located within the grassland biome. This biome is centrally located in southern Africa, and adjoins all biomes except the desert, fynbos and succulent Karoo biomes (Mucina & Rutherford, 2006). Major macroclimatic traits that characterise the grassland biome include:

a) Seasonal precipitation; and
b) The minimum temperatures in winter (Mucina & Rutherford, 2006).

The grassland biome is found chiefly on the high central plateau of South Africa, and the inland areas of KwaZulu-Natal and the Eastern Cape. The topography is mainly flat and rolling but includes the escarpment itself. Altitude varies from near sea level to 2 850 m above sea level.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the -grasslands and prevent the establishment of trees.

The project area falls within two vegetation types: Soweto Highveld Grassland and Carletonville Dolomite Grassland (Mucina & Rutherford, 2018 vegetation delineation) (Figure 7-17

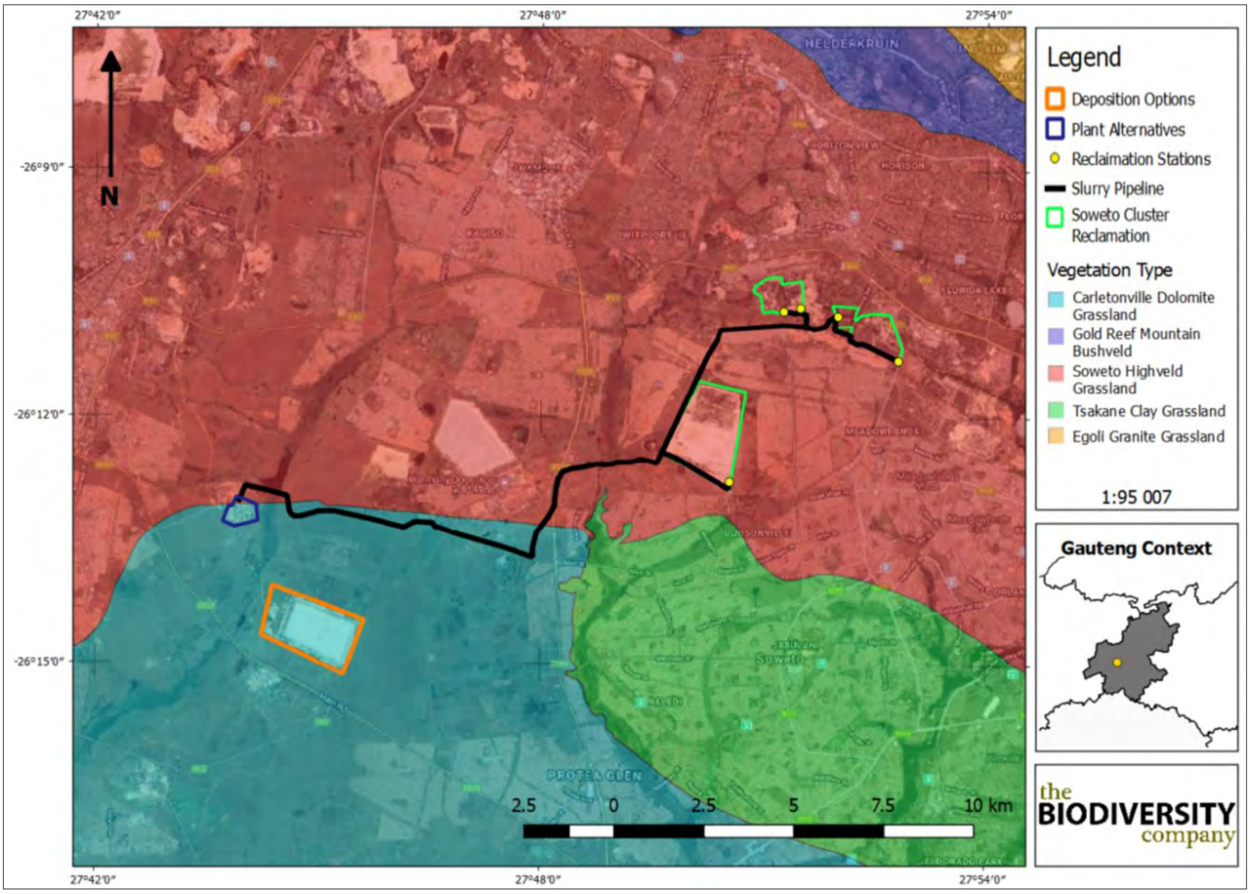


Figure 7-17:The project area showing the vegetation type based on the Vegetation Map of South Africa, Lesotho & Swaziland (BGIS, 2017).

7.5.8.2 *Soweto Highveld Grasses*

The Soweto Highveld Grassland vegetation type is found in Mpumalanga, Gauteng and to a -small extent in the Free State and North-West Provinces. This vegetation type typically comprises of an undulating landscape on the Highveld plateau, supporting short to medium-high, dense, tufted grassland dominated almost entirely by *Themeda triandra* and accompanied by a variety of other grasses such as *Elionurus muticus, Eragrostis racemosa, Heteropogon contortus* and *Tristachya leucothrix*. Scattered small wetlands, narrow stream alluvia, pans and occasional ridges or rocky outcrops interrupt the continuous grassland cover (Mucina & Rutherford, 2006).

7.5.8.2.1 Conservation Status

The Soweto Highveld Grassland vegetation type is classified as Endangered. The national target for conservation protection for this vegetation types is 24%, but only a few patches are statutorily conserved in Waldrift, Krugersdorp, Leeuwkuil, Suikerbosrand, Rolfe's Pan Nature Reserves or privately conserved in Johanna Jacobs, Tweefontein, Gert Jacobs, Nikolaas and Avalon Nature Reserves and the Heidelberg Natural Heritage Site. By 2006, nearly half of this vegetation type was already transformed by cultivation, urban sprawl, mining and building of road infrastructure. The amount of area transformed since 2006 has most likely increased substantially. Some Soweto Grassland areas have been flooded by dams such as Grootdraai, Leeukuil, Trichardtsfontein, Vaal and Willem Brummer (Mucina & Rutherford, 2006).

7.5.8.3 Carletonville Dolomite Grassland

This vegetation type occurs on slightly undulating plains dissected by prominent rocky chert ridges. The species-rich grasslands form a complex mosaic pattern dominated by a number of species (Mucina & Rutherford, 2006). This vegetation type occurs in the North-West, Gauteng and extends marginally into the Free State Province: 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.

7.5.8.3.1 Conservation Status

This vegetation type is classified as Vulnerable. The national target for conservation protection for this vegetation types is 24%, but only a small extent is conserved in statutory (Sterkfontein Caves — part of the Cradle of Humankind World Heritage Site, Oog Van Malmanie, Abe Bailey, Boskop Dam, Schoonspruit, Krugersdorp, Olifantsvlei, Groenkloof) and in at least six private conservation areas. Almost a quarter is already transformed for cultivation, by urban sprawl or by mining activity as well as the building of the Boskop and Klerkskraal Dams.

Figure 7-18: The habitats observed within the project area; A) Degraded Grassland, B) Natural Grassland.

Figure 7-19: The habitats observed within the project area; A) Transformed, B) Wetlands

7.5.8.4 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 940 plant species were previously recorded in the area (Figure 7-20), of these, five species are listed as being SCC and is described in Table 8.

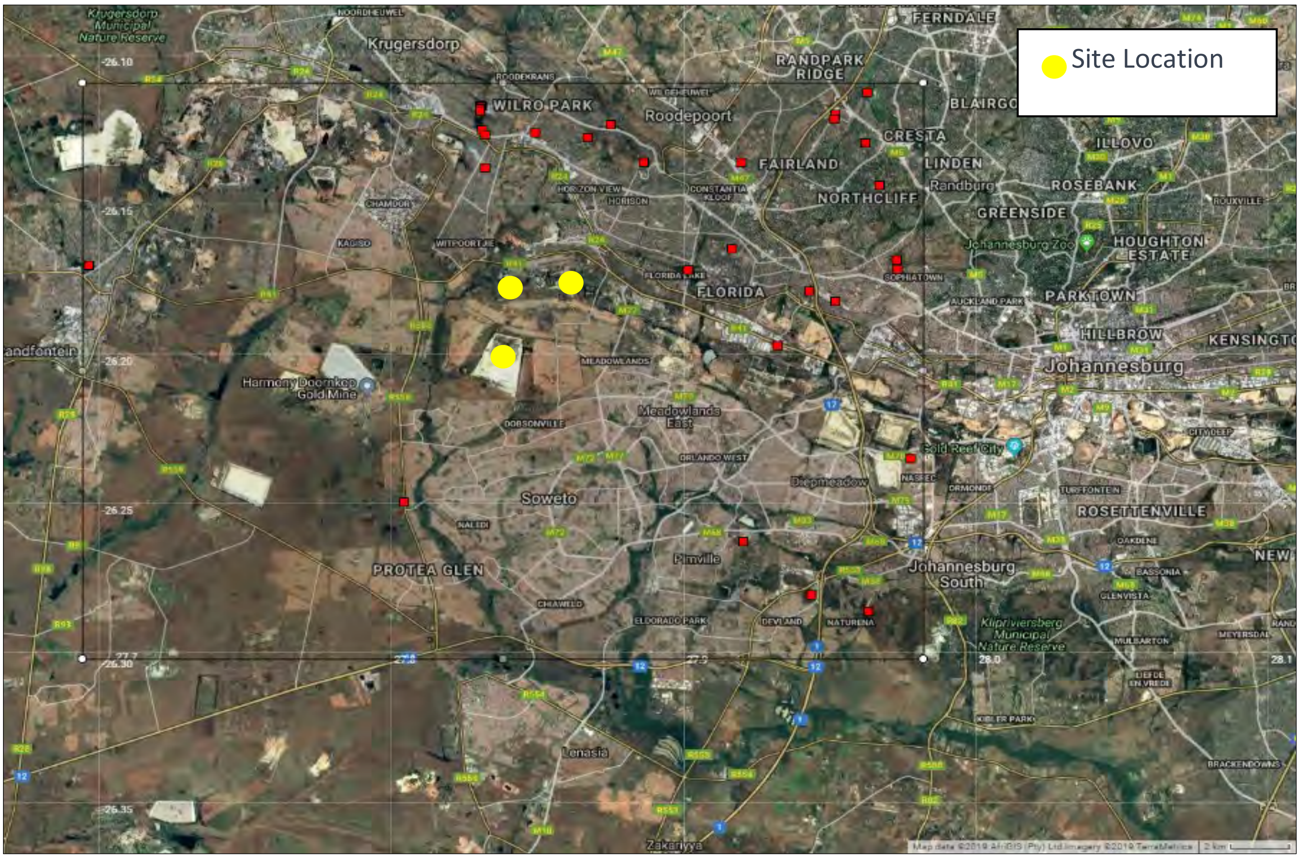


Figure 7-20: Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016).

Table 7-6: Plant Species of Conservation Concern (SCC) expected to occur in the project area (BODATSA-POSA, 2016)

Family	Taxon	IUCN	Ecology
Asteraceae	*Cineraria austrotransvaalensis*	**NT**	Indigenous; Endemic
Asteraceae	*Cineraria longipes*	**VU**	Indigenous; Endemic
Aizoaceae	*Delosperma leendertziae*	**NT**	Indigenous; Endemic
Orchidaceae	*Habenaria barbertoni*	**NT**	Indigenous; Endemic
Fabaceae	*Pearsonia bracteata*	**NT**	Indigenous; Endemic

The vegetation assessment was conducted throughout the extent of the project area. A total of 73 tree, shrub and herbaceous plant species were recorded in the project area (Table 7-7). Plants listed as Category 1 alien or invasive species under the National Environmental Management: Biodiversity Act (NEMBA) appear in green text. Plants listed in Category 2 or as 'not indigenous' or 'naturalised', appear in blue text. No provincially listed plants or National listed trees were recorded.

Table 7-7: Trees, shrubs and weeds recorded at the proposed project area

SCIENTIFIC NAME	COMMON NAME	THREAT STATUS (SANBI, 2017)	SA ENDEMIC	NEMBA CATEGORY
Acalypha angustata	Copper Leaf	LC	No	
Argemone ochroleuca	**White-Flowered Mexican Poppy**			**NEMBA Category 1b**
Bidens pilosa	**Blackjack**			**Not Indigenous, Naturalised**
Celtis africana	White Stinkwood	LC	No	
Cirsium vulgare	**Spear Thistle**			**NEMBA Category 1b**
Cortaderia selloana	**Pampas Grass**			**NEMBA Category 1b**
Cynodon dactylon	**Bermuda Grass / Common Couch**			**NEMBA Category 2**
Felicia muricata	Fine-leaved Aster	LC	No	
Gomphocarpus fruticosus	Milkweed, Wild Cotton	LC	No	
Helichrysum rugulosum	Marotole	LC	No	
Hyparrhenia hirta	Common Thatching Grass	LC	No	
Morus alba	**Common Mulberry**			**NEMBA Category 3**
Pennisetum clandestinum	**Kikuyu Grass**			**NEMBA Category 1b in protected areas and wetlands**
Phragmites australis	Commom Reed	LC	No	
Plantago lanceolata	Narrow-leaved Ribwort	LC	No	
Populus alba	**White Poplar**			**NEMBA Category 2**
Solanum sisymbriifolium	**Dense-thorned Bitter Apple**			**NEMBA Category 1b**
Stoebe plumosa	Slangbos	LC	No	
Tagetes minuta	**Khaki Weed**			**Not Indigenous, Naturalised**
Tamarix ramosissima	**Pink Tamarisk**			**NEMBA Category 1b**
Themeda triandra	Red Grass	LC	No	
Typha capensis	Bulrush	LC	No	
Vachellia tortilis	Umbrella Thorn	LC	No	
Verbena bonariensis	**Wild Verbena**			**NEMBA Category 1b**
Vernonia oligocephala	Bicoloured-leaved Vernonia	LC	No	
Ziziphus zeyheriana	Dwarf Buffalo-thorn	LC	No	

7.5.8.5 Alien and Invasive Plants

Declared weeds and invader plant species have the tendency to dominate or replace the canopy or herbaceous layer of natural ecosystems, thereby transforming the structure, composition and function of these systems. Therefore, it is important that these plants are controlled and eradicated by means of an eradication and monitoring programme. Some invader plants may also degrade ecosystems through superior competitive capabilities to exclude native plant species.

The National Environmental Management: Biodiversity Act (NEMBA) is the most recent legislation pertaining to alien invasive plant species. In August 2014, the list of Alien Invasive Species was published in terms of the National Environmental Management: Biodiversity Act (Act 10 of 2004) (Government Gazette No 78 of 2014). The Alien and Invasive Species Regulations were published in the Government Gazette No. 37886, 1 August 2014. The legislation calls for the removal and / or control of alien invasive plant species (Category 1 species). In addition, unless authorised thereto in terms of the National Water Act, 1998 (Act No. 36 of 1998), no land user shall allow Category 2 plants to occur within 30 meters of the 1:50 year flood line of a river, stream, spring, natural channel in which water flows regularly or intermittently, lake, dam or wetland. Category 3 plants are also prohibited from occurring within proximity to a watercourse.

Eighteen (18) Category 1b invasive species were recorded within the project area and must therefore be removed by implementing an alien invasive plant management programme in compliance of section 75 of the Act as stated above. The NEMBA listed species identified within the project area are marked in green (Table 7-7).

7.5.9 Fauna

Most of the study area has been transformed by agricultural activities in the form of commercial crop farming, settlements and mining activities. Throughout the study area, wetlands occur.

7.5.9.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 384 bird species are known to occur in the vicinity of the project area (pentads 2605_2740; 2605_2745; 2605_2750; 2610_2740; 2610_2745; 2610_2750; 2615_2740; 2615_2745; 2615_2750). The full list of regionally occurring bird species is provided in Appendix B of the Biodiversity Impact Assessment (Appendix D1 of this EIA).

Of the regionally occurring bird species, twenty-two (22) species are listed as SCC (Table 7-8). The SCC include the following: The bird species protected under provincial legislation is indicated by *

- Three (3) species that are listed as EN on a regional basis;
- Seven (7) species that are listed as VU on a regional basis; and
- Eight (8) species that are listed as NT on a regional basis.

Of these only one species namely Lanner Falcon (*Falco biarmicus*) is considered likely to occur (sporadically, breeding is highly unlikely) within the project area. A full description of each specie is given in the Biodiversity Impact Assessment (Appendix D1) of this EIA.

Table 7-8: List of bird species of regional or global conservation importance that are expected to occur in pentads 2605_2740; 2605_2745; 2605_2750; 2610_2740; 2610_2745; 2610_2750; 2615_2740; 2615_2745; 2615_2750 (SANBI, 2017, ESKOM, 2014; IUCN, 2017)

SPECIES	COMMON NAME	CONSERVATION STATUS		DESKTOP LIKELIHOOD OF OCCURRENCE
		Regional (SANBI, 2016)	IUCN (2017)	
Alcedo semitorquata	Kingfisher, Half-collared	NT	LC	Low
Anthropoides paradiseus	Crane, Blue	NT	VU	Low
Aquila verreauxii	Eagle, Verreaux's	VU	LC	Low
*Bubo capensis**	Eagle-Owl, Cape	Unlisted	LC	Low
Ciconia abdimii	Stork, Abdim's	NT	LC	Low
Ciconia nigra	Stork, Black	VU	LC	Low
Circus ranivorus	Marsh-harrier, African*	EN	LC	Low
Eupodotis caerulescens	Korhaan, Blue	LC	NT	Low
Coracias garrulus	Roller, European	NT	LC	Low
Eupodotis senegalensis	Korhaan, White-bellied*	VU	LC	Low
Falco biarmicus	Falcon, Lanner	VU	LC	Moderate
*Falco peregrinus**	Falcon, Peregrine	Unlisted	LC	Low
Geocolaptes olivaceus	Woodpecker, Ground	Unlisted	NT	Low
Gorsachius leuconotus	Night Heron, White-backed	VU	LC	Low
Gyps coprotheres	Vulture, Cape	EN	EN	Low
Mycteria ibis	Stork, Yellow-billed	EN	LC	Low
Mirafra cheniana	Lark, Melodious	LC	NT	Low
*Monticola brevipes**	Rock-thrush, Short-toed	Unlisted	LC	Low
Oxyura maccoa	Duck, Maccoa	NT	NT	Low
Phoenicopterus minor	Flamingo, Lesser	NT	NT	Low
Phoenicopterus ruber	Flamingo, Greater	NT	LC	Low
Sagittarius serpentarius	Secretarybird	VU	VU	Low

Figure 7-21: Avifaunal species recorded during the survey: A) Laughing Dove (*Streptopelia senegalensis*), B) Blacksmith Lapwing (*Vanellus armatus*), C) African Sacred Ibis (*Threskiornis aethiopicus*) , D) Glossy Ibis (Plegadis falcinellus), E) African Stonechat (*Saxicola torquatus*) and F) Cattle egret (*Bubulcus ibis*)

7.5.9.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 88 mammal species likely to occur within the project area (Appendix C of the Biodiversity Impact Assessment (Appendix D1 of this EIA)).

Of these species, 9 are medium to large conservation dependant species, such *Ceratotherium simum* (Southern White Rhinoceros) and *Tragelaphus oryx* (Common Eland) that, in South Africa, are generally restricted to protected areas such as game reserves. These species are not expected to occur in the project area and are removed from the expected SCC list. They are however still included (highlighted in red) in Appendix C of the Biodiversity Impact Assessment (Appendix D1 of this EIA).

Of the remaining 79 small to medium sized mammal species, fifteen (15) (18.99%) are listed as being of conservation concern on a regional or global -scale (Table 7-9).

The list of potential species includes Herpetofauna (Reptiles & Amphibians):

- Two (2) that are listed as EN on a regional scale;
- Five (5) that are listed as VU on a regional scale; and
- Nine (9) that are listed as NT on a regional scale (Table 7-9)
- On a global scale, 1 species is listed as EN, 2 are listed as VU and 4 as NT (Table 7-9).

A full description of each specie is given in the Biodiversity Impact Assessment (Appendix D1) of this EIA.

Table 7-9: List of mammal species of conservation concern that may occur in the greater project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016)

SPECIES	COMMON NAME	CONSERVATION STATUS		DESKTOP LIKELIHOOD OF OCCURRENCE
		Regional (SANBI, 2016)	IUCN (2017)	
Aonyx capensis	Cape Clawless Otter	**NT**	**NT**	Moderate
Atelerix frontalis	South Africa Hedgehog	**NT**	**LC**	Low
Crocidura maquassiensis	Makwassie musk shrew	**VU**	**LC**	Low
Dasymys incomtus	African Marsh rat	**NT**	**LC**	Moderate
Felis nigripes	Black-footed Cat	**VU**	**VU**	Low
Leptailurus serval	Serval	**NT**	**LC**	Moderate
Mystromys albicaudatus	White-tailed Rat	**VU**	**EN**	Low
Poecilogale albinucha	African Striped Weasel	**NT**	**LC**	Low
Rhinolophus blasii	Blasius's horseshoe bat	**NT**	**LC**	Low

7.5.9.3 Herpetofauna (Reptiles & Amphibians)

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the ReptileMap database provided by the Animal Demography Unit (ADU, 2017) 56 reptile species are expected to occur in the project area (Appendix D of the Biodiversity Impact Assessment (Appendix D1 of this EIA)).

One (1) SCC (Nile Crocodile) **should be** present according to the above-mentioned sources within the project area. It is not likely at all that this specie will occur in the project area.

Based on the IUCN Red List Spatial Data (IUCN, 2017) and the AmphibianMap database provided by the Animal Demography Unit (ADU, 2019) 21 amphibian species are expected to occur in the project area (Appendix E of the Biodiversity Impact Assessment (Appendix D1 of this EIA)).

One (1) amphibian SCC could be present in the project area according to the above-mentioned sources.

Table 7-10: List of amphibian species of conservation concern that may occur in the project area as well as their global and regional conservation statuses (IUCN, 2017; SANBI, 2016).

SPECIES	COMMON NAME	CONSERVATION STATUS		LIKELIHOOD OF OCCURRENCE
		Regional (SANBI, 2016)	IUCN (2017)	
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Moderate

Herpetofauna diversity was low with no reptile and three amphibian species observed or recorded in the project area during the November 2018 survey. Based on the disturbed nature of the area the herpetofauna diversity is expected to be low (Table 7-11).

Table 7-11: The Herpetofauna species recorded in the project area.

SPECIES	COMMON NAME	CONSERVATION STATUS	
		Regional (SANBI, 2016)	IUCN (2017)
Afrana angolensis	Common River Frog	LC	LC
Sclerophrys gutturalis	Guttural Toad	LC	LC
Xenopus laevis	Common Platanna	LC	LC

It must be noted that where species '**Likelihood of occurrence'** has been indicated as **"low"** – it is probable that these species will **never** occur in the project area due to the transformed and altered habitat associated with the proposed project. Results were obtained from regional databases on a desktop level and may not be a true reflection of what is occurring on site.

7.6 Wetlands

Refer to Specialist Study: Appendix D1 – Biodiversity Impact Assessment and Wetland Assessment

7.6.1 NEFPA Wetlands

Drainage within the project area occurs in a southerly direction via a series of wetlands that are associated with three main watercourses, the Wonderfonteinspruit in the far west, the Klip River in the central regions and the Klipspruit / Russel stream in the far east of the project area. All of the identified wetlands have been considerably impacted by artificially increased water inputs from mining and industrial effluent seepage and / or discharge as well as sewerage and grey water inputs from the large expanse of high density, predominantly informal, urban areas that surrounds them.

For well over a century (since the 1890's) these systems have been receiving mine water discharge as well as tailings sediments and the contaminants that accompany it, the most serious of which being heavy metals, salts and radioactive materials associated with mine water discharge and tailings sediments. Although the wetlands act as sinks in this regard, helping to remove toxicants and nutrients, their capacity to do so is finite which has resulted in an accumulation of these toxicants in their sediments. Additionally, most of the systems, or their drainage lines, are used as waste and refuse disposal dumps further compounding the issue.

Due to the increased water inputs, most of the systems are considerably larger and more saturated than their historical reference state. Examination of historical aerial imagery reveals systems that were narrower with a proportionally smaller permanent zone and larger seasonal / temporary zone. Historically the systems would have supported a more diverse compliment of low sedges and hydromorphic grassland species but are now dominated by dense, tall, relatively monospecific reedbeds.

Figure 7-22: View of the Klipspruit (HGM 5)

7.6.2 Wetland Delineation

The wetland areas were delineated in accordance with the DWAF (2005) guidelines. The National Wetland Classification Systems (NWCS) developed by the South African National Biodiversity Institute (SANBI) comprises a hierarchical classification process of defining a wetland based on the principles of the hydrogeomorphic (HGM) approach at higher levels, and then also includes structural features at the lower levels of classification (Ollis et al. 2013).

Eight wetland hydrogeomorphic units HGM units were identified and delineated within the 500 m regulated area surrounding the project area based on a combination of desktop and in-field delineation. The level 1-4 classification for these systems as per the national wetland classification system (Ollis et al., 2013) is presented in Table 7-12. These HGM units were further distinguished on account of their drainage patterns and were grouped according to the named system into which they flow.

Table 7-12: Wetland classification as per SANBI guideline (Ollis et al. 2013)

WETLAND SYSTEM	LEVEL 1	LEVEL 2		LEVEL 3	LEVEL 4		
	SYSTEM	DHSWS ECOREGION/S	NFEPA WET VEG GROUP*	LANDSCAPE UNIT	4A (HGM)	4B	4C
Wonderfonteinspruit							

WETLAND SYSTEM	LEVEL 1	LEVEL 2		LEVEL 3	LEVEL 4		
	SYSTEM	DHSWS ECOREGION/S	NFEPA WET VEG GROUP*	LANDSCAPE UNIT	4A (HGM)	4B	4C
HGM 1	Inland	Highveld	MHGG3	Valley Bottom	Unchannelled valley-bottom	N/A	N/A
Klip River							
HGM 2	Inland	Highveld	MHGG3	Valley Bottom	Unchannelled valley-bottom	N/A	N/A
HGM 3	Inland	Highveld	MHGG3	Slope	Seep	Without channelled outflow	N/A
HGM 6	Inland	Highveld	MHGG3	Valley Bottom	Channelled valley-bottom	N/A	N/A
Klipspruit							
HGM 4	Inland	Highveld	MHGG3	Valley Bottom	Unchannelled valley-bottom	N/A	N/A
Endorheic							
HGM 5	Inland	Highveld	MHGG3	Bench	Depression	Endorheic	Without channelled inflow

*MHGG3 = Mesic Highveld Grasslands Group 3

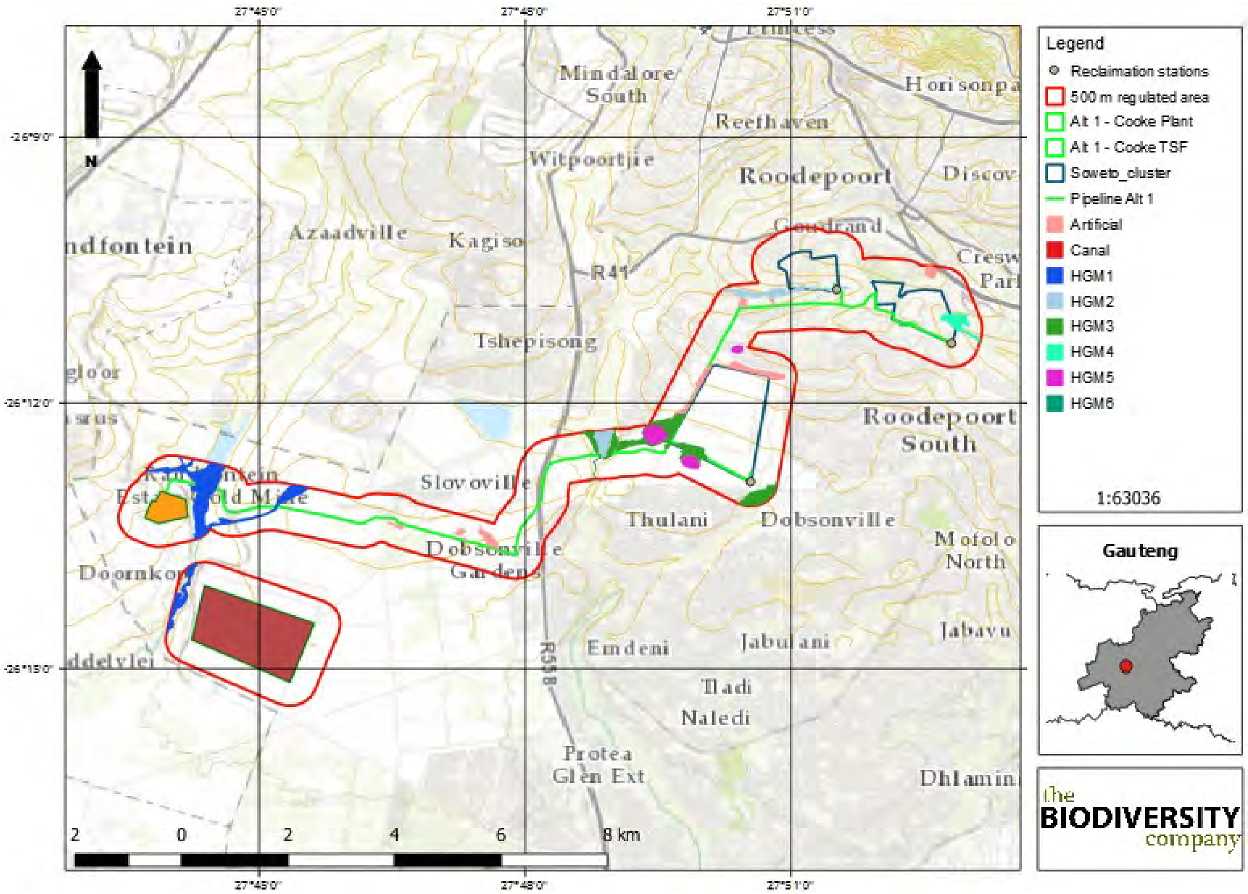


Figure 7-23: Delineation of wetlands within the 500m regulation area, overview

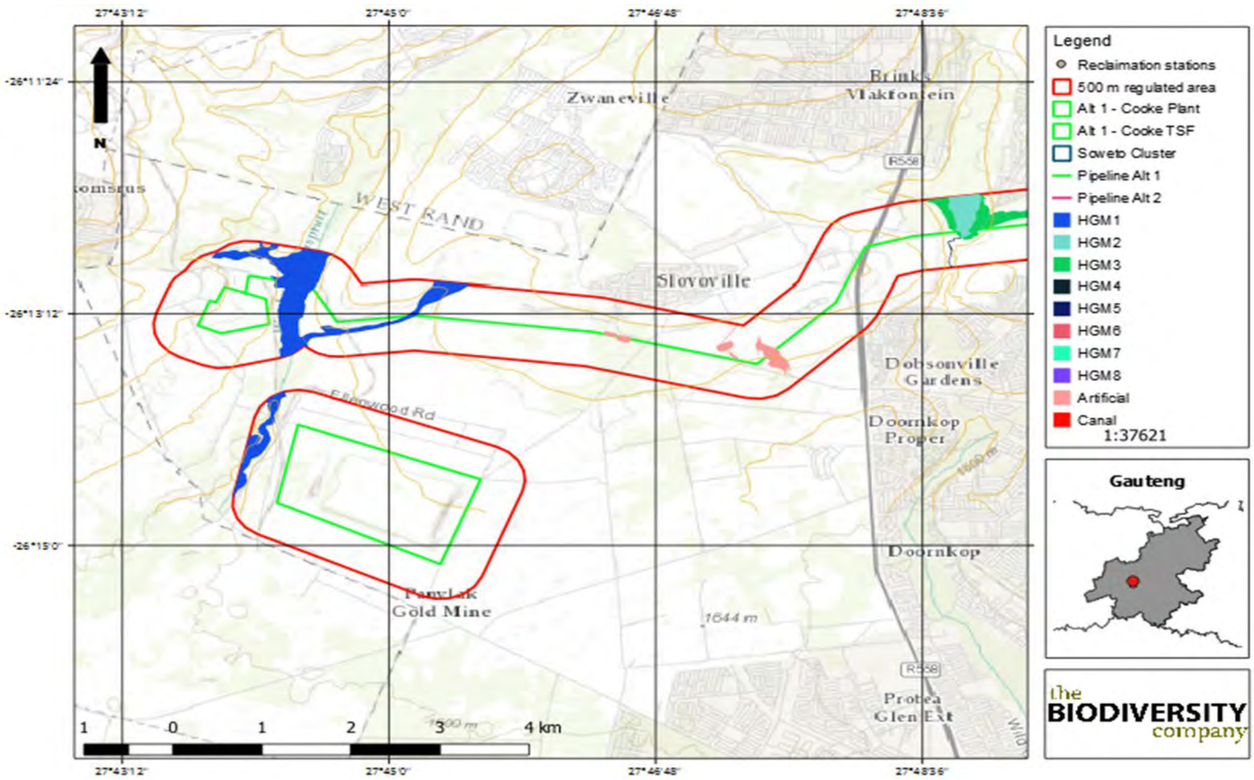


Figure 7-24: Delineation of wetlands within the 500m regulation area, western region

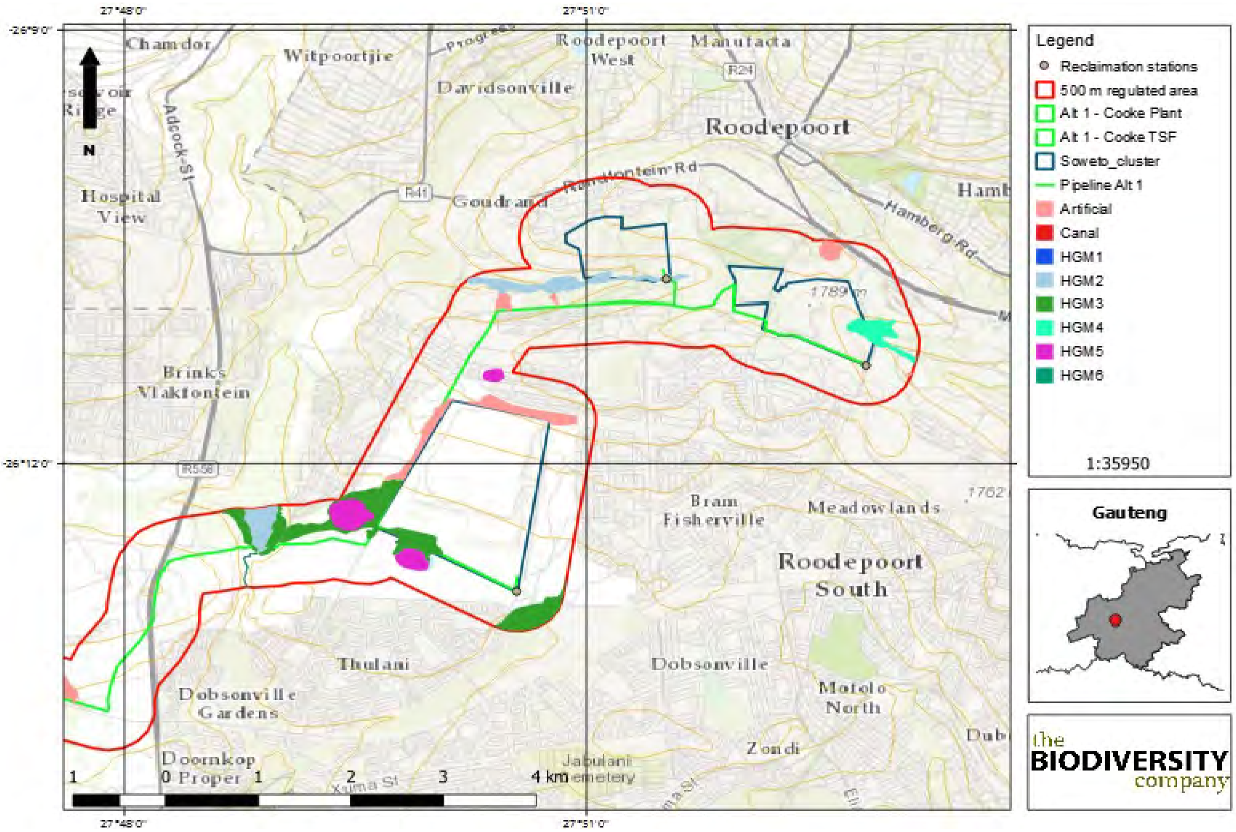


Figure 7-25: Delineation of wetlands within the 500m regulation area, eastern region

7.6.3 Wetland Unit Identification

The six wetland HGM units identified on site represent four main hydro morphological types namely unchanneled valley-bottoms, channelled valley-bottoms, seeps and depressions. A brief description of the three assessed HGM Units is provided below with on-site photographs of each presented in Figure 7-26 (Ollis *et al*., 2013).

Channelled Valley-bottoms (HGM 6): These are typically found on valley floors with a clearly defined, finite stream channel and lacks floodplain features, referring specifically to meanders. Channelled valley-bottom wetlands are known to undergo loss of sediment in cases where the wetlands' slope is high and the deposition thereof in cases of low relief. Unchanneled valley-bottom wetlands are typically found on valley floors where the landscape does not allow high energy flows.

Unchannelled Valley-bottoms (HGM 1, 2 and 4): These are typically found on valley-floors where the landscape does not allow high energy flows. Unchanneled valley-bottoms are characterised by sediment deposition, a gentle gradient with streamflow generally being spread diffusely across the wetland, ultimately ensuring prolonged saturation levels and high levels of organic matter. The assimilation of toxicants, nitrates and phosphates are usually high for unchanneled valley-bottom wetlands, especially in cases where the valley is fed by sub-surface interflow from slopes.

The Seeps (HGM 3): These systems contribute significantly to recharge and stream flow regulation of the valley-bottom systems. Seeps are wetlands that tend to occur on slopes in situations where the underlying geology and topography facilitates either the discharge of groundwater to the land surface or rainwater to seep down-slope as subsurface interflow (Ollis *et al*. 2013). Either way flows are typically unidirectional and diffuse.

Depressions (HGM 5: These are inward draining basins with an enclosed topography that allows for water to accumulate within the system. Depressions, in some cases, are also fed by lateral sub-surface flows in cases where the dominant geology allows for these types of flows. The depressions in the project area were classified as inward draining (endorheic) systems.

Figure 7-26: Photographs of the four main hydrogeomorphic types encountered within the project area; A) unchanneled valley-bottom, B) channelled valley-bottom, C) seep and D) depression

7.6.4 Wetland Ecological Functional Assessment

The ecosystem services provided by the wetlands identified on site were assessed and rated using the WET-EcoServices method (Kotze *et al*. 2008). Overall the systems provide mainly indirect regulating and supporting services providing little in the way of direct services related to the provision of water or cultivated foods nor recreational or educational services. HGMs 1, 2, 3 and 5 provide the most meaningful ecosystem services with an overall rating of Moderately High while the rest are considered Intermediate Table 7-13.

All of the HGM units have a high opportunity to receive stormflows, sediments and contaminants from the mining, urban and industrial developments in the area. However, the wide shallow slopes, high surface roughness, disproportionately large permanent zone and dense emergent vegetation cover within HGMs

1, 2, 3 and 5 have created a depositional environment that makes them particularly effective at attenuating floods, trapping sediments, removing nutrients and assimilating toxicants. These wetlands have, and still do, play a very important role in mitigating the impact associated with gold mining in Johannesburg.

Due to their size and habitat complexity these systems also play an important role in biodiversity maintenance, particularly from an avifaunal perspective. However, contamination with heavy metals and / or radioactive substances as well as eutrophication from raw sewerage inputs means that the systems are not capable of providing clean water or harvestable resources nor are they aesthetically pleasing or safe enough to be utilised from a recreational, cultural, tourism or even educational perspective. HGM's 1 and 2 play an important role in carbon storage due to their size and moderate abundance of peat.

Table 7-13: The ecosystem services being provided by the identified wetlands

				WETLAND HGM UNIT	1	2	3	4	5
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits		Flood attenuation	3	2.9	2.3	2.6	2.5
				Streamflow regulation	3.3	3.3	2.7	2.5	2.8
			Water Quality enhancement benefits	Sediment trapping	3.1	2.9	3	2.3	2.8
				Phosphate assimilation	3.1	3.5	3.3	2.7	2.9
				Nitrate assimilation	3.1	3.3	3.1	2.6	3
				Toxicant assimilation	3.2	3.5	3.3	2.6	3
				Erosion control	3	2.8	2.4	1.7	2.4
				Carbon storage	2.7	2.7	1.3	0.7	1
	Direct Benefits	**Biodiversity maintenance**			3.5				
		Provisioning benefits		Provisioning of water for human use	1.7	1.7	0.9	1.3	1
				Provisioning of harvestable resources	2	2	1.6	1.6	1.6
				Provisioning of cultivated foods	3	3	1.6	3	1.6
		Cultural benefits		Cultural heritage	1	1	1	1	1
				Tourism and recreation	1.3	1.1	0.4	0.1	0.7
				Education and research	2	2.3	0.5	0.5	0.5
Overall					38.9	39.5	30.9	26.9	30.4
Average					2.6	2.6	2.1	1.8	2.0
Threats					4	4.0	4.0	4.0	4.0
Opportunities					4	4.0	4.0	4.0	4.0

7.6.5 The Wetland Health Assessment

The least hydrologically impacted system are the depressions which due to their largely isolated and endorheic (inward draining) nature have remained less affected by effluent discharge and were rated as Moderately Modified (class: C). HGM 2 was rated as Moderately Modified (class: D). All other HGM units were rated as Seriously Modified (class E) mainly on account of the artificially increased flows, extent hardened surfaces within their catchments and presence of impeding features.

From geomorphological perspective the impacted systems are HGM 1, 3, 5 and 7 (E: Seriously Modified) while the least where HGMs 6 and 8. The most readily apparent impact to these systems has been the long-standing deposition of gold mining tailings sediments within the wetlands. All of the identified wetlands showed evidence of tailings sediments in auger samples but was particularly high in HGM 1, 2, 3, 5. Although a depositional environment predominates upstream of all impeding features (e.g. roads and railway lines), narrow culverts and increased flow volumes and velocities has led to erosion in HGMs 4, 5.

In terms of wetland vegetation, the artificially increased flow volumes has led to the proliferation of dense, tall reed beds dominated by *Phragmites australis* and *Typha capensis* in most of the systems at the expense of a more diverse and shorter mix of sedges and hydromorphic grasses which likely prevailed in the reference state. The largest reedbeds occur in the two unchanneled valley-bottoms to the east namely HGM 1 and 2. Some of the most diverse short wetland vegetation occurs in HGM 3, however, like all other systems faces impacts from sediment drowning as well as sulphate and iron oxide precipitation from acid mine drainage.

Table 7-14: Summary of the scores for the Wetland PES

WETLAND	HYDROLOGY		GEOMORPHOLOGY		VEGETATION	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	E: Seriously Modified	7	E: Seriously Modified	6.2	B: Largely Natural	5
Overall PES Score		6.2	Overall PES Class			E: Seriously Modified
HGM 2	E: Seriously Modified	6.5	D: Largely Modified	5.1	C: Moderately Modified	3.4
Overall PES Score		5.2	Overall PES Class			D: Largely Modified
HGM 3	E: Seriously Modified	7	E: Seriously Modified	7.5	B: Largely Natural	3.4
Overall PES Score		6.1	Overall PES Class			E: Seriously Modified
HGM 4	E: Seriously Modified	7.5	E: Seriously Modified	4.5	D: Largely Modified	5.6
Overall PES Score		6.1	Overall PES Class			E: Seriously Modified
HGM 5	D: Largely Modified	4	C: Moderately Modified	2.1	C: Moderately Modified	2.9
Overall PES Score		**3.2**	**Overall PES Class**			**C: Moderately Modified**

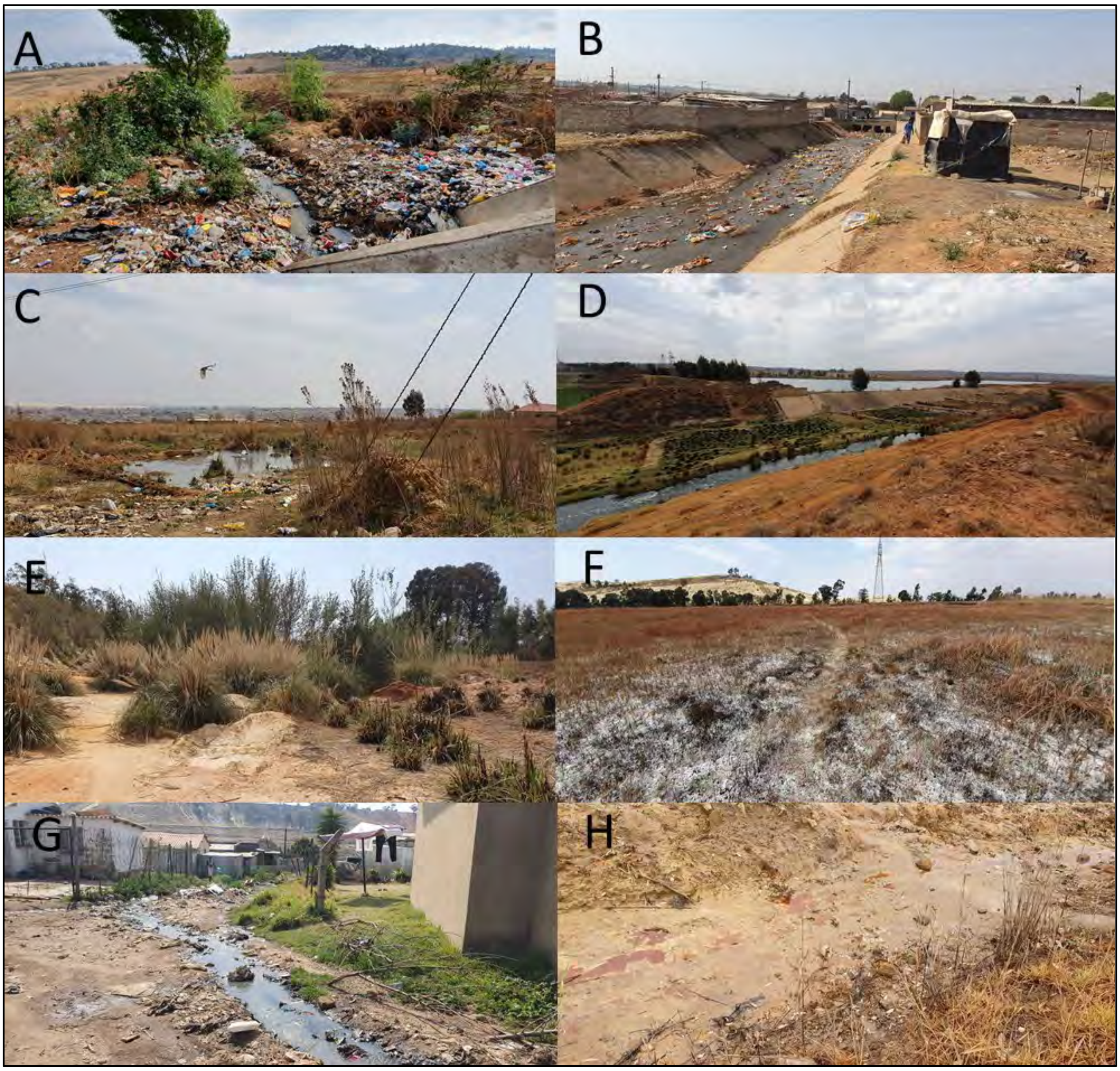


Figure 7-27: Examples of some the existing impacts influencing the PES ratings; A) domestic waste disposal, B) canalisation, C) burst water mains D) dams, E) alien and invasive vegetation, F) sulphate precipitation G) domestic effluent runoff, H) iron oxide precipitation in acid mine drainage.

7.6.6 The Ecological Importance and Sensitivity Assessment

The results of the assessment are shown in Table 7-15. From a regional perspective no Code 1 NFEPA rivers or wetlands are located within the 500 m regulated area. The only rivers recognised on the NFEPA database within the project area are the Wonderfonteinspruit which is listed as a Code 4 Upstream management Area and the Klip River which is listed as Code 0 Unclassified. The NFEPA Wetveg database recognises Mesic Highveld Grassland Group 3 wetlands (all HGM types) as Critically Endangered and Not Protected and the regional vegetation type is classified as Endangered. Wetlands in this region are highly threatened by mining, urban and industrial developments. Due to their long-standing contamination and degradation none of the systems are considered sensitive, however, some are considered important.

These include HGMs 1, 2, 3 and 5 which were rated as having a High ecological importance on account of their size, presence peat (HGM 1 and 2), open water, dense emergent vegetation and overall habitat diversity which, like the Blesbokspruit, may support large congregations of local and migratory waterfowl and may. These systems are large and provide important corridors for wildlife movement in a heavily developed landscape

Table 7-15: The EIS results for the delineated HGM types

WETLAND IMPORTANCE AND SENSITIVITY	HGM 1	HGM 2	HGM 3	HGM 7	HGM 8
Ecological Importance & Sensitivity	3.0	3.0	2.7	1.7	2.7
Hydrological/Functional Importance	3.1	3.1	2.7	3.1	2.7
Direct Human Benefits	0.5	1.9	1.0	1.9	1.0

7.7 Biodiversity and Wetlands Sensitivity Mapping

As per the terms of reference for the project, GIS sensitivity maps are required to identify sensitive features in terms of the relevant specialist discipline/s within the study area. The sensitivity scores identified during the field survey for each terrestrial habitat and wetland are mapped in Figure 7-28 to Figure 7-30 respectively. These sensitivity maps were made by combining the terrestrial sensitivities with the wetland sensitivities.

In terms of terrestrial habitats, areas that were classified as having a low sensitivity are those areas which were deemed by the specialists to have been most impacted upon and/or were modified from their original condition due to factors such as previous and current human activity and/or presence of alien invasive species. A low-moderate sensitivity was given to the degraded grassland habitats. These habitats function as an ecosystem, habitat and/or important corridors for various species within the transformed areas in the project area and the immediate local area. The high sensitivity areas are the natural grassland areas that are still viable portions of CBA as identified by the C-plan (Figure 7-10)

In terms of wetlands, all identified HGM units were classified as having a High sensitivity while their associated 30 m buffers were assigned a Moderate sensitivity. All other artificial wetlands and non-wetland areas within the 500 m regulated area were assigned a Low sensitivity.

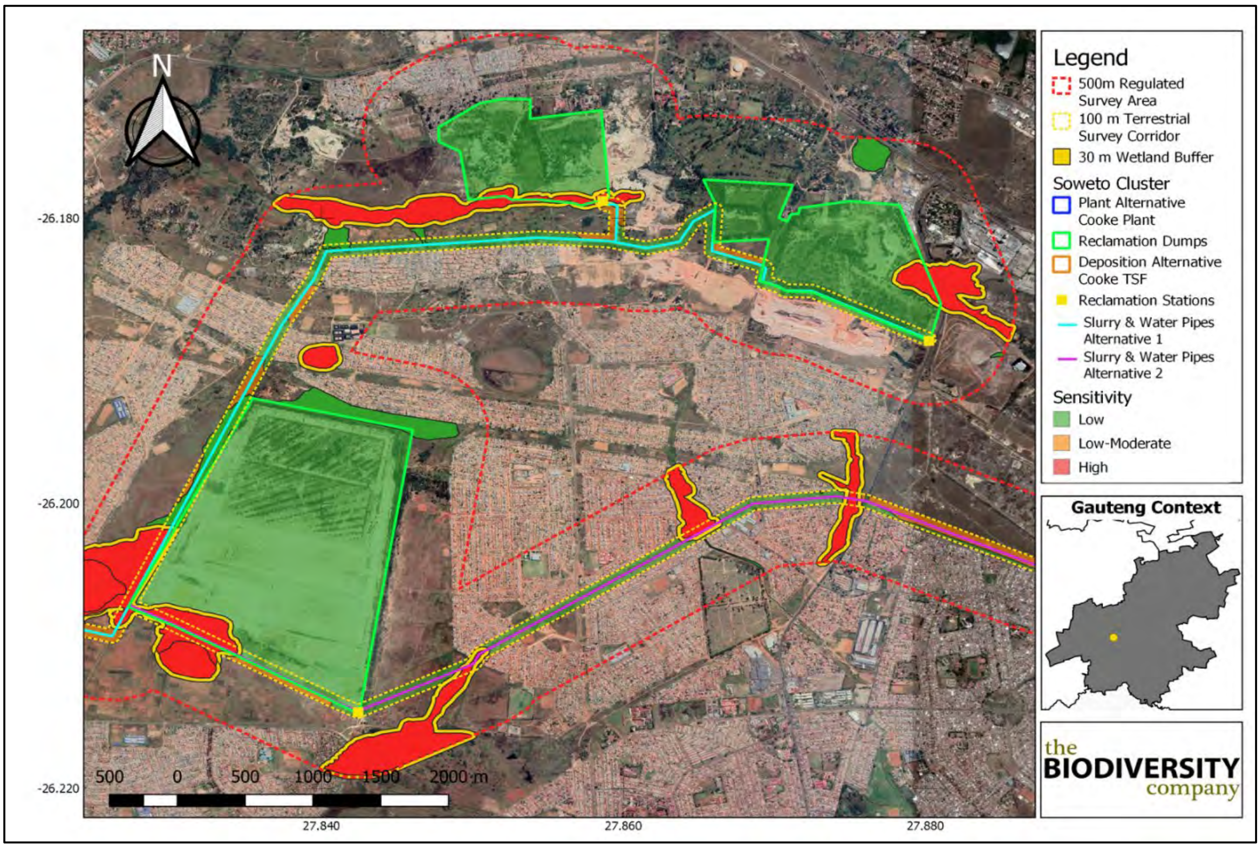


Figure 7-28: Habitat sensitivity within Soweto Cluster project area.

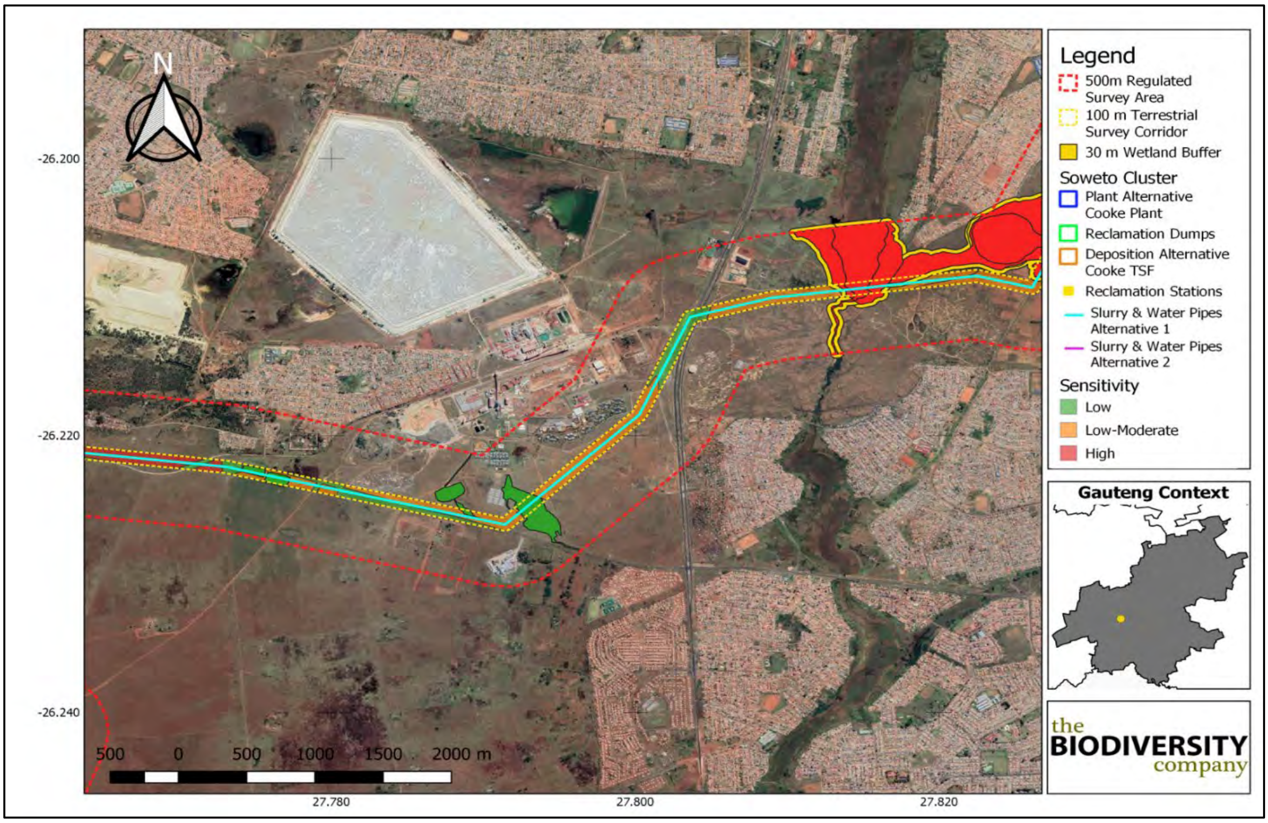


Figure 7-29: Habitat sensitivity within the pipeline from Soweto Cluster to the Cooke Plant

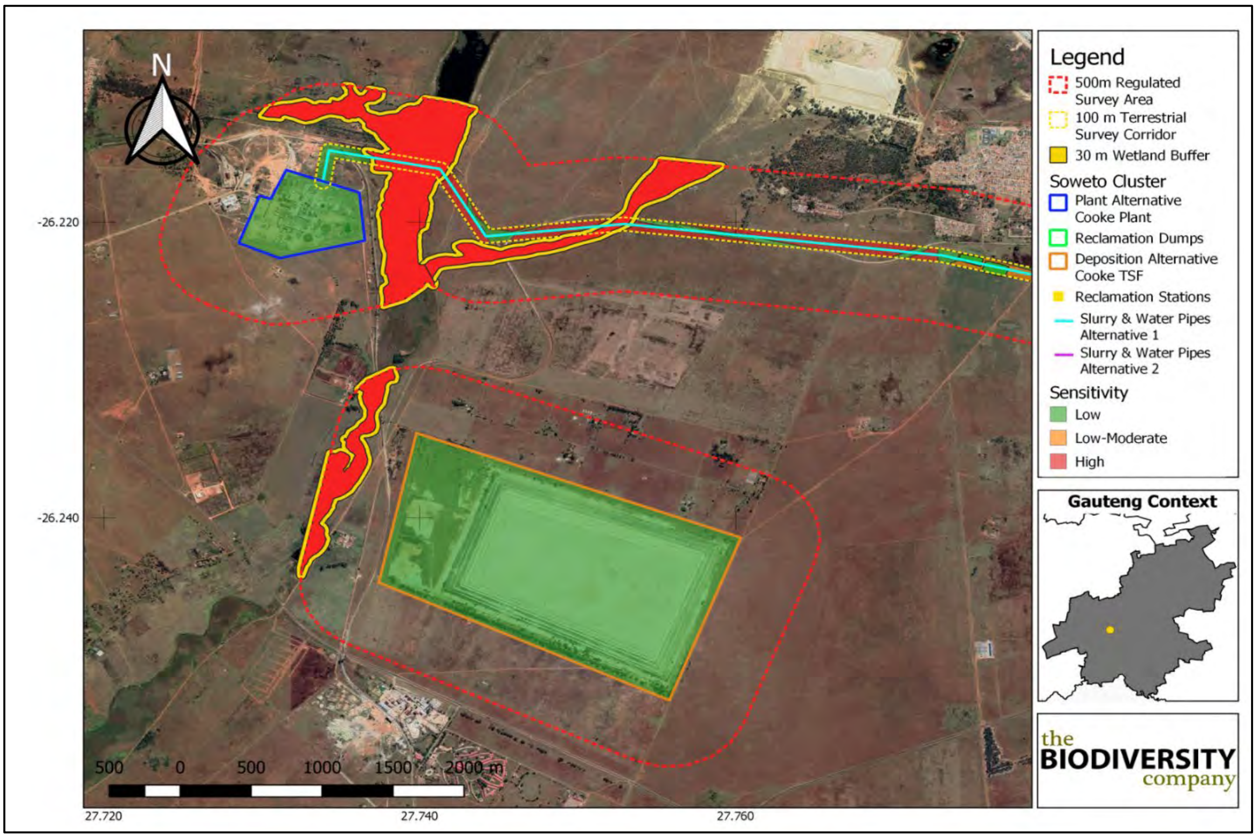


Figure 7-30: Habitat sensitivity around the Cooke Plant

Potential impacts were evaluated against the data captured during the desktop and field assessment to identify relevance to the study area. The following list provides a framework for the anticipated impacts associated with the project:

MAIN IMPACT	PROJECT ACTIVITIES THAT CAN CAUSE LOSS OF HABITAT (ESPECIALLY WITH REGARD TO THE PROPOSED INFRASTRUCTURE AREAS):	SECONDARY IMPACTS ANTICIPATED
1. Loss / degradation of ecosystems	❖ Physical removal of vegetation ❖ Access roads and servitudes ❖ Pipelines ❖ Soil dust precipitation ❖ Water leakages ❖ Dumping of waste products ❖ Random events such as fire (cooking fires or cigarettes)	❖ Displacement/loss of flora & fauna (including possible SCC) ❖ Increased potential for soil erosion ❖ Habitat fragmentation ❖ Increased potential for establishment of alien & invasive vegetation
2. Spread and/or establishment of alien and/or invasive species	❖ Vegetation removal ❖ Vehicles potentially spreading seed ❖ Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents ❖ Creation of infrastructure suitable for breeding activities of alien and/or invasive birds ❖ Vehicles potentially spreading seed	❖ Habitat loss for native flora & fauna (including SCC) ❖ Spreading of potentially dangerous diseases due to invasive and pest species ❖ Alteration of fauna assemblages due to habitat modification

	❖ Unsanitary conditions surrounding infrastructure promoting the establishment of alien and/or invasive rodents	
3. Direct mortality of fauna	❖ Clearing of vegetation ❖ Roadkill due to vehicle collision ❖ Pollution of water resources due to dust effects, chemical spills, acid mine drainage etc. ❖ Intentional killing of fauna for food (hunting) or otherwise (killing of snakes) ❖ Bird collisions with electrical lines	❖ Displacement/loss of fauna (including possible SCC) ❖ Loss of ecosystem services ❖ Increase in rodent populations and associated disease risk
4. Reduced dispersal/migration of fauna	❖ Loss of landscape used as corridor ❖ Compacted roads ❖ Removal of vegetation	❖ Loss of ecosystem services ❖ Reduced plant seed dispersal
5. Environmental pollution due to water/ mine drainage runoff	❖ Chemical (organic/inorganic) spills ❖ Erosion ❖ Acid mine drainage	❖ Secondary impacts associated with pollution in water courses and the surrounding environment ❖ Faunal mortality (direct and indirectly) ❖ Groundwater pollution ❖ Loss of ecosystem services
6. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to noise	❖ Operation of machinery (Large earth moving machinery, generators, water cannons, slurry pumps, vehicles)	❖ Loss of ecosystem services
7. Disruption/alteration of ecological life cycles (breeding, migration, feeding) due to dust	❖ Vehicles ❖ Exposed mine dumps	❖ Loss of ecosystem services
8. Staff and others interacting directly with potentially dangerous fauna or poaching of animals	❖ All unregulated/supervised activities outdoors	❖ Loss of ecosystem services ❖ Introduction of diseases and feral species such as cats.

7.8 Surface Water

Refer to Appendix D2 of the EIA for the Surface Water Impact Assessment

7.8.1 Regional Catchments and Drainage

The DHSWS and the Surface Water Resources of South Africa studies (WR90, WR2005 and WR2012) have divided South Africa into primary, secondary, tertiary and quaternary catchments. Primary catchments are the largest defined catchments for South Africa, of which there are 22, and are assigned a letter ranging from A – X (excluding O). Secondary catchments are subdivisions of the primary catchments, and are the second largest catchments in South Africa, and are assigned the primary catchment letter within which they are located, and a number e.g. A5 (secondary catchment 5 located within primary catchment A).

Similarly, tertiary catchments are subdivisions of secondary catchments, and are represented for example by A53 (tertiary catchment 3 located within secondary catchment A5). Lastly, quaternary catchments are the smallest defined catchments and are assigned the tertiary catchment number, along with a quaternary catchment letter e.g. A53D (quaternary catchment D located within tertiary catchment A53).

Further to the above, the DHSWS has divided South Africa into 9 Water Management Areas (WMAs), which are managed by separate Catchment Management Agencies (CMA). The 9 WMAs include the Limpopo, Olifants, Inkomati-Usuthu, Pongola-Mtamvuna, Vaal, Orange, Mzimvubu-Tsitsikamma, Breede-Gouritz and Berg-Olifants.

The project is located in the Upper Vaal WMA, primarily within quaternary catchment C22A in the Klip River Catchment. The dumps are drained by a number of non-perennial streams that are tributaries of the Klip River, which flows into the Vaal River immediately above the Vaal Barrage, near the town of Vereeniging.

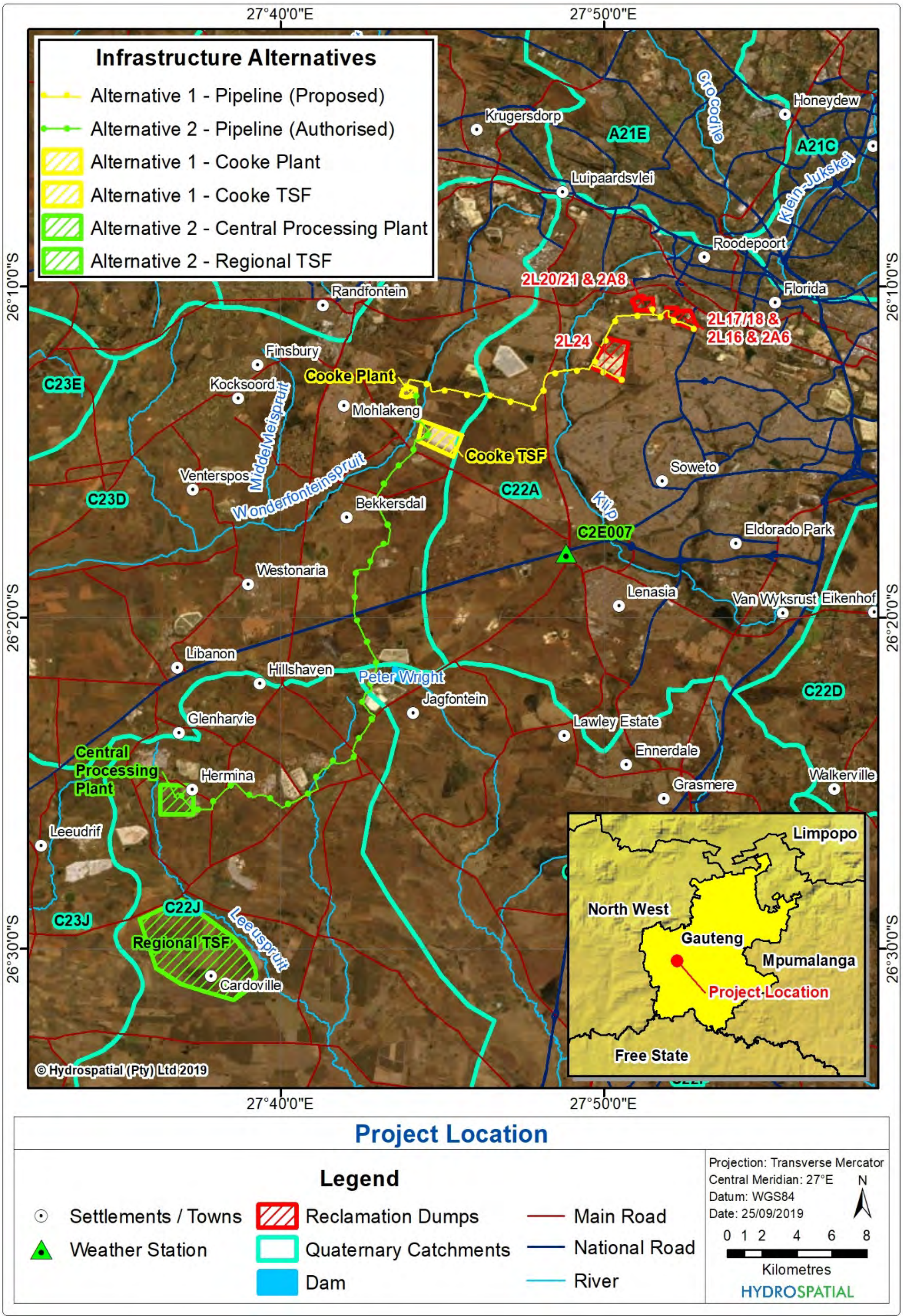


Figure 7-31: Project location

7.8.2 Surface Water Runoff

Quaternary catchment C22A has a Mean Annual Runoff (MAR) of 26.87 million cubic metres.

7.8.3 Surface Water Quality

Surface water quality sampling was undertaken on the site visit conducted on 13 August 2019. Samples were sent to Aquatico Laboratories for water quality analysis. The sampling locations, water quality results and a discussion of the results is provided below.

7.8.3.1 Sampling Locations

The coordinates of the sampling locations are provided below in Table 7-16 and shown in Figure 7-32.

Table 7-16: Surface Water Quality Sampling Locations

SAMPLING LOCATION	LATITUDE*	LONGITUDE*
SW1	-26.219025	27.811815
SW2	-26.198255	27.832384
SW3	-26.179546	27.842158
SW4	-26.184531	27.879198
SW5	-26.169587	27.833282
SW6	-26.243827	27.731798
SW7	-26.250540	27.809593

*Coordinates in decimal degrees, geographic coordinate system (latitude and longitude), WGS84 datum

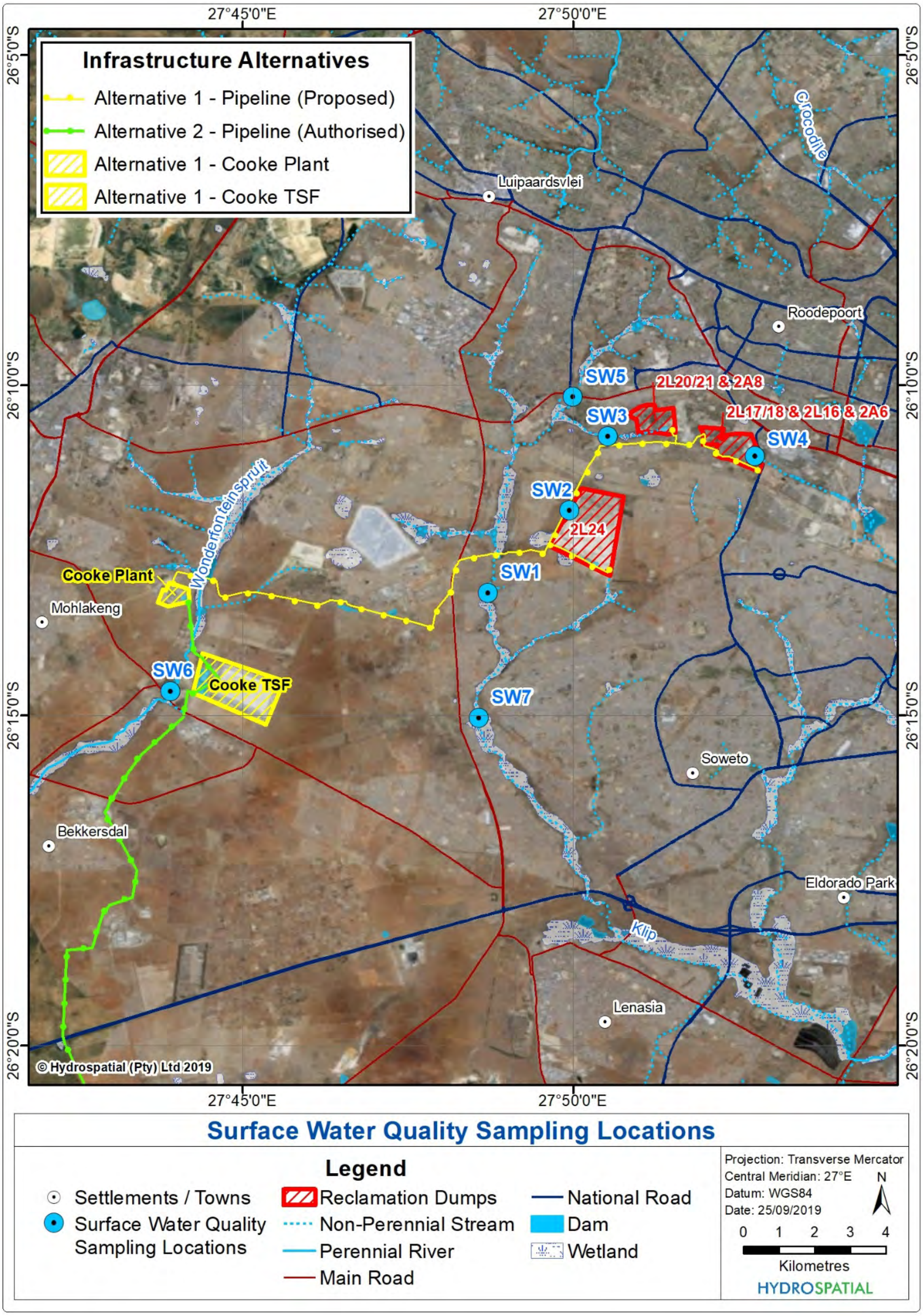


Figure 7-32: Surface water quality sampling locations

7.8.3.2 Water Quality Results and Discussion

The surface water quality results are indicated in Table 3 5. Results for sampling location SW6 was compared to the South African National Standards (SANS) 241:2015 Drinking Water Quality, whilst the remaining sampling locations were compared to the Klip River catchment guideline limits, as those sampling locations are located within the Klip River catchment. Where there were no limits specified for the Klip River catchment, the SANS 241:2015 limits were used. The guideline limits are described below:

- SANS 241:2015 Drinking Water Quality – This standard is generally used for comparison purposes, albeit providing stringent limits that are required for drinking water purposes. The limits provided in the SANS 241:2015 are separated into the following risks:
  - Acute health: Parameter that poses immediate unacceptable health risk if consumed with water at concentration values exceeding the specified limit;
  - Aesthetic: Parameter that taints water with respect to taste, odour and colour, and that does not pose an unacceptable health risk if present at concentration values exceeding the specified limit;
  - Chronic health: Parameter that poses an unacceptable health risk if ingested over an extended period if present at concentration values exceeding the specified limit; and
  - Operational: Parameter that is essential for assessing the efficient operation of treatment systems and risks to infrastructure.

The Klip River catchment guideline limits are specified as follows –

- **Ideal** – this is the range that results should ideally fall within;
- **Acceptable** – results that fall within this range are acceptable but not ideal;
- Tolerable – results that fall within this range are tolerable; and
- **Unacceptable** – results that fall within this range are unacceptable.

Results exceeding the SANS 241:2015 limits are highlighted in orange, whilst those exceeding the Klip River catchment tolerable and unacceptable limits, are coloured in yellow and red respectively. The water quality results are summarised below:

- No water quality issues were noted for SW1;
- SW2 and SW4 exceeded a number of parameter limits and were found to have a low pH (acidic), high dissolved salts, high Total Suspended Solids (TSS) and turbidity, as well as being high in heavy metals. SW2 also had elevated levels of uranium. The water quality from these dumps are typical of Acid Mine Drainage (AMD);
- SW3 was high in Total Suspended Solids (TSS) and turbidity. The stream was not flowing at the time of sampling, and therefore, water was sampled from stagnant water, which may be the result of the high TSS and turbidity;
- SW5 was elevated in turbidity, fluoride, ammonium and iron;
- No major issues were noted at SW6, other than having slightly elevated dissolved salts, nitrate, orthophosphate and ammonium; and
- Parameters were within limits at SW7, except for ammonium which was slightly elevated.

Table 7-17: Surface water quality results for the Soweto Cluster Project

PARAMETERS	UNITS	KLIP RIVER CATCHMENT GUIDELINE LIMITS		SANS 241:2015 LIMITS		SAMPLING LOCATIONS AND WATER QUALITY RESULTS						
		Tolerable Interim Target	Unacceptable	Risk	Limit	SW1	SW2	SW3	SW4	SW5	SW6	SW7
pH Value @ 25 º C	pH units	-	< 6.0; > 9.0	Operational	≥ 5 to ≤ 9.7	8.1	3	6.12	2.75	7.48	7.89	7.56
Electrical Conductivity in mS/m @ 25°C	mS/m	100 - 150	> 150	Aesthetic	≤ 170	48	447	34.5	1192	62.3	76	56.7
Total Dissolved Solids @ 180°C	mg/ℓ	-	-	Aesthetic	≤ 1 200	290	3397	222	9945	291	436	334
Total Suspended Solids	mg/ℓ	-	-	-	-	<4.5	24	5110	116	16	27	11
Turbidity	NTU	-	-	Aesthetic	≤ 5	1.98	59.2	4000	236	9.44	2.37	7.51
Total Alkalinity as $CaCO_3$	mg/ℓ	-	-	-	-	155	<1.99	45.2	<1.99	156	213	156
Total Hardness as $CaCO_3$	mg/ℓ	-	-	-	-	141	1338	125	2764	114	161	182
Chloride as Cl	mg/ℓ	75 - 100	> 100	Aesthetic	≤ 300	36.2	64.2	26	33.4	42.4	45	34.9
Sulphate as SO_4	mg/ℓ	350 - 500	> 500	Acute health	≤ 500	43.9	2739	101	9000	33.5	80.6	75.2
Fluoride as F	mg/ℓ	0.7 - 1.00	> 1.00	Chronic health	≤ 1.5	<0.263	<0.263	0.325	<0.263	1.42	0.367	<0.263
Nitrate as N	mg/ℓ	4.0 - 7.0	> 7.0	Acute health	≤ 11	3.74	<0.194	0.994	2.42	0.984	4.75	3.79
Orthophosphate as P	mg/ℓ	-	-	-	-	0.052	<0.005	<0.005	1.09	1.46	2.23	0.205
Ammonium (NH_4) as N	mg/ℓ	1.5 - 4.0	> 4.0	-	-	0.24	0.501	0.425	5.68	10.6	6.85	2.18
Sodium as Na mg/l	mg/ℓ	80 - 100	> 100	Aesthetic	≤ 200	41.5	117	21.5	71.8	50.4	81.4	40.8

PARAMETERS	UNITS	KLIP RIVER CATCHMENT GUIDELINE LIMITS		SANS 241:2015 LIMITS		SAMPLING LOCATIONS AND WATER QUALITY RESULTS						
		Tolerable Interim Target	Unacceptable	Risk	Limit	SW1	SW2	SW3	SW4	SW5	SW6	SW7
Potassium as K	mg/ℓ	-	-	-	-	8.23	16	0.436	10	10.9	12.1	7.6
Calcium as Ca	mg/ℓ	-	-	-	-	36.8	340	26.1	356	28.5	44.9	42.2
Magnesium as Mg	mg/ℓ	30 - 70	> 70	-	-	11.9	119	14.6	455	10.5	11.9	18.8
Aluminium as Al	mg/ℓ	0.3 - 0.5	> 0.5	Operational	≤ 0.3	0.003	30.6	0.004	559	0.091	0.014	0.012
Cadmium as Cd	mg/ℓ	-	-	Chronic health	≤ 0.003	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Total Chromium as Cr	mg/ℓ	-	-	Chronic health	≤ 0.05	<0.003	0.024	<0.003	1.6	<0.003	<0.003	<0.003
Cobalt as Co	mg/ℓ	-	-	-	-	<0.003	1.61	0.016	7.42	0.006	<0.003	<0.003
Copper as Cu	mg/ℓ	-	-	Chronic health	≤ 2	<0.002	0.008	<0.002	6.2	<0.002	<0.002	<0.002
Iron as Fe	mg/ℓ	1.0 - 1.5	> 1.5	Chronic health	≤ 2	<0.004	210	0.005	1564	1.38	<0.004	<0.004
Lead as Pb	mg/ℓ	-	-	Chronic health	≤ 0.01	<0.004	<0.004	<0.004	0.356	<0.004	<0.004	<0.004
Manganese as Mn	mg/ℓ	2.0 - 4.0	> 4.0	Chronic health	≤ 0.4	-	-	-	-	-	-	-
Nickel as Ni	mg/ℓ	-	-	Chronic health	≤ 0.07	<0.002	0.832	0.014	4.79	<0.002	0.02	<0.002
Uranium as U	mg/ℓ	-	-	Chronic health	≤ 0.03	<0.015	0.185	<0.015	<0.015	<0.015	<0.015	<0.015
Zinc as Zn	mg/ℓ	-	-	Aesthetic	≤ 5	0.049	1.01	0.043	12.9	0.044	0.052	0.055

7.8.4 Floodlines and 100 m Stream Buffer

According to Regulation 4 of GN R704, no person in control of a mine or activity may –

- Locate or place any residue deposit, dam, reservoir, together with any associated structure or any other facility within the 1:100 year floodline or within a horizontal distance of 100 metres from any watercourse or estuary, borehole or well, excluding boreholes or wells drilled specifically to monitor the pollution of groundwater, or on water-logged ground, or on ground likely to become water-logged, undermined, unstable or cracked; and
- Carry on any underground or opencast mining or prospecting or any other operation or activity under or within the 1:50 year floodline or within a horizontal distance of 100 m from any watercourse or estuary, whichever is the greatest.

The purpose of this section is to determine 1:100 year floodlines, as well as the 100 m buffer of watercourses, to ensure that the proposed project is compliant with GN R704 Regulations. It should be noted that the dumps were established prior to GN R704, and as such, some of them already occur within the floodlines or 100 m buffer of watercourses.

The delineated catchments and pipeline River Crossings (RC) are indicated on Figure 7-33 . The 1:100 year floodlines and 100 m watercourse buffer are indicated on Figure 7-34 to Figure 7-35. The proposed pipeline alternatives cross a number of watercourses.

The following is recommended:

- The selected pipeline alternative should be constructed above the 1:100 year floodline. Any supporting pipeline structures proposed within the floodline, should be constructed to withstand a 1:100 year flood;
- Any proposed infrastructure should as far as possible be located outside of the 1:100 year floodline and 100 m watercourse buffer, whichever is the greatest between the two. It must be noted that these are historical dumps that were created prior to GN R704; and
- Proposed infrastructure located within the floodlines or 100 m watercourse buffer must be exempted from GN R704.

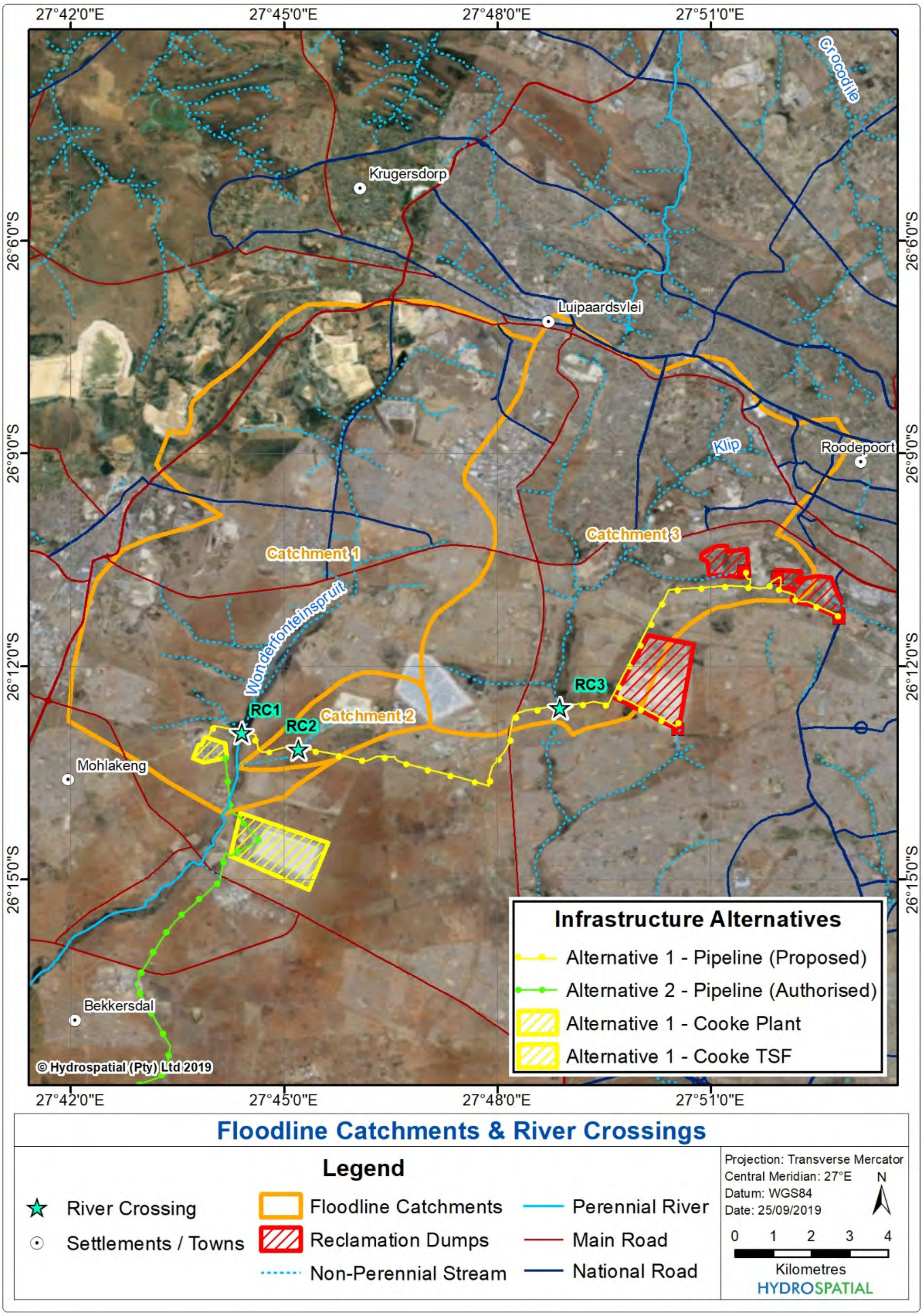


Figure 7-33: Floodline catchments and river crossings

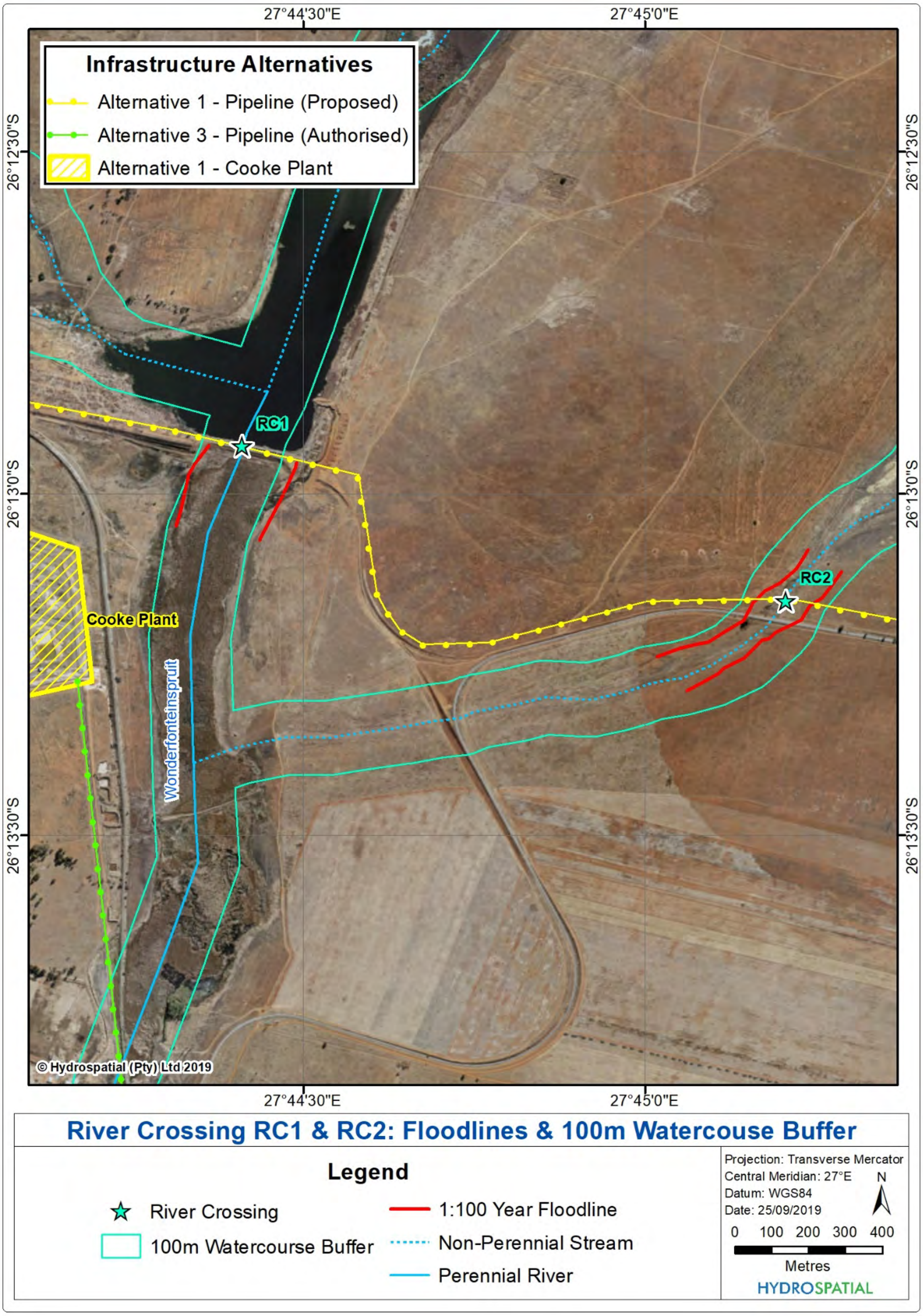


Figure 7-34: Floodlines and 100 m watercourse buffer for river crossing 1 and 2. This is the pipeline from Soweto Cluster to the Cooke Plant

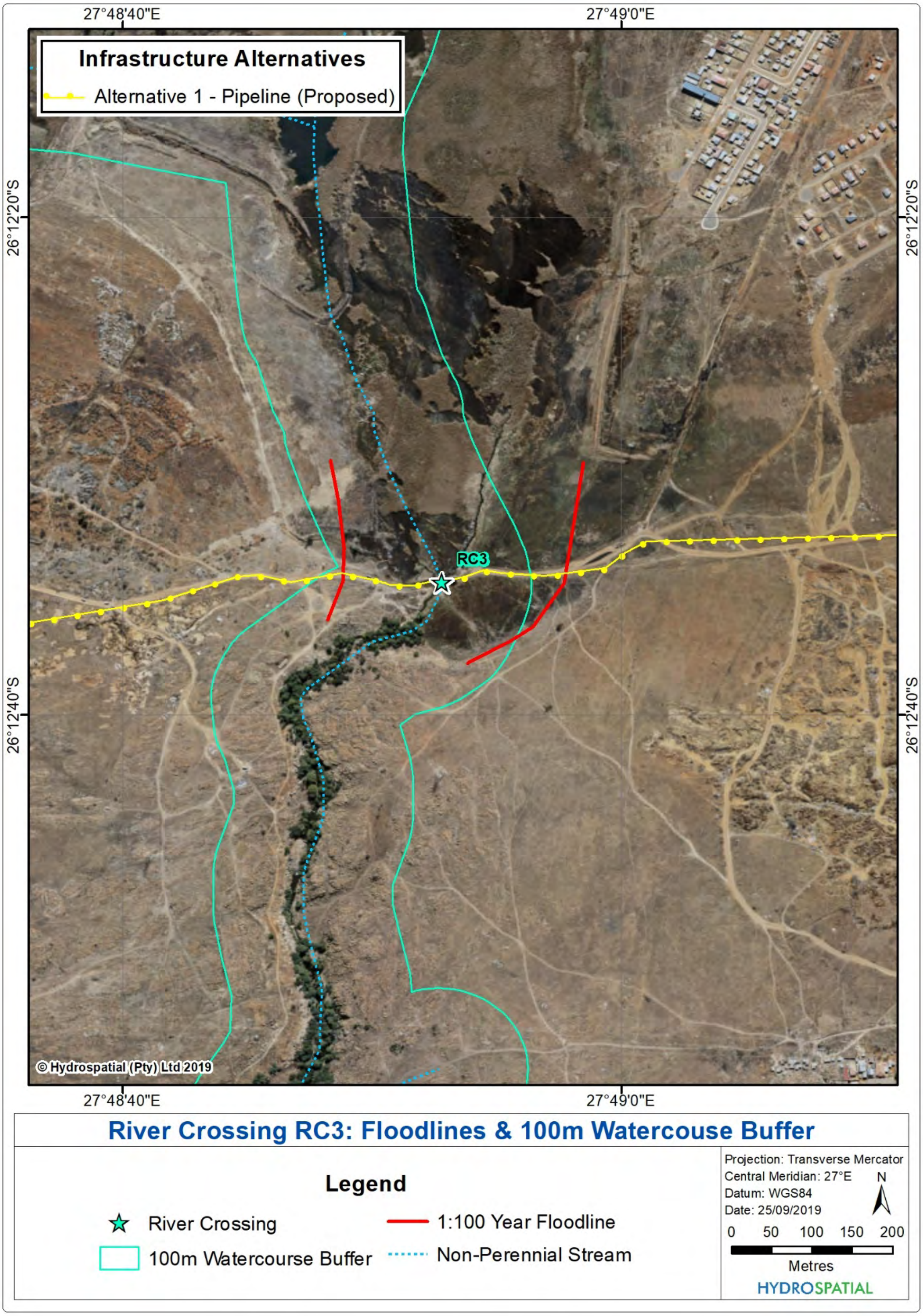


Figure 7-35: Floodlines and 100 m watercourse buffer for river crossing 3

7.8.5 Conceptual Stormwater Management Plan

The purpose of the conceptual SWMP is to ensure that clean and dirty water are adequately separated, by diverting clean water away from dirty areas, and ensuring that dirty water from the operation is captured, contained and managed appropriately.

The following design philosophy was adopted to guide the development of the SWMP, and is based on GN R704 and the DWS Best Practice Guideline (BPG) G1: Storm Water Management:

- Confine or divert any unpolluted water to a clean water system, away from a dirty area;
- Runoff from dirty areas must be captured, contained and managed appropriately;
- Clean and dirty water systems must be designed and constructed to prevent cross contamination;
- Dirty water must, as far as possible, be recycled and reused or treated and discharged;
- Clean and dirty water systems must convey/contain runoff from the 50 year storm event, and should not lie within the 100 year floodline or within a horizontal distance of 100 m from any watercourse, whichever is the greater of the two; and
- Appropriate maintenance and management of stormwater related infrastructure should be ensured at all times.

The following are assumptions and limitations for the conceptual SWMP:

- The SWMP is based on the project description provided. Should the project description or infrastructure layout change, then the SWMP will need to be revised; and
- The SWMP is conceptual. A detailed SWMP should be designed based on the concept design prior to construction.

7.8.5.1 Clean and Dirty areas

Dirty areas include the following areas:

- Dump area;
- Finger and vibrating screens;
- Slurry receiving sump;
- Emergency stormwater dam; and
- Coarse material stockpile.

Clean areas include all areas adjacent to the abovementioned dirty areas. The clean and dirty areas are indicated on Figure 7-36, Figure 7-37 and Figure 7-38.

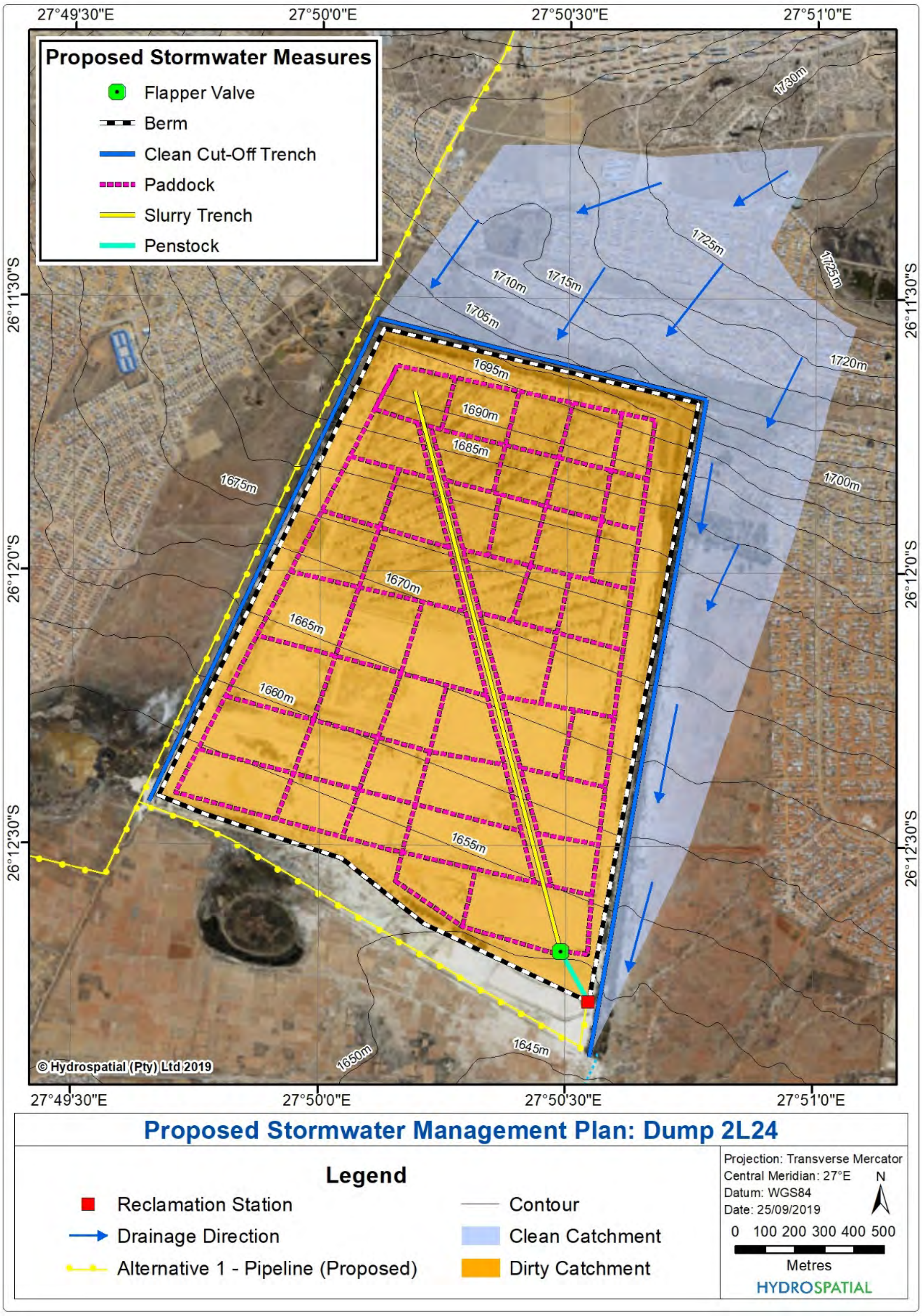


Figure 7-36: Proposed stormwater water measures for Dump 2L24

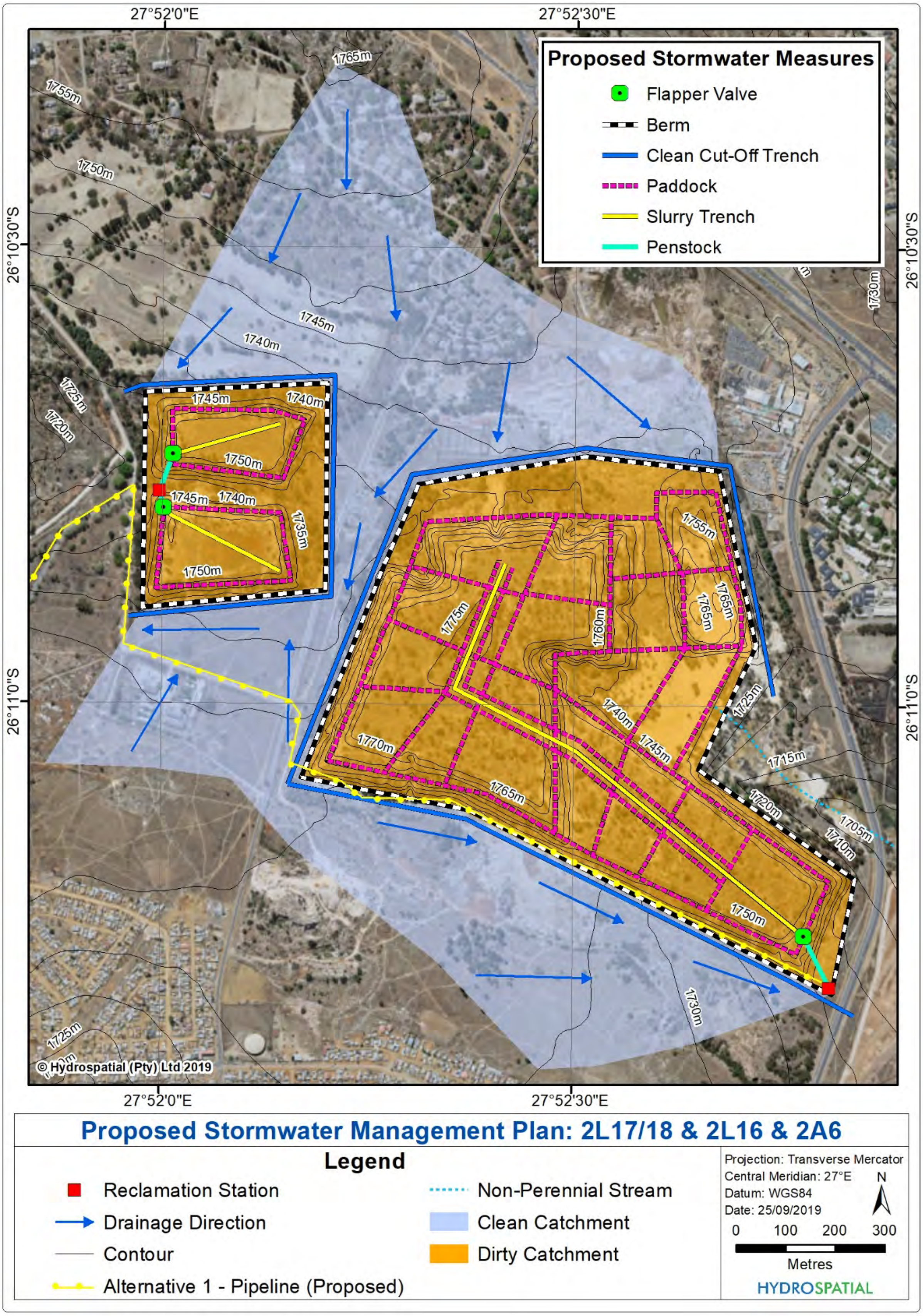


Figure 7-37: Proposed stormwater water measures for Dump 2L17/18 & 2L16 & 2A6

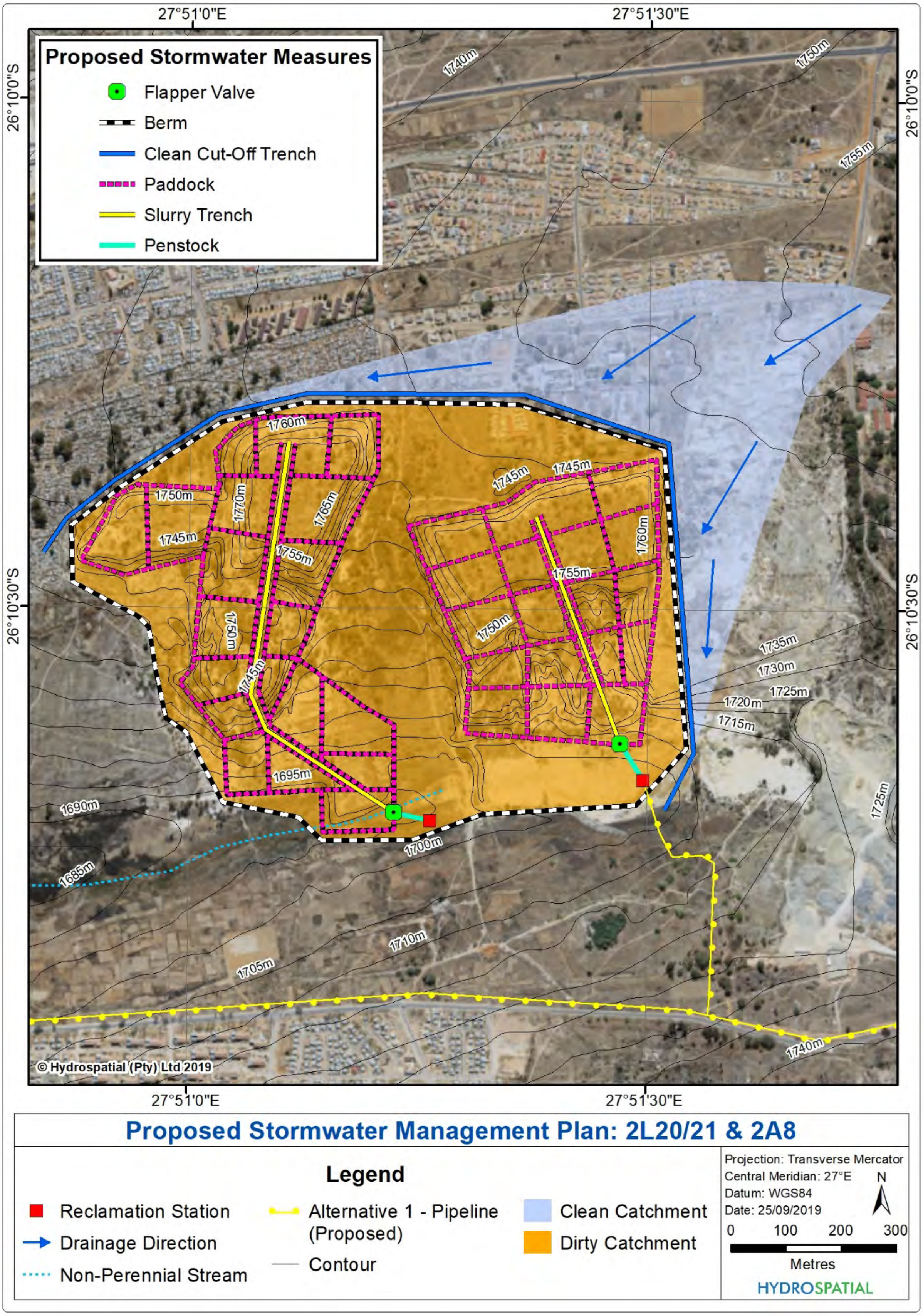


Figure 7-38: Proposed stormwater water measures for Dump 2L20/21 & 2A8

7.8.5.2 Proposed stormwater measures

The SWMPs have been designed as a closed system (i.e. no discharge of dirty water to the environment). Stormwater measures proposed to separate clean and dirty water areas include paddocks, open trapezoidal channels (trenches), berms and flapper valves. These are discussed in further detail below.

7.8.5.2.1 Slimes Dams

The slimes dams will be mined using a hydraulic mining method. The berms will act as a barrier between clean and dirty areas, by diverting upslope clean water around dirty areas, and ensuring that dirty water is contained. It is recommended that the berms must be vegetated to prevent erosion. The purpose of the clean cut-off trenches is to divert upslope clean runoff around dirty areas.

It is proposed that the clean channels are grassed. The slurry trench will convey slurry from the working area of the dump, to the finger and vibrating screens, and then to the reclamation station. It is unlikely that the slurry trenches will be lined, as the trench will be located within existing dirty areas of the dump. It is proposed that a series of paddocks (containment berms) are constructed on top of the dump, to capture and contain stormwater runoff. A flapper valve is proposed at the top of the dump, at the point where the slurry trench discharges into the penstock. The purpose of the flapper valve will be to contain stormwater runoff on top of the dump, in order to alleviate the amount of runoff reporting to the reclamation station. Slurry will be transported from the flapper valve, via a penstock (pipeline) to the reclamation station. All stormwater will be managed on top of the slimes dam (through the opening and closing of the flapper valve) and not at the reclamation station.

Figure 7-39 provides an indication of the proposed channel and berm design.

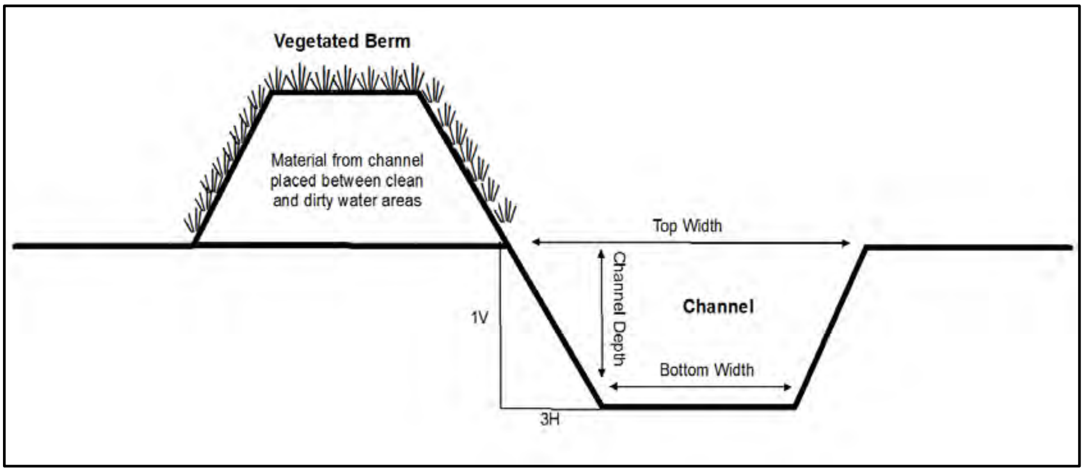


Figure 7-39: Proposed channel and berm design

7.8.5.2.2 Sand Dumps

The sand dumps will be mechanically removed using front end loaders. As with the slimes dams, berms and clean cut-off channels are proposed to divert clean water around dirty areas. The berms will also ensure that dirty water is contained. Paddocks are proposed to control stormwater runoff from the dumps.

7.9 Groundwater

Refer to Appendix D3 of the EIA for the Surface Water Impact Assessment

7.9.1 Conceptual Hydrogeological Model

According to Barnard (2000) various aquifer types are found in the area i.e. fractured aquifers, karst aquifers and intergranular and fractured aquifers:

- Karst aquifers: The Malmani dolomite aquifers are irregular shaped, with solution cavities and fractures, often associated with faults or dykes.
- Weathered and fractured aquifers: The Klipriviersberg Group and Witwatersrand formations present aquifers that have a combination of loose unconsolidated/ weathered material overlaying hard rock formations, in which fractures, fissures or joints potentially hold water.
- Fractured aquifers: The deeper Klipriviersberg Group and Black Reef quartzite are hard rock aquifers where water is stored and moves through fractures

7.9.1.1 Groundwater Levels

Based on the limited information available, the depth to groundwater in the area varies between 5 m below ground level (m bgl) and 46 m bgl (east of 2L24), with an average groundwater level depth of 14 m bgl (Intraconsult, 2000). The groundwater levels are 2 to 5 metres below surface at the proposed Dobsonville Mall site (Geohazard Solutions, 2019).

The water table in an area generally mimics the topography and drains on a regional scale towards the larger rivers and streams. On a local scale groundwater movement might be in the opposite direction, but adopt the regional trend / flow direction as the groundwater moves further away from the topographical feature. Generally, a groundwater mound occurs beneath a TSF as a result of seepage from the TSF, that recharges the underlying aquifer. This results in radial flow from the TSF footprint, but assumes regional flow direction again as the distance increases from the TSF.

For the Soweto Cluster area, the groundwater flow direction will be in a southerly to the south-westerly direction, towards the Klip River.

DHSWS registered, long term groundwater monitoring data points are located approximately 8 km south and 8 km west of the Soweto Cluster; where time series water levels are recorded. The data recording unfortunately stopped around April / May 2018 for the various sites. The closest DHSWS dolomite monitoring sites include C2N0317 and C2N0320; located in the Zuurbekom compartment.

The available groundwater levels are presented in Figure 7-40 and Figure 7-41. Borehole C2N0317 is located to the west, in the Bekkersdal area. The groundwater level is approximately 9 m bgl. A drop in the water table is visible over the September 2001 period, but other than that the water level indicates normal seasonal changes; monitoring stopped in 2012.

Borehole C2N0320 is located to the south, in the Protea South, Soweto area. The groundwater level is approximately 28 m bgl. A rise in the water table is visible over the January 2010 period, but other than that the water level indicates normal seasonal changes; monitoring stopped in May 2018.

Groundwater level fluctuations in the dolomitic areas are generally small due to the large storage volume in the dolomitic aquifers, thus a large volume of water has to be added or removed to result in a signification change in the compartment groundwater level.

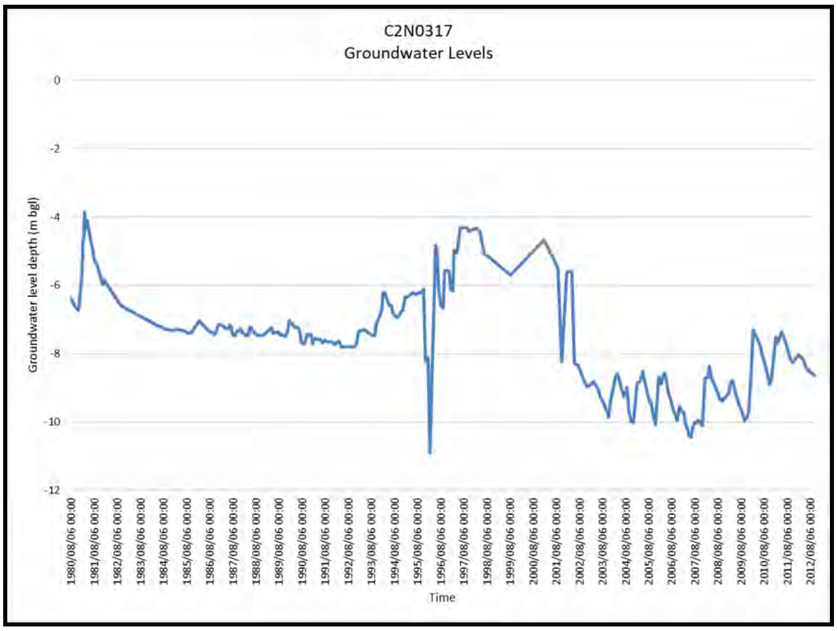


Figure 7-40: DHSWS monitoring borehole C2N0317

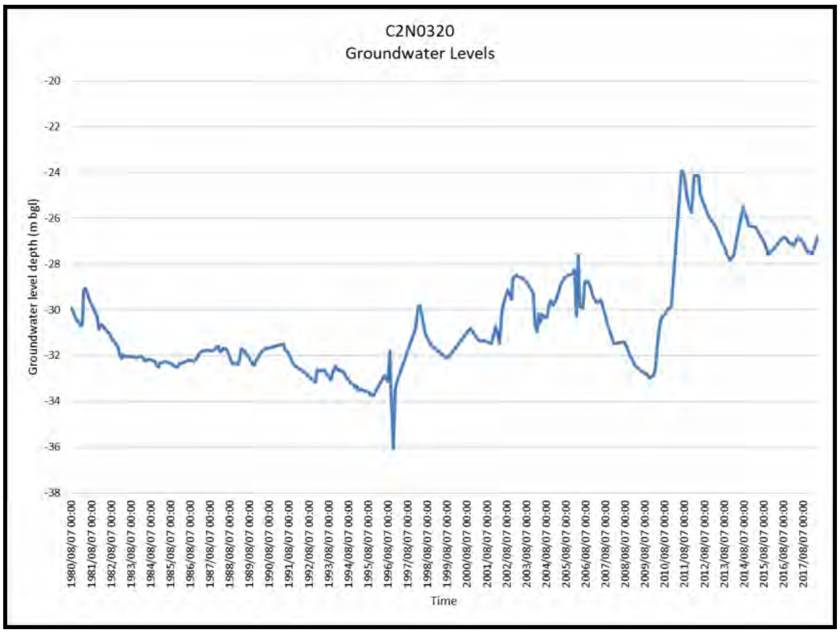


Figure 7-41: DHSWS monitoring borehole C2N0320

7.9.1.2 Groundwater Quality

No historical groundwater quality information could be sourced for the project area. One groundwater sample was collected from the Dobsonville monitoring site – borehole GWBH03 (Figure 7-42) (Geohazard Solutions, 2019). The sampling site is approximately 3 km south and east of the Soweto Cluster dumps, downstream from the dumps and in the dolomitic aquifer. This sample provides an indication of background groundwater quality in the dolomitic aquifer.

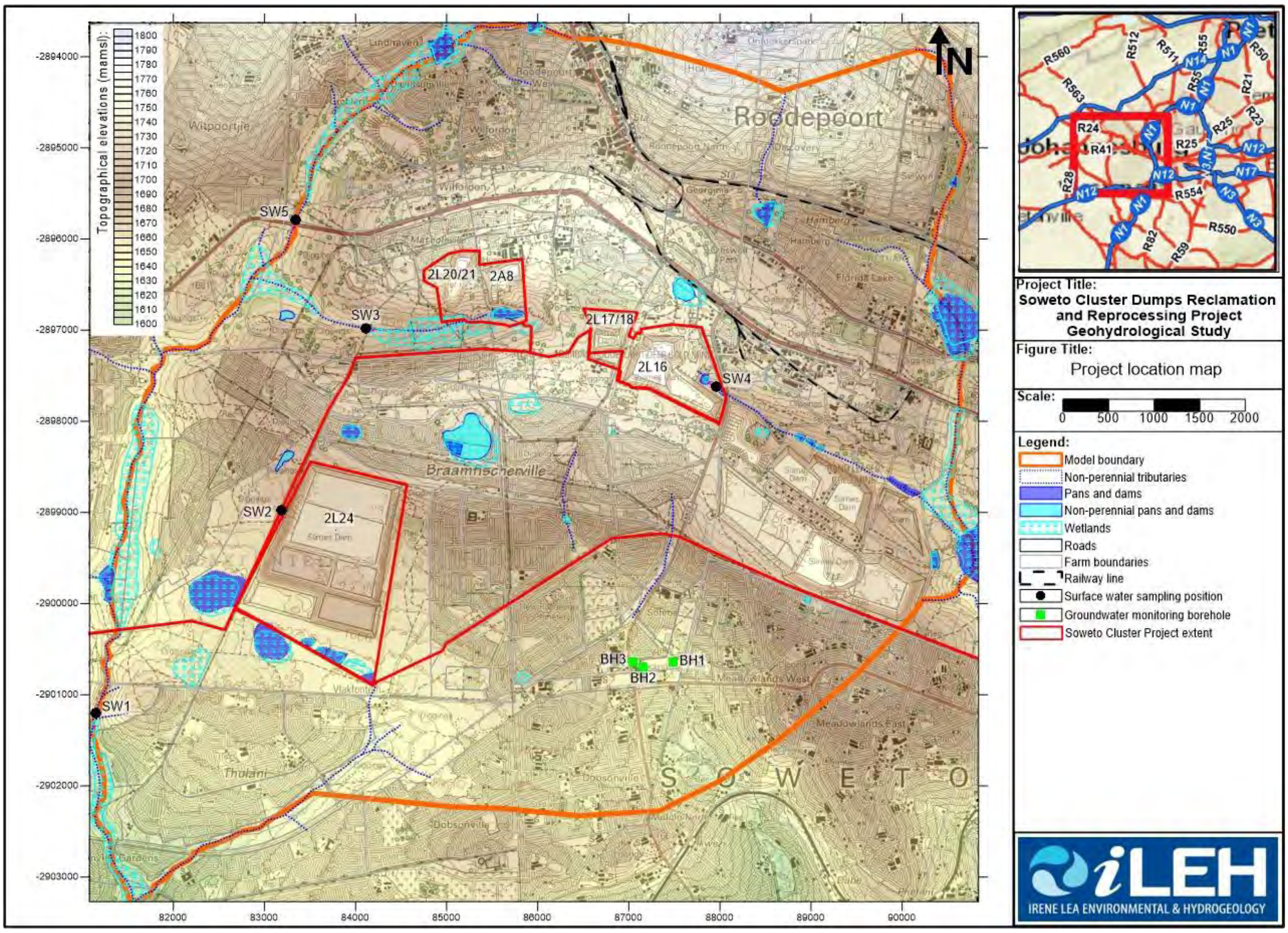


Figure 7-42: Soweto Cluster Groundwater Site Map

The water sample was submitted to Aquatico Laboratories for analysis. Aquatico is a SANAS accredited laboratory (South African National Accreditation System). The water sample was analysed for basic inorganic parameters and the results were compared against the SANS 241:2015 Drinking Water Standards.

The sample was taken using single valve, decontaminated bailer. Sterilized 500 millilitre (ml) sample bottles were used and filled to the top. Samples were stored in a cooler box during the site survey. The water quality has been presented by means of Piper and Stiff diagrams (refer to the Groundwater Impact Assessment in Appendix D2 for more detail on these diagrams).

Based on Piper and Stiff diagrams, the groundwater in the dolomitic aquifer represents a Magnesium-bicarbonate water, indicating recent recharge.

Based on the water quality results (Table 7-18), the following conclusions were drawn:

- The groundwater in the Dobsonville area (dolomitic aquifer) is classified as moderately hard water; associated with the calcium and magnesium in the dolomite.
- The pH is high – 9.2, thus alkaline.
- There is no chemical of concern associated with the sampled site – borehole GWBH03. All salts and metals, including sulphate were present in concentrations below the SANS241 drinking water guideline limits.
- Negative impacts from on site or external point sources are not visible.

Table 7-18: Dobsonville groundwater quality – August 2019

PARAMETER	UNIT	SANS241 STANDARD LIMITS		DHSWS DRINKING STANDARDS	GWBH03
Ammonium	mg N/ℓ	Aesthetic ≤1.5			0.834
Chloride	mg Cl/ℓ	Aesthetic ≤300			6.32
Aluminium	mg Al/ℓ	≤0.3			0.005
Cadmium	mg Cd/ℓ		Chronic health ≤0.003		-0.002
Calcium	mg Ca/ℓ			No health. Scaling intensifies from 32mg/L	11.9
Copper	mg Cu/ℓ		Chronic health ≤2		-0.002
Iron	mg Fe/ℓ	Aesthetic ≤0.3	Chronic health ≤2		-0.004
Lead	mg Pb/ℓ		Chronic health ≤0.01		-0.004
Magnesium	mg Mg/ℓ			Diarrhoea and scaling issues from 70mg/L	12.3
Manganese	mg Mn/ℓ	Aesthetic ≤0.1	Chronic health ≤0.4		0.024
Nickel	mg Ni/ℓ		Chronic health ≤0.07		-0.002
Zinc	mg Zn/ℓ	Aesthetic ≤5			0.009
Electrical Conductivity at 25°C	mS/m	Aesthetic ≤170			16.4
Fluoride	mg/ℓ		Chronic health ≤1.5		-0.263
Nitrate	mg/ℓ		Acute health ≤11		0.218
pH at 25°C		≥5 - ≤9.7			9.22

PARAMETER	UNIT	SANS241 STANDARD LIMITS		DHSWS DRINKING STANDARDS	GWBH03
Potassium	mg K/ℓ			No aesthetic or health effects below 50mg/L	0.972
Sodium	mg Na/ℓ	Aesthetic ≤200			6.65
Sulphate	mg SO4/ℓ	Aesthetic ≤250	Acute health ≤500		14.4
Total Alkalinity	mg CaCO3/ℓ				80.6
Total Dissolved Solids	mg/ℓ	Aesthetic ≤1200			104.0
Total Hardness	mg CaCO3/ℓ	60–120 mg/l, moderately hard	120–180 mg/l, hard	more than 180 mg/l, very hard	80.0
Orthophosphate (PO4) as P	mg/ℓ				-0.005
Cobalt	mg/ℓ				-0.003
Turbidity	NTU	Aesthetic ≤5			67.9

It was found that the many pollution sources (industrial discharge, mining activities and poor waste and sanitation management) which exist within the immediate surrounds of the project area, can (and do) contribute to groundwater contamination. The groundwater specialist stated that it is difficult to define the contaminants and concentration at all point sources in the area.

Historic TSFs (such as Soweto Cluster) can potentially add sulphate, chloride, calcium, magnesium, manganese and aluminium to the local groundwater system. Contamination pathways are if the management of contaminated water on site is not effective, or through seepage from the TSFs. It has been found that metals like cobalt, copper, nickel and zinc can also be elevated in historic TSFs.

The groundwater specialist concluded that sulphate concentrations around a tailings complex vary between 20 and 2,500 mg/L.

It was found that the pyrite present in the TSFs will become oxidised in the presence of oxygen and water to form ferrous sulphate and sulphuric acid. Both reactions result in an acidic pH, and high sulphate and metal concentrations (Acid Mine Drainage – AMD) are often measured in leachate of historical TSFs. The rate at which pyrite oxidation takes place varies and decreases with depth. The groundwater specialist concluded that the addition of lime during the reprocessing raises the pH to neutral conditions when tailings are deposited on the deposition facilities. Lastly, the groundwater in the proposed Dobsonville Mall area presents a low sodium hazard and a low salinity hazard to soil if used for irrigation.

7.9.2 Hydrocensus

A hydrocensus was conducted across the Soweto Cluster area during August 2019. The survey included the Soweto Cluster area and adjacent properties and concentrated on identifying existing boreholes to enhance the knowledge of the groundwater systems and current groundwater use.

During the 2019 hydrocensus no groundwater sites (boreholes) were identified. Access to the Wes Wits borehole database, as well as the Marie Louise Landfill Site monitoring boreholes was not granted, and the area survey yielded no boreholes. The hydrocensus included visits to several private and commercial properties in the area, e.g. the Community Garden at the south-eastern corner of the 2L24 dump, residential areas, communication with community members, communication with mining operations in the northern portion of the Soweto Cluster, and a visit to the rundown Durban Deep Golf Course.

The extent of the study area, budget and time constraints, and land access limited the hydrocensus in terms of surveying every property in the area. The study did aim at covering the whole area to ensure a data set representative of the study area.

7.9.3 Site Geochemistry

During tailings deposition and after closure, seepage from the tailings facility walls are largely removed by the drain systems. A study has shown that the top 3 metres of an old TSF / dump indicate low element concentrations, as leaching from rainfall most probably flushed out the minerals. Deeper into the TSF the pH is much lower and element concentrations higher, but due to stable conditions that include low permeability and low oxygen levels, metal and salt leaching does not happen readily (Irene Lea, 2016). This could potentially change when the reclamation process introduces high volumes of water and oxygen.

The prerequisite for AMD is the generation of acid at a faster rate than it can be neutralised by any alkaline materials in the system, with pyrite being the most common mineral in AMD formation. The oxidation of pyrite occurs in the following steps:

$$2FeS_2 + 7O_2 + 2H_2O = 2Fe^{2+} + 4SO_4^{2-} + 4H^+ \qquad (1)$$

$$4Fe^{2+} + 10H_2O + O_2 = 4Fe\,(OH)_3 + 8H^+ \qquad (2)$$

$$2Fe^{2+} + O_2 + 2H^+ = 2Fe^{3+} + H_2O \qquad (3)$$

$$FeS_2 + 14Fe^{3+} + 8H_2O = 15Fe^{2+} + 2SO_4^{2-} + 16H^+ \qquad (4)$$

The intensity of acid generation is determined by chemical parameters such as pH, temperature and oxygen concentration in the different stages and the surface area of the exposed metal sulphides (Nengovhela, October 2006). The reclaimed slurry and any water must be removed from the exposed surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper karst aquifers.

7.9.4 Linking Surface Water Findings

Hydrospatial collected seven surface water samples during its site visit in August 2019 (Table 7-16 and shown in Figure 7-32). Based on the water quality results the element concentrations for sampling sites SW2 and SW4 exceed the acceptable SANS Drinking Water health limits for sulphate, iron, total chrome, copper, nickel and lead. pH values for the two sites were 2.3 and 3.0 respectively. Calcium, magnesium, aluminium and zinc concentrations were also elevated for the two sites. SW2 represents water taken from the toe drains at 2L24 and SW4 is water flowing from 2L16 and 2A6. The water qualities associated with

SW2 and SW4 (Table 4) will be used as source quality information for the numerical model simulations (Sections 9.4 to 9.6).

Sample sites SW4, SW5, SW6 and SW7 also presented elevated ammonia concentrations; similar to the Rand Water sampling data (Figure 2). In general, sampling sites SW1, SW3, SW6 and SW7 is of acceptable quality; based on parameters analysed for.

There are two surface water channels along the western perimeter of 2L24:

- Water flow along the foot of the slimes dam in a southerly direction; assumed to be water discharging from the toe drains and TSF – acidic pH and high salt and metal concentrations (see Surface Water Impact Assessment Report – water sample SW2); and
- Clean water channel flow to the west of the slimes dam. According to local residents the source is a surface water body to the north of 2L24 – neutral pH and acceptable salt and metal concentrations.

The water qualities associated with surface water samples SW2 and SW4 (Hydrospatial, 2019) were used as source quality information for the numerical model simulations (Refer to sections 9.4 to 9.6 of the Groundwater Impact Assessment).

7.9.5 Aquifer Characterisation

Aquifer characterisation is done based on the information presented thus far, and guidelines and maps provided by the DHSWS. This system was created as it allows the grouping of aquifer areas into types according to their associated supply potential, water quality and local importance as a resource.

Except for the Malmani dolomite, all the aquifers in the study area are classified as minor aquifer systems according to the South African aquifer system management classification. The groundwater is therefore of limited quantity, but potentially important for local water supply and base flow for rivers. The dolomite underlying 2L24 is classified as a major aquifer system, which are viewed as a high yielding aquifer, with generally good quality water (Parsons, 1998).

7.9.5.1 Groundwater Vulnerability

Groundwater vulnerability indicates the tendency or likelihood for contamination to reach a specified position in the groundwater system after introduction at some location above the uppermost aquifer. Based on the aquifer vulnerability map published by the DHSWS in July 2013 the dolomite is classified as a vulnerable aquifer system (DHSWS, July 2013). The Witwatersrand and Ventersdorp formations are less vulnerable.

7.9.5.2 Aquifer Susceptibility

Aquifer susceptibility is a qualitative measure of the relative ease with which a groundwater body can potentially be contaminated by anthropogenic activities and includes both aquifer vulnerability and the relative importance of the aquifer in terms of its classification. Based on the classification above the

Witwatersrand and Ventersdorp formations have a low susceptibility to contamination. The dolomite is highly susceptible to contamination.

7.9.6 Groundwater Modelling

The following modelling objectives were set for the project:

- To estimate the historical impact of tailings deposition on groundwater quality;
- To assess the potential impact of tailings reprocessing, during the operational, rehabilitation and closure phases of the project on groundwater quality;
- To assess the potential long-term impacts associated with the project; and
- To evaluate the long-term impact of tailings deposition if the proposed project is not implemented.

7.9.6.1 Key Modelling Assumptions and Limitations

The groundwater model presented in the Groundwater Impact Assessment is based on the aquifer conceptualisation. There are however a number of assumptions and limitations that affect the confidence level of the simulations results. These include:

- Site-specific aquifer parameters are not available at the project sites. In order to complete an assessment of the impacts of Soweto Cluster reprocessing on groundwater quality, literature-based aquifer parameters were considered. These are listed in Table 7-19 below. It is shown that a wide range of values are reported for the affected geological formations. This is expected in fractured and karst-type aquifers, where groundwater flow is complex and changes with time. However, for the purpose of simulations, simplifications are required. For this reason, likely minimum and maximum flow conditions will be evaluated at the hand of adjusting the permeabilities of the formations to understand groundwater flow under these hypothetical conditions.
- Due to the fact that no on-site groundwater levels are available, model calibration and sensitivity analysis could not be performed to a satisfactory level. Limited calibration was completed with groundwater levels measured in three boreholes situated approximately 3 km east of 2L24, in the dolomitic aquifer. It is noted that the inadequate level of model calibration limits the level of confidence in the output.

Table 7-19: Literature-based aquifer parameters considered

FORMATION	PERMEABILITY (M/D)			SPECIFIC STORAGE (M^{-1})		POROSITY (%)	
	Irene Lea (2016)	Freeze & Cherry (1979)	Domenico & Schwartz (1990)	Irene Lea (2016)	Anderson & Woessner (1992)	Irene Lea (2016)	Freeze & Cherry (1979)
Dolomite (minimum)	5,00E-01	8,64E-05		1,00E-03		10	
Dolomite (maximum)	1,00E+00	8,64E-02		1,00E-01		20	
Karst limestone (minimum)		8,64E+00	1,73E-05				5
Karst limestone (maximum)		8,64E+04	8,64E-02				50
Shale (minimum)		8,64E-09	8,64E-09		1,50E-06	1	0
Shale (maximum)		8,64E-05	1,73E-04		6,90E-05	5	10

Fractured crystalline rock (minimum)		8,64E-04	6,91E-04		6,90E-05		0
Fractured crystalline rock (maximum)		8,64E+02	2,59E+01		3,30E-06		10

- In order to test the model's sensitivity to possible variations in aquifer permeabilities, likely minimum and maximum flow conditions were evaluated, as mentioned above. The sensitivity to other aquifer parameters was not tested as it is thought that aquifer permeability would play the most significant role in plume movement.
- Despite the current low confidence in the model, the water balance error for the flow components considered during simulations is less than 1%, as indicated in Table 7-20. This means that the difference between inflows and outflows simulated are within generally acceptable bounds.

Table 7-20: Model Water Balance

FLOW TERM	INFLOW (M^3/D)	OUTFLOW (M^3/D)	BALANCE (M^3/D)
Storage	5,94E+01	3,80E+02	-3,21E+02
Constant Head	0,00E+00	2,34E+02	-2,34E+02
Drains	0,00E+00	5,11E-02	-5,11E-02
Recharge	5,52E+02	0,00E+00	5,52E+02
River Leakance	1,09E-02	1,43E-01	-1,32E-01
Head Dependent Boundaries	2,46E-01	8,33E-01	-5,87E-01
Total	6,12E+02	6,15E+02	-3,45E+00
		Water Balance Error (%)	-0,56

- The source term used during simulations is based on surface water sampling and the water balance prepared for the site by Hydrospatial (2019). Generalised assumptions are made to characterise all the slimes dams and sand dumps that are considered as part of this project. It is strongly recommended that a better understanding of the volume of seepage available for infiltration from the TSFs to the underlying aquifers, as well as the quality of leachate, is obtained. Once this information is available, the predictive modelling should be updated.
- The historical impact of tailings deposition is not well understood. Some information is available to define the period over which groundwater quality has been affected in the past, but this is not sufficient to assess historical impacts with confidence. The available information was however incorporated and included during simulations. It is noted that the historical impact on groundwater quality plays a significant role in the current and future extent of plume movement.
- Only advective transport of contaminants was simulated. While it is acknowledged that attenuation will take place, there is currently no information available to characterise this aspect. Due to the fact that it is assumed that contamination will flow at the same rate as groundwater would in the aquifers, the scenarios represent a worst-case scenario, in line with taking a precautionary approach.

7.9.6.2 Groundwater Flow

The groundwater flow gradient is affected by the permeabilities of the rock formations. Zones of low permeability, like the Booysens shale, are expected to result in a steepening of the flow gradient, as flow is retarded through the shale. Formations with higher permeabilities, like the dolomite, would result in shallower flow gradients. Based on the current understanding of the aquifers present, it is thought that groundwater flow in the dolomitic outlier would be controlled by its extent.

It is furthermore thought that historical and current recharge of rainwater and leachate from the TSF creates a mound in groundwater levels around these facilities. This means that groundwater levels are higher underneath and immediately adjacent to the TSF and that groundwater flow takes place radially from the Soweto Cluster dumps.

7.10 Air Quality

Refer to Appendix D4 for the Air Quality Impact Assessment (AIQA) report.

7.10.1 Health Effects of Particulate Air Pollutants

There are an increasing number of research studies highlighting the impact of gases and air pollutants on humans. Many of these emissions, even in small quantities, have adverse effects on workers and neighbouring residents alike.

Particles can be classified by their aerodynamic properties into coarse particles, PM_{10} and fine particles, $PM_{2.5}$ (Harrison & Van Grieken, 1998). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002). Particle size is important for health because it controls where in the respiratory system a given particle is deposited. Fine particles are thought to be more damaging to human health than coarse particles, as they can penetrate deeper into the lungs (Manahan, 1991). Larger particles are deposited into the extrathoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000). Furthermore, both the amount and the chemical and mineralogical composition of these small particles will influence the potential for health impacts (Schwegler, 2006).

In terms of health effects, particulate air pollution is associated with respiratory and cardiovascular morbidity, such as aggravation of asthma, respiratory symptoms and an increase in hospital admissions. Inhalable PM also leads to increased mortality from cardiovascular and respiratory diseases and from lung cancer (WHO, 2013). A study was undertaken to investigate the association between proximity to mine dumps and prevalence of chronic respiratory disease in people aged 55 years and older (Nkosi, Wichmann, & Voyi, 2015). Elderly people in communities 1-2 km (exposed) and ≥5 km (unexposed), from five mine dumps in Gauteng and North West Province, in South Africa were included in a cross-sectional study. The results showed that exposed elderly people had a significantly higher prevalence of chronic respiratory symptoms and diseases than those who were unexposed.

In the past, daily particulate concentrations were in the range 100 to 1000µg/m^3 whereas in more recent times, daily concentrations are between 10 and 100µg/m^3. However, it has been found that overall, exposure-response can be described as curvilinear, with small absolute changes in exposure at the low end of the curve having similar effects on mortality to large absolute changes at the high end (WHO, 2000). Both short-term and long-term exposure to particulate matter in the air can have health impacts (Table 7-21).

Table 7-21: Short-term and long-term health effects associated with exposure to PM (WHO, 2004).

POLLUTANT	SHORT-TERM EXPOSURE	LONG-TERM EXPOSURE
Particulate matter	❖ Lung inflammatory reactions ❖ Respiratory symptoms ❖ Adverse effects on the cardiovascular system ❖ Increase in medication usage ❖ Increase in hospital admissions ❖ Increase in mortality	❖ Increase in lower respiratory symptoms ❖ Reduction in lung function in children ❖ Increase in chronic obstructive pulmonary disease ❖ Reduction in lung function in adults ❖ Reduction in life expectancy ❖ Reduction in lung function development

7.10.1.1 Short-term Exposure

There is good evidence that short-term exposure to particulate matter is associated with health effects (WHO, 2013). Health effects associated with short-term exposure to particulates include increases in lower respiratory symptoms, medication use and small reductions in lung function. Susceptible groups with pre-existing lung or heart disease, as well as elderly people and children, are particularly vulnerable. Exposure to particulate matter affects lung development in children, including reversible deficits in lung function as well as chronically reduced lung growth rate and a deficit in long-term lung function (WHO, 2011). There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur (WHO, 2013).

7.10.1.2 Long-term Exposure

Long-term exposure to low concentrations (~10µg/m^3) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO, 2000). Studies have indicated an association between lung function, chronic respiratory disease and airborne particles. Relative risk estimates suggest an 11% increase in cough and bronchitis rates for each 10µg/m^3 increase in annual average particulate concentrations (WHO, 2000). Based on studies conducted in the USA, Europe and Canada, mortality is estimated to increase by 0.2–0.6% per 10 µg/m^3 of PM_{10} (WHO, 2005; Samoli, et al., 2008). $PM_{2.5}$ is a higher risk factor than the coarse part of PM_{10} (particles in the 2.5–10 µm range), especially as a consequence of long-term exposure. Long-term exposure to $PM_{2.5}$ is associated with an increase in the long-term risk of cardiopulmonary mortality by 6–13% per 10 µg/m^3 of $PM_{2.5}$ (Beelen, et al., 2008; Krewski, et al., 2009; Pope III, et al., 2002).

7.10.2 Ambient Air Quality

The AIQA found that 2L24 TSF (or Site 1) falls just within the declared Vaal Triangle Airshed Priority Area (VTAPA) for Air Quality, while the other reclamation areas fall just to the north of this priority area. The Minister declared the VTAPA in April 2006 as the first National Priority Area (Government Notice No. 365, 2006; Government Notice No. 711, 2007) due to concern for elevated pollutant concentrations within the area, specifically particulates.

The draft second generation Air Quality Management Plan (AQMP) for the VTAPA found that exceedances of both the PM_{10} and $PM_{2.5}$ NAAQS were experienced over most of the VTAPA. This they attributed to mining, tailings facilities, industrial activities and heavy domestic fuel combustion (DEA, 2019). Particularly, the high concentrations in the northern areas of the VTAPA where the Soweto cluster is situated are attributed to TSFs both in and in close proximity to the border.

The AIQA found that there are several sectors that emit pollutants which affect the ambient air quality of the City of Johannesburg. These include biogenic VOC (Because Johannesburg has the world's largest urban forest, the emission of volatile organic compounds from this forest ecosystem are significant); biomass burning (The burning of organic matter in natural or manmade fires such as veld fires); aircraft emissions; household fuel combustion for cooking and heating; windblown dust from TSFs; industrial sources; on-road vehicles; and waste treatment.

Figure 7-43 shows the relative contribution of each of these sources to the overall load of criteria pollutants in the air. Household fuel burning and TSFs are the largest sources of particulate emissions in the city, followed by emissions from biomass burning, industries (not fully quantified in this emissions inventory due to lack of data) and a small amount from vehicles.

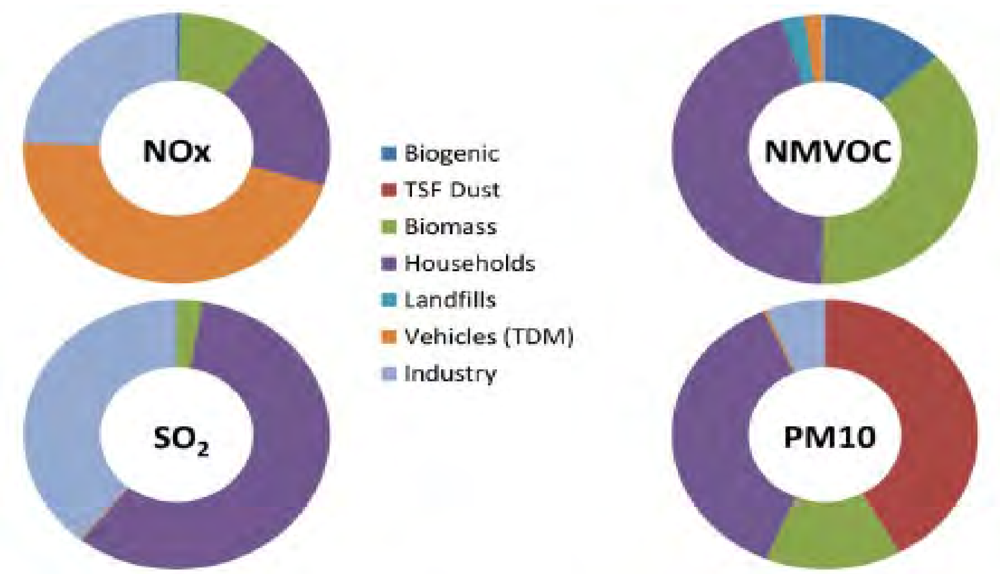


Figure 7-43: Summary of sector contribution to total annual criteria pollutant emissions within the City of Johannesburg (CSIR and Airshed Planning Professionals, 2017)

The closest air quality monitoring stations to the Soweto Cluster are the Mogale City, and Jabavu monitoring stations. The former is run by the West Rand District Municipality, while the latter is part of the City of Johannesburg network. The graph (compiled on the South African Air Quality Information System (SAAQIS) website) of the measured average daily PM_{10} ambient concentrations at these monitoring stations illustrates the high ambient concentrations of PM_{10} in the area, with several exceedances of the NAAQS

(Figure 7-44) which highlights and confirms the concern about air quality in this area. The more recent measurements at Jabavu indicate that although ambient concentrations are high, they have decreased since 2012.

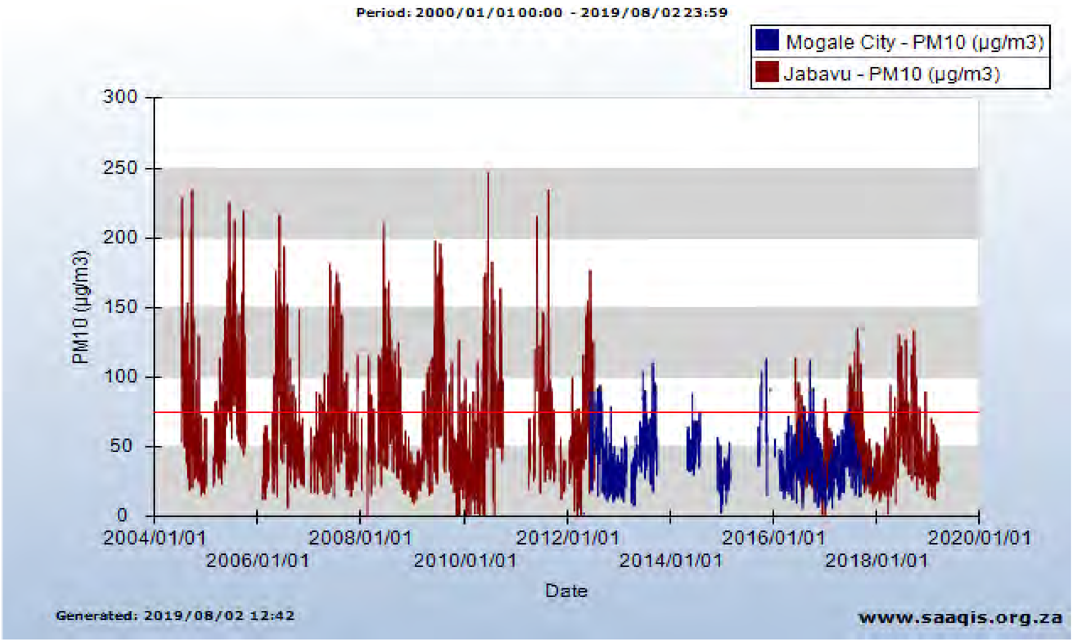


Figure 7-44: Daily average PM_{10} concentrations for Mogale City and Jabavu (SAAQIS, 2019).

There are also two dustfall monitoring stations in the vicinity of the Soweto Cluster. They are situated at Moroeroe L.P. School and Mrs Matswee House 1121 and are run by DRDGold. Both of these monitoring stations are situated near a TSF and gravel roads.

The graph (compiled on the SAAQIS website) of the measured average dustfall rates at these monitoring stations (Figure 7-45) illustrates that there are exceedances of the National Dustfall Standard of 600mg/m^2/day for residential areas, however, the exceedances do not occur in sequential months, and there are not more than two exceedances per year as permitted by the National Dust Control Regulations (Government Notice No. R827, 2013) (see Table 7 of the AIQA).

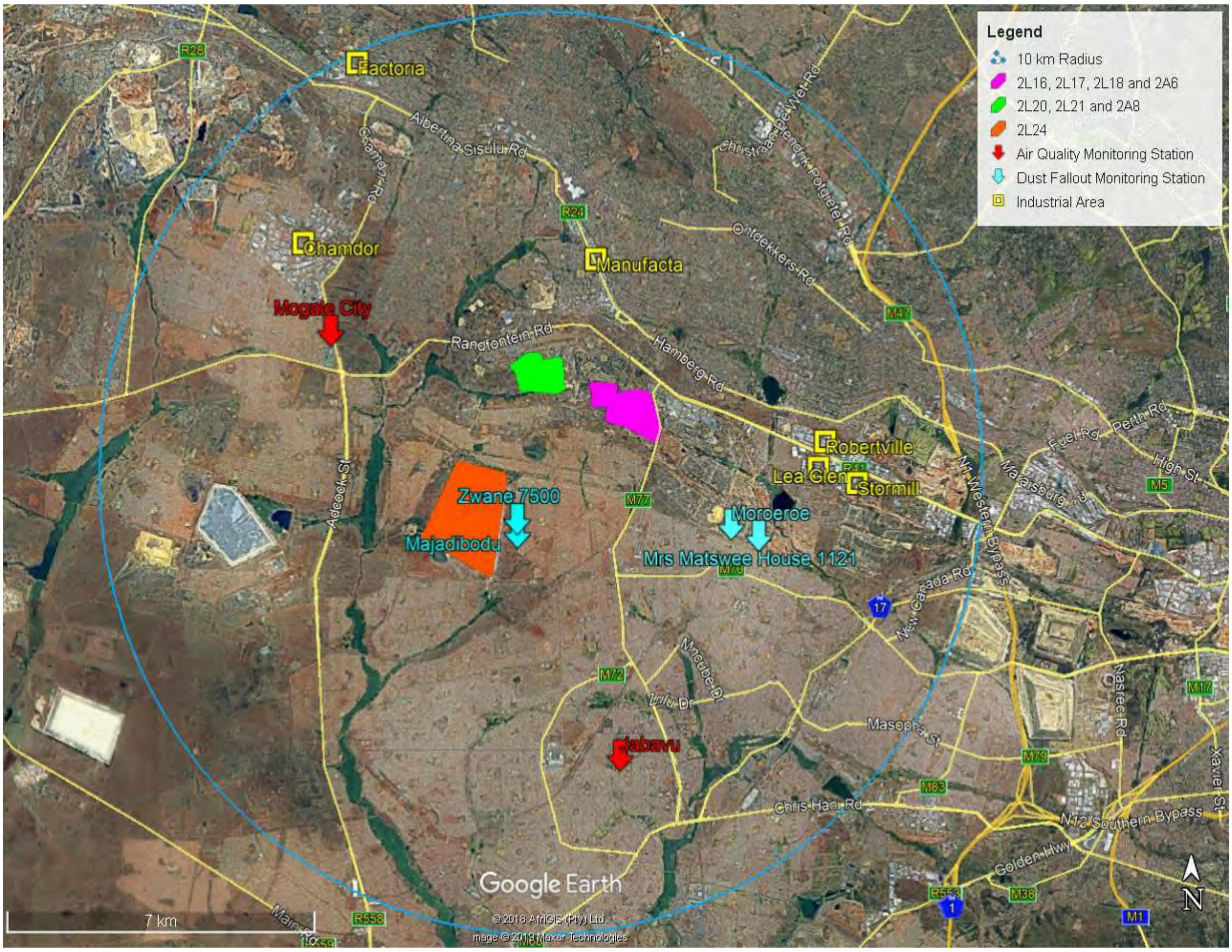


Figure 7-45: Industrial areas and monitoring stations in the vicinity of the Soweto Cluster

Although efforts have been made to plant vegetation on TSFs, they remain a significant source of airborne PM, therefore, the removal of TSFs will bring about a marked improvement to the air quality of these areas of the city.

7.10.3 Dispersion Modelling

Dispersion simulations were undertaken as part of the Air Quality Impact Assessment to determine ambient concentrations of $PM_{2.5}$ and PM_{10} resulting from activities related to the reclamation of the Soweto Cluster. Because of the distance between the TSFs, 2L24 (Site 1) was modelled separately from the northern TSFs (Site 2 and Site 3). For each area, a scenario illustrating current, undisturbed emissions or the 'status quo' scenario was modelled. The reclamation of the sand dumps was modelled with emissions emanating from the removal of sand at the work face and emissions from the transfer of the sand to the conveyors if this alternative is preferred. Two scenarios were modelled, one with the work face in the centre of each dump and one with the work face at the northern end of each dump.

For each of the TSFs, it was assumed that the lowest southern areas would be reclaimed first, after the sand dumps. A section along the south side of two TSFs was modelled, with the status quo emissions emanating from the remainder of the TSFs. A northern cut was also modelled, as these areas of the TSFs lie close to residential areas. These areas would represent the last areas to be reclaimed, and the remainder of the

TSFs and sand dumps were modelled with emission rates for bare 'red earth'. The last scenarios modelled illustrate conditions once the mining is complete and bare 'red earth' soil is exposed across the entire reclamation areas.

The position of the modelled cuts and roads is shown in Figure 7-46. The dispersion of particulate matter was modelled up to a distance of 3.5 km from the centre of each area.

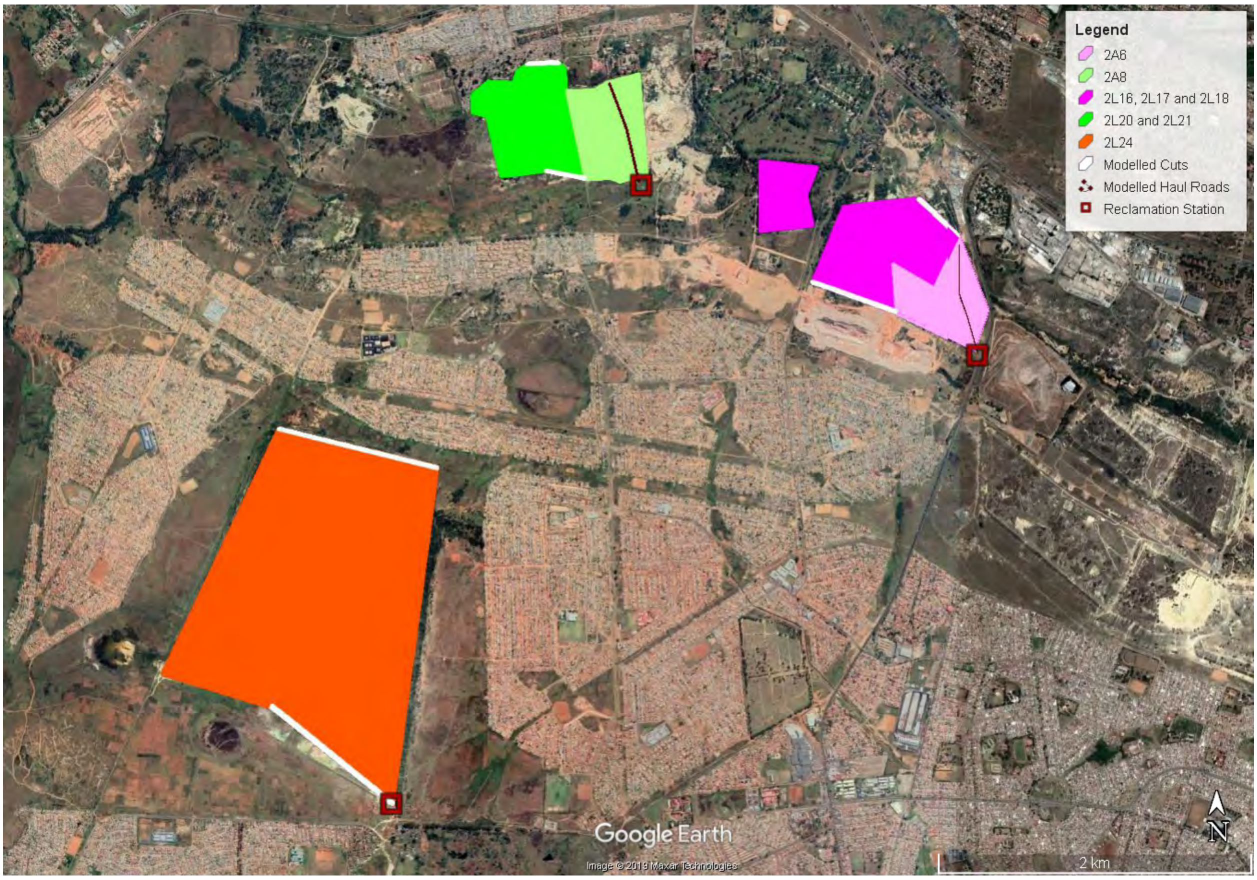


Figure 7-46: Position of the modelled cut areas.

The level of dustfall has been raised as a concern by Interested and Affected Parties. The AIQA concluded that the emissions from the TSFs and sand dumps in the current, undisturbed state are expected to be causing elevated ambient concentrations of both PM_{10} and $PM_{2.5}$ in downwind areas on windy days.

The report found that exceedances of the NAAQS may be expected up to 450 m from Site 2 (2L20/21, 2A6). This particularly affects the residents of Matholesville who reside within this area of impact. The size and lack of vegetation on 2L24 means that the area of impact surrounding this TSF is larger, with modelled exceedances of the NAAQS occurring over greater distances than for the northern cluster. The communities of Bram Fischerville to the north, Braamfischerville Township 14 to the west, Braamfischerville Phase 2 to the east and Thulani to the south are potentially affected if they are on the downwind side of the TSF on particularly windy days.

Lastly, the AIQA modelling indicates that the reclamation of the sand dumps may be expected to cause increased PM emissions with exceedances of the NAAQS extending over approximately 250 m from the work face and the reclamation stations on windy days. However, the areas of impact do not extend over any residential areas.

7.10.3.1 Status Quo Modelling

The AIQA concluded that the status quo at Site 1 (TSF 2L24) – given the lack of vegetation cover on the southern area – means that emissions from this TSF on windy days can be substantial. This is shown in the modelling results by the large area of exceedances of the PM_{10} annual average of 40µg/m^3. Exceedances of the $PM_{2.5}$ 24-hr standard of 40µg/m^3 may be experienced over almost the entire modelling domain of 3.5 km. Cognisance must be taken of the fact that the inadequacies of modelling emissions from TSFs (See the AIQA in Appendix D4 for more detail) may be amplified in this large a TSF with sparse vegetation.

It was also found that the modelled daily average concentrations of PM_{10} indicates that exceedances of the national 24-hr standard of 75µg/m^3 can be expected on windy days up to approximately 500 m to the north of the TSFs. Exceedances for modelled daily average concentrations of $PM_{2.5}$ indicated that exceedances of the national 24-hr standard of 40µg/m^3 can be expected on windy days up to approximately 280 m to the north of the TSFs. The modelling also indicates that annual average concentrations of both PM_{10} and $PM_{2.5}$ may be expected to exceed the national standards of 40µg/m^3 and 20µg/m^3 respectively in areas up to 200 m from the TSFs.

7.10.3.2 Evaluation of the Status Quo Modelling Results

7.10.3.2.1 Northern Soweto Cluster

- The modelled daily average concentrations of PM_{10} indicate that exceedances of the national 24-hr standard of 75µg/m^3 can be expected on windy days up to approximately 500 m to the north of the TSFs. This includes parts of the residential areas of Matholesville.
- The modelled daily average concentrations of $PM_{2.5}$ indicate that exceedances of the national 24-hr standard of 40µg/m^3 can be expected on windy days up to approximately 280 m to the north of the TSFs. This includes parts of the residential areas of Matholesville.
- The modelling also indicates that annual average concentrations of both PM_{10} and $PM_{2.5}$ may be expected to exceed the national standards of 40µg/m^3 and 20µg/m^3 respectively in areas up to 200 m from the TSFs.

7.10.3.2.2 Southern Soweto Cluster (2L24)

- The large size of 2L24 and the lack of vegetation cover on the southern areas means that the status quo emissions from this TSF on windy days can be substantial. This is shown in the modelling results by the large area of exceedances of the PM_{10} annual average of 40µg/m^3.
- Exceedances of the $PM_{2.5}$ 24-hr standard of 40µg/m^3 may be experienced over almost the entire modelling domain of 3.5 km. However, cognisance must be taken of the fact that the inadequacies of modelling emissions from TSFs (See section 5.5) may be amplified in this large a TSF with sparse vegetation.

7.10.3.3 Sand Dumps Modelling Results

7.10.3.3.1 Northern Soweto Cluster

- The modelling results of the reclamation of the sand dumps indicates that localised increases in ambient concentrations can be expected around the work face and around the area of transfer to the conveyors.
- Schools are sensitive receptors in terms of air quality, therefore the impact on the school to the north of 2A8 is of particular concern. The modelling indicates that the NAAQS are not expected to be exceeded over the school during both the reclamation of the central and the northern areas of the sand dumps.
- The modelling indicates that only a small section of the industrial area to the east of 2A6 may experience exceedances of the NAAQS during reclamation of the closest parts of the sand dump.
- However, the results of the modelling are based on a throughput of 1 300 t of sand per day from each dump. In order to prevent exceedances of the 24-hr NAAQS at the school and also to prevent an increase in the extent of the industrial area that may experience exceedances, increases in throughput above 1 300 t per day should be mitigated by: either chemical stabilisation / wet suppression of all on-site haul roads; or using conveyor belts to move the sand from within 500 m of the work face all the way to the reclamation station; or screening the sand, wetting it as it is tipped into a hopper, and from there piping the slurry down to the reclamation station. And, if the dust monitoring indicates that there are exceedances caused by the reclamation process, dust suppression with water sprays at all transfer points should be implemented to further mitigate emissions.

7.10.3.4 Evaluation of the South Cut Modelling Results

7.10.3.4.1 Northern Soweto Cluster

- The south cuts of the slimes dams are the areas where the largest effects of the reclamation process may be expected. This is because all of the status quo emissions to the north of the cut continue, with the added increase in emissions resulting from the stripping of vegetation in a 15-metre wide band for reclamation. The modelling results indicate that an increased area of up to 70 m further than the status quo area can expect to experience exceedances of the national standards. However, this is over open ground in the case of the northern cluster.

7.10.3.4.2 Southern Soweto Cluster (2L24)

- The modelling results indicate that clearing areas of 2L24 for reclamation will initially cause an increase in emissions. The largest increase in emissions is a result of clearing the ground in preparation for reclamation, therefore, the most effective mitigation is to keep the cleared area as small as possible. However, the emissions will decrease as the project progresses and as more of the southern section of 2L24, which is already sparsely vegetated, is removed. Therefore, speeding up the reclamation of this TSF by clearing bands of up to 30 m wide at a time would be beneficial in the long term.

7.10.3.5 Evaluation of the North Cut Modelling Results

7.10.3.5.1 Northern Soweto Cluster

- The northern sections of the slimes dams are the last areas to be reclaimed. Consequently, all the preceding reclamation areas should have been cleared to bare 'red earth' with no remnants of tailings material. The expected reduction in emissions is evident from the modelling results. Only small areas adjacent to the work faces may still experience exceedances of the NAAQS for PM_{10} and $PM_{2.5}$. Curtailing the cleared section for reclamation to an area of approximately 15 m by 200 m will keep the area of exceedances to a minimum.

7.10.3.5.2 Southern Soweto Cluster (2L24)

- The modelling results of the reclamation of the north cut of 2L24 also indicate the favourable outcome of clearing the TSF to bare 'red earth' in the long run. Exceedances of the NAAQS for PM_{10} and $PM_{2.5}$ are restricted to a narrow band to the north of the TSF.

7.10.3.6 Modelling Post Mining

The AIQA stated that once all mining is complete, and all tailings material has been removed, leaving bare 'red earth', the predicted worst-case maximum daily average concentrations do not approach the NAAQS for PM_{10} and $PM_{2.5}$. The surrounding areas, should notice a marked decrease in ambient concentrations of PM_{10} and $PM_{2.5}$ on windy days.

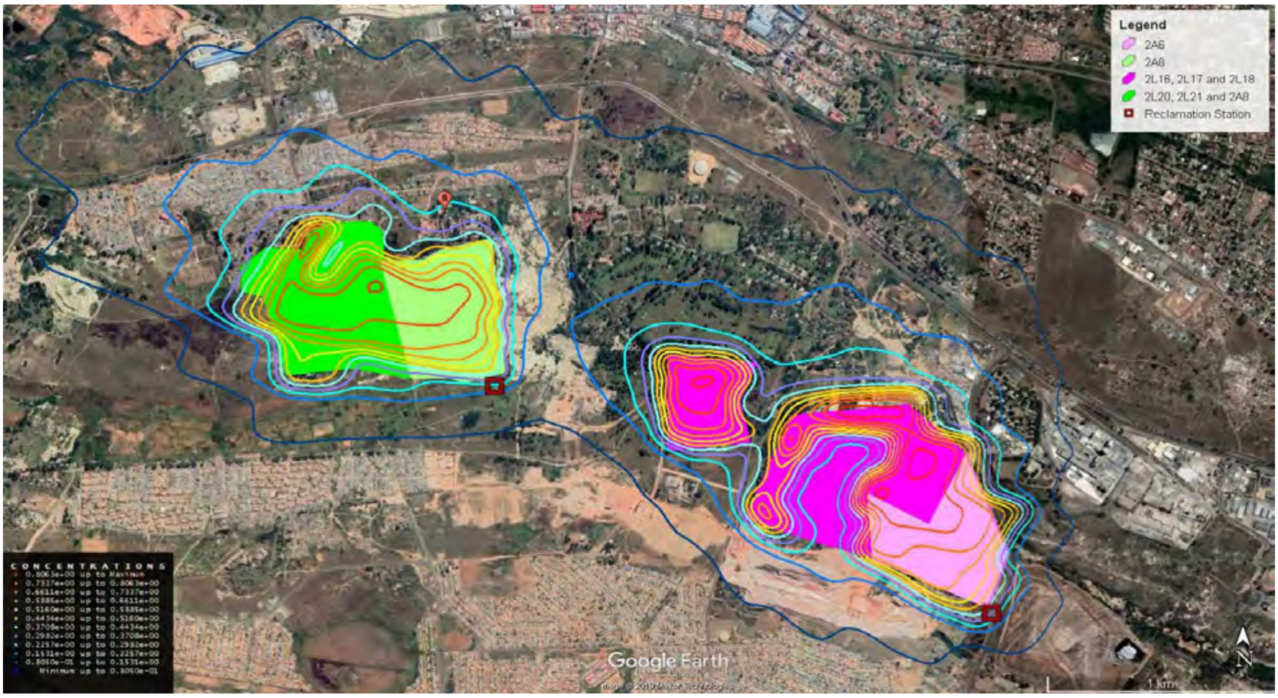


Figure 7-47: Modelled prediction of the highest 24-hour average PM10 concentrations resulting from the northern Soweto Cluster area after reclamation is completed.

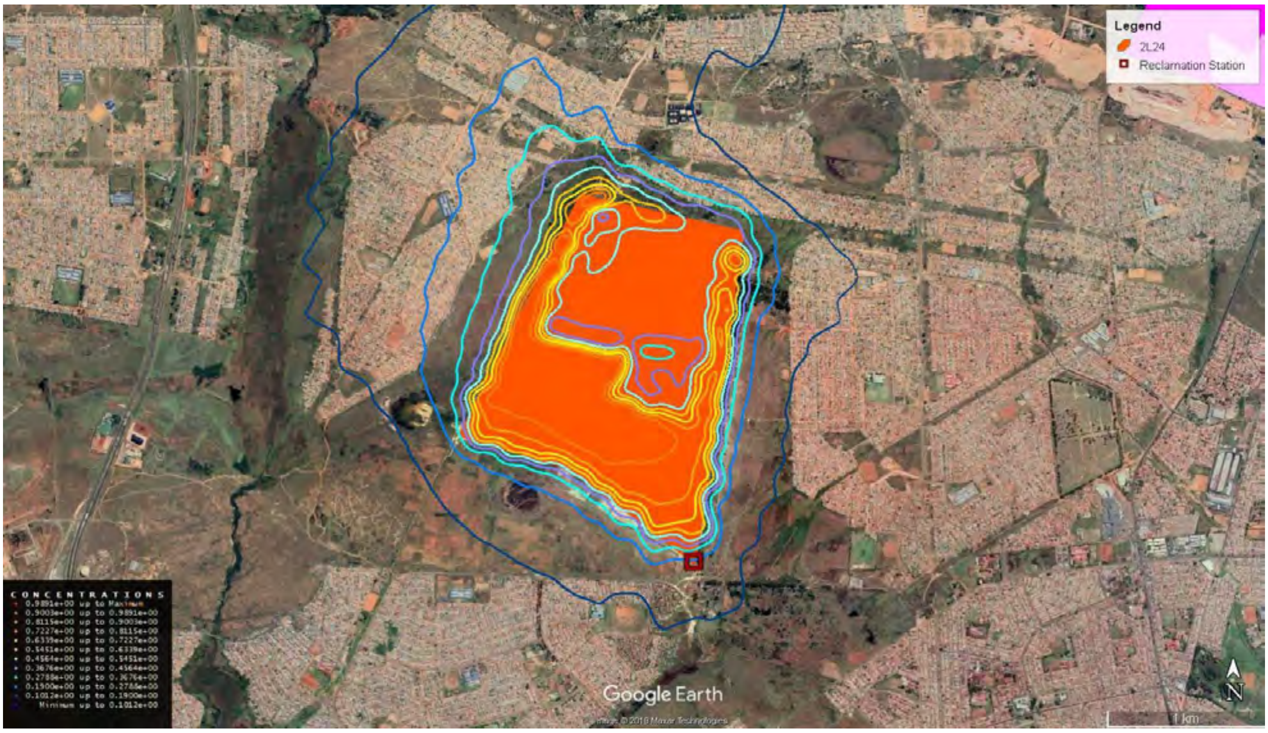


Figure 7-48: Modelled prediction of the highest 24-hour average PM10 concentrations resulting from the northern Soweto Cluster area after reclamation is completed.

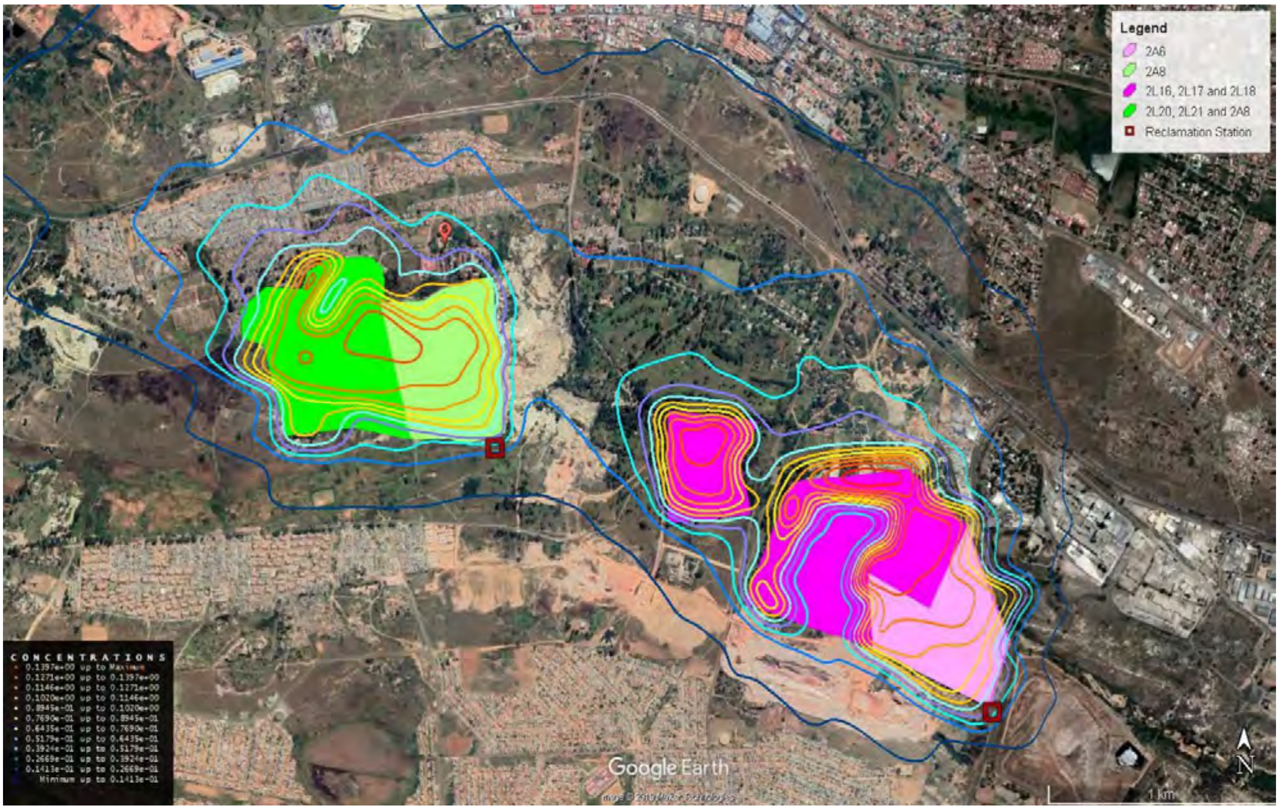


Figure 7-49: Modelled prediction of the highest 24-hour average PM2.5 concentrations resulting from the northern Soweto Cluster area after reclamation is completed

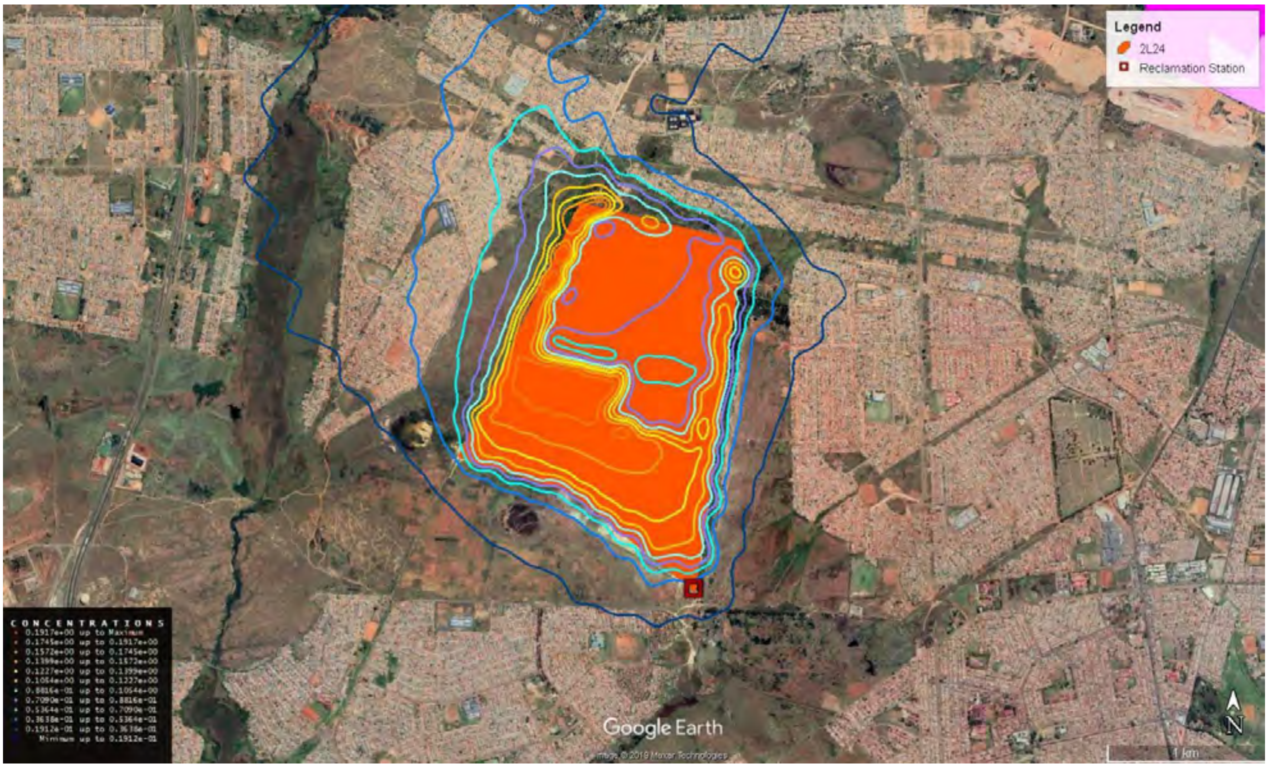


Figure 7-50: Modelled prediction of the highest 24-hour average PM2.5 concentrations resulting from the northern Soweto Cluster area after reclamation is completed

7.11 Noise

Refer to Appendix D5 for the Environmental Noise Impact Assessment (ENIA)

The ENIA calculated the potential noise rating levels were using a sound propagation model. Conceptual scenarios were developed for the construction and operational phase with the output of the modelling exercise indicating:

- a low risk of a noise impact for construction activities that are further than 200m from a Noise-sensitive Development (NSD);
- a medium risk of a noise impact for construction activities that are closer than 200m from NSD;
- a low risk for day-time operational activities (subject to the implementation of mitigation measures recommended for construction phase); and
- a potential high risk for night-time operational activities.

Though Crown Gold indicated that activities will only take place during the day, this assessment also considered potential night-time reclamation activities (potential worst- case scenario). Mitigation is recommended for potential night-time activities. The Soweto Cluster is located within a dense urban district and noise rating levels will be assumed as typical for an "Urban Noise District" (55 and 45 dBA day/night-time Rating in terms of SANS 10103:2008.

7.11.1 Potential Noise-sensitive Receptors (Developments) and no-go areas

Potentially sensitive receptors, also known as noise-sensitive developments (NSDs), located within or close to potential construction or operational activities were identified using Google Earth®. The closest potential NSDs (within approximately 200m from the closest proposed activities) are illustrated in Figure 7-51.

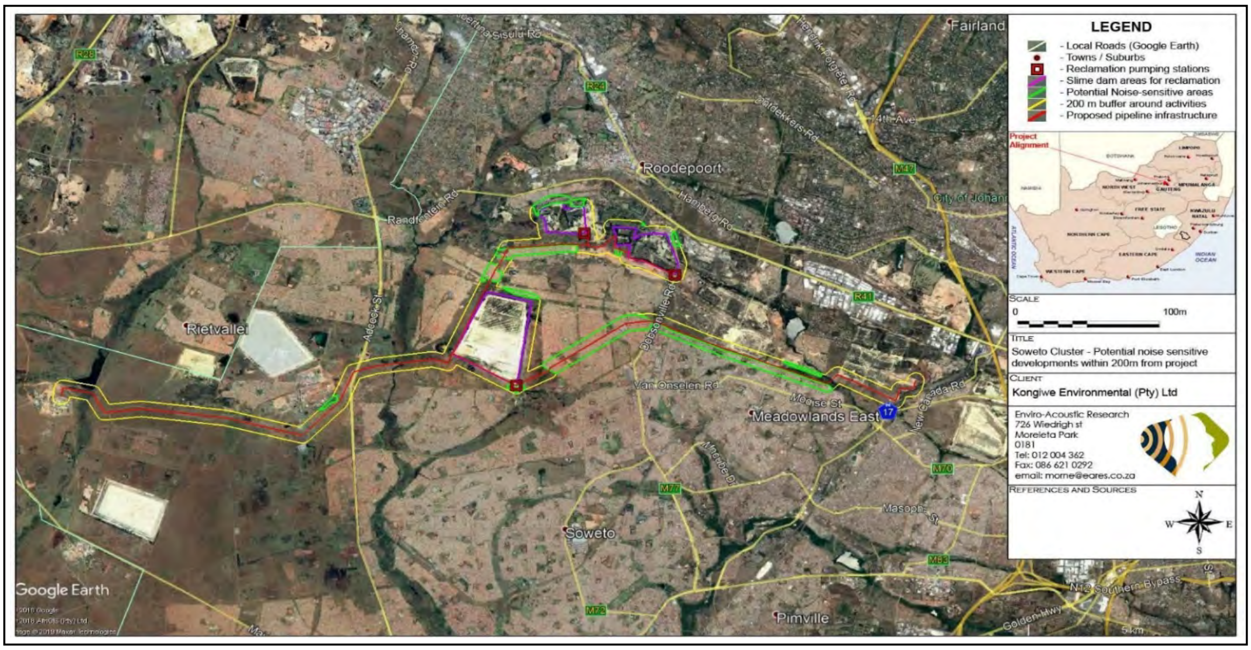


Figure 7-51: Aerial image indicating potentially noise-sensitive receptors close to proposed project area.

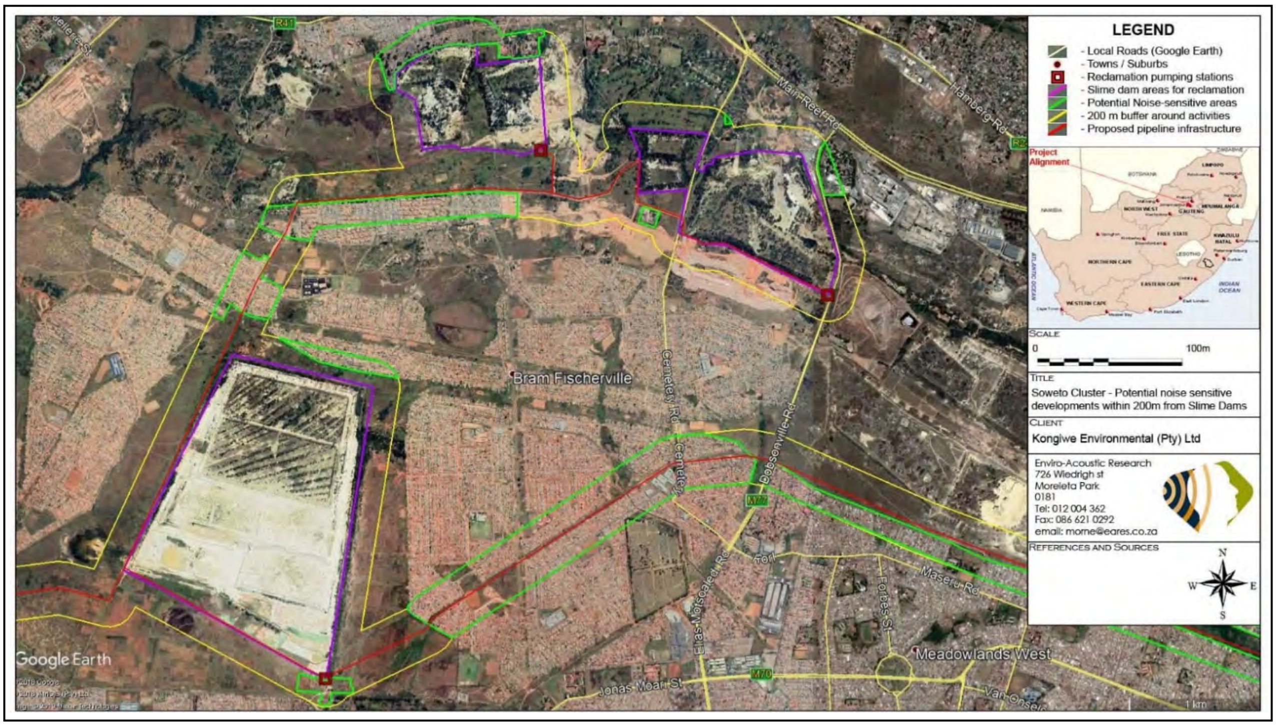


Figure 7-52: Aerial image indicating potentially noise-sensitive receptors close to proposed project area.

7.11.2 Potential Noise Sources

7.11.2.1 Construction Noises

The level and character of the construction noise will be highly variable as different activities with different equipment take place at different times, for different periods of time (operating cycles), in different combinations/sequences and on different parts of the construction site.

The potential extent and impact of construction noises depends on a number of factors, including the prevailing ambient sound levels during the time in which the maximum noise event occurred, as well as the spectral character of the noise and the ambient surroundings.

Maximum noise generated can be audible over a large distance. However, it is generally of very short duration. If maximum noise levels however exceed 65 dBA at a receptor, or if it is clearly audible with a significant number of instances where the noise level exceeds the prevailing ambient sound level with more than 15 dBA the noise can increase annoyance levels and may ultimately result in noise complaints. Potential maximum noise levels generated by various types of construction equipment as well as the potential extent of these sounds are presented in Table 7-22.

The following are likely the main construction related sources:

- Transport of workers, components & equipment to site – brought to site by means of flatbed trucks;
- Digging of foundations for infrastructure – TLB;
- Development of storm water infrastructure – TLB;
- Civil work to install the substation / transformer, screens, tanks and pump station – cement truck, flatbed trucks (with mobile crane);
- Civil construction activities.

7.11.2.2 Operational Noises

Hydraulic reclamation involves the use of high pressure water monitors (water cannons) to break up the material and turn it into slurry as it mixes with the runoff water. The slurry will be screened to remove vegetation and other material with the underflow directed to a penstock, feeding the pump station where the slurry will be delivered to a tank farm via a slurry pipeline.

Sand material will be loaded using Front End Loaders (FEL) to load the sand from the dump onto a small conveyor belt. The conveyor belt then feeds the sand over a screen, to remove oversize material while water is sprayed to turn the sand into a slurry. This slurry is pumped via new and existing pipelines to one of the three alternative processing plants where it is prepared and treated for gold extraction and beneficiation.

The level and character of the noise during this phase is generally constant as it does not involve mobile equipment movement around the site. Potential maximum noise levels generated by various mining equipment as well as the potential extent of these sounds are presented in Table 7-22 with Table 7-23 the typical sound power levels associated with various activities (or equipment).

Table 7-22: Potential maximum noise levels generated by construction equipment

EQUIPMENT DESCRIPTION[1]	IMPACT DEVICE?	MAXIMUM SOUND POWER LEVELS (DBA)	OPERATIONAL NOISE LEVEL AT GIVEN DISTANCE CONSIDERING POTENTIAL MAXIMUM NOISE LEVELS (CUMULATIVE AS WELL AS THE MITIGATORY EFFECT OF POTENTIAL BARRIERS OR OTHER MITIGATION NOT INCLUDED – SIMPLE NOISE PROPAGATION MODELLING ONLY CONSIDERING DISTANCE) (DBA)											
			5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
Compressor (air)	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Concrete Batch Plant	No	117.7	92.7	86.7	80.6	72.7	66.7	63.1	60.6	57.1	52.7	49.2	46.7	40.6
Concrete Mixer Truck	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6
Drum Mixer	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Dump Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Front End Loader	No	114.7	89.7	83.7	77.6	69.7	63.7	60.1	57.6	54.1	49.7	46.2	43.7	37.6
Flat Bed Truck	No	118.7	93.7	87.7	81.6	73.7	67.7	64.1	61.6	58.1	53.7	50.2	47.7	41.6
Generator	No	116.7	91.7	85.7	79.6	71.7	65.7	62.1	59.6	56.1	51.7	48.2	45.7	39.6
Grader	No	119.7	94.7	88.7	82.6	74.7	68.7	65.1	62.6	59.1	54.7	51.2	48.7	42.6

Table 7-23: Potential equivalent noise levels generated by various equipment

EQUIPMENT DESCRIPTION	EQUIVALENT (AVERAGE) SOUND LEVELS (DBA)	OPERATIONAL NOISE LEVEL AT GIVEN DISTANCE CONSIDERING EQUIVALENT (AVERAGE) SOUND POWER EMISSION LEVELS (CUMULATIVE AS WELL AS THE MITIGATORY EFFECT OF POTENTIAL BARRIERS OR OTHER MITIGATION NOT INCLUDED – SIMPLE NOISE PROPAGATION MODELLING ONLY CONSIDERING DISTANCE) (DBA)											
		5 m	10 m	20 m	50 m	100 m	150 m	200 m	300 m	500 m	750 m	1000 m	2000 m
General noise	108.8	83.8	77.8	71.8	63.8	57.8	54.2	51.8	48.2	43.8	40.3	37.8	31.8
JBL TLB	108.8	83.8	77.8	71.8	63.8	57.8	54.3	51.8	48.3	43.8	40.3	37.8	31.8
Slurry pump	109.0	84.0	78.0	72.0	64.0	58.0	54.5	52.0	48.5	44.0	40.5	38.0	32.0
Vibrating screens	109.1	84.2	78.1	72.1	64.2	58.1	54.6	52.1	48.6	44.2	40.6	38.1	32.1
Water Dozer, CAT	113.8	88.8	82.8	76.8	68.8	62.8	59.3	56.8	53.3	48.8	45.3	42.8	36.8

7.11.2.3 Decommissioning Phase

The Decommissioning Phase will include:

- Decommissioning and reinstatement of the reclamation area:
- Removal of other infrastructure no longer required (temporary buildings).
- The reinstatement of disturbed areas including the necessary ripping of compacted soils and the shaping of rehabilitated areas to ensure free drainage.
- The preparation of land to Red-Earth in preparation for future development.
- Monitoring and maintenance of the rehabilitated areas.

While there are numerous activities that may be taking place during the decommissioning stage, the potential noise impact has been assessed in general. This is because the noise impacts associated with the decommissioning phase is normally less than both the construction and operational phases for the following reasons:

- Final decommissioning normally takes place only during the day, a time period when existing ambient sound levels are higher, generally masking most external noises for surrounding receptors;
- There is a lower urgency of completing this phase and less equipment remains onsite (and are used simultaneously) to effect the final decommissioning.

7.11.3 Noise Modelling

Noise contours are illustrated from 45 and 65 dBA upwards. This may represent the potential audibility of the project activities. Three different colours are used to illustrate the potential noise impact, namely:

- Green: Zone where the noises due to reclamation activities may change ambient sound levels sufficiently for surrounding receptors to detect this change. This change in ambient sound levels may be measurable and audible;
- Yellow: Zone where reclamation activities may be clearly audible and potentially disturbing during quiet periods. Receptors may start to complain about noises. The noise-generating activities will change the ambient sound levels and this change can be measured;
- Red: Noise level exceed the permissible noise limit adopted in this report. Noises will be clearly audible and the noise level can be considered disturbing.
- For the zone outside the green area: noises from the reclamation activity are unlikely to change the ambient sound levels even though the reclamation activities may be audible at times.

7.11.3.1 Construction Phase

Two conceptual noise models were developed considering the activities, namely:

- Construction of the proposed reclamation infrastructure; and
- Temporary noises associated with maintenance and repair of the pipeline (arbitrary location).

Crown Gold confirmed that construction activities will only take place during the day. It is assumed that construction equipment would be operating under full load (generate the most noise) and that atmospheric conditions would be ideal for sound propagation. This is likely the worst case scenario that can occur during the construction phase of the project. Noise rating level contours are illustrated in:

- Figure 7-53 Figure 7-53(daytime) – Construction of plant infrastructure at Dump 2L20/21 and 2A8;
- Figure 7-54 (daytime) – Construction of plant infrastructure at Dump 2L17/18, 2L16 and 2A8;
- Figure 7-55 (daytime) – Construction of plant infrastructure at Dump 2L24;

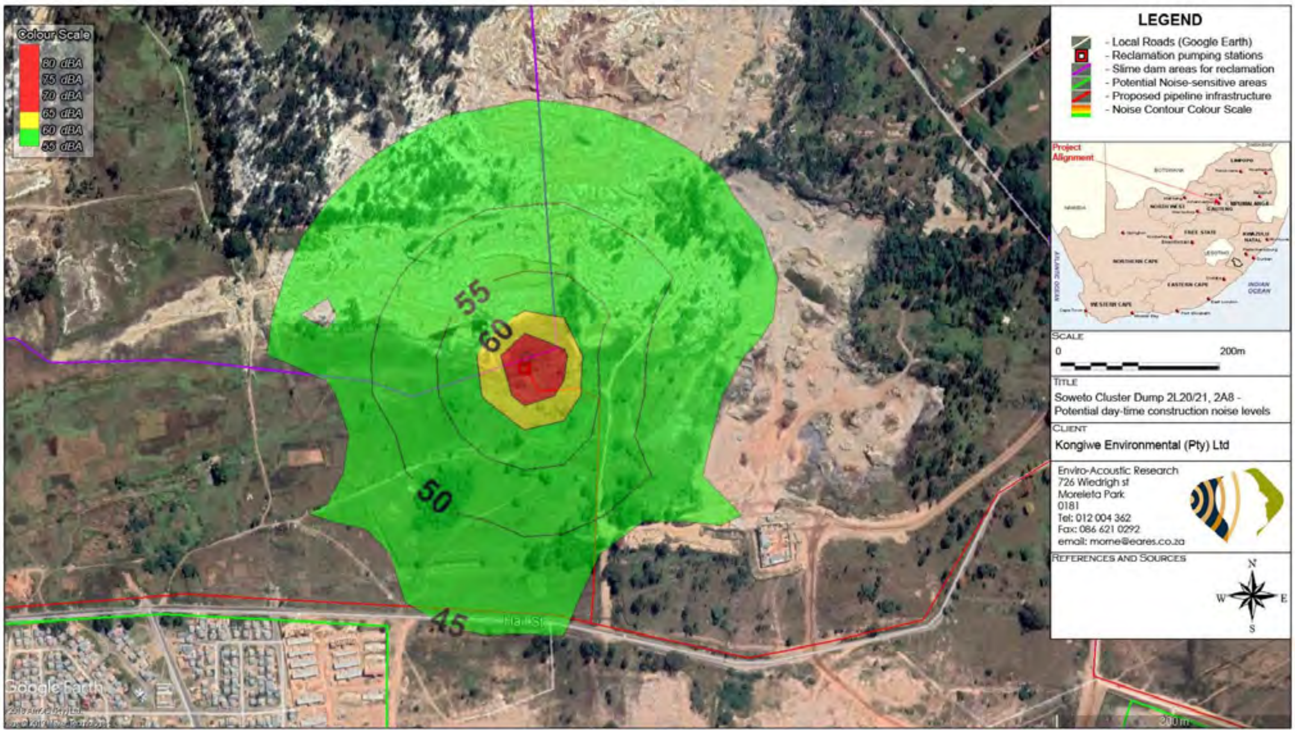


Figure 7-53: Projected conceptual daytime construction noise levels – Pump station infrastructure at Dump 2L20/21, 2A8

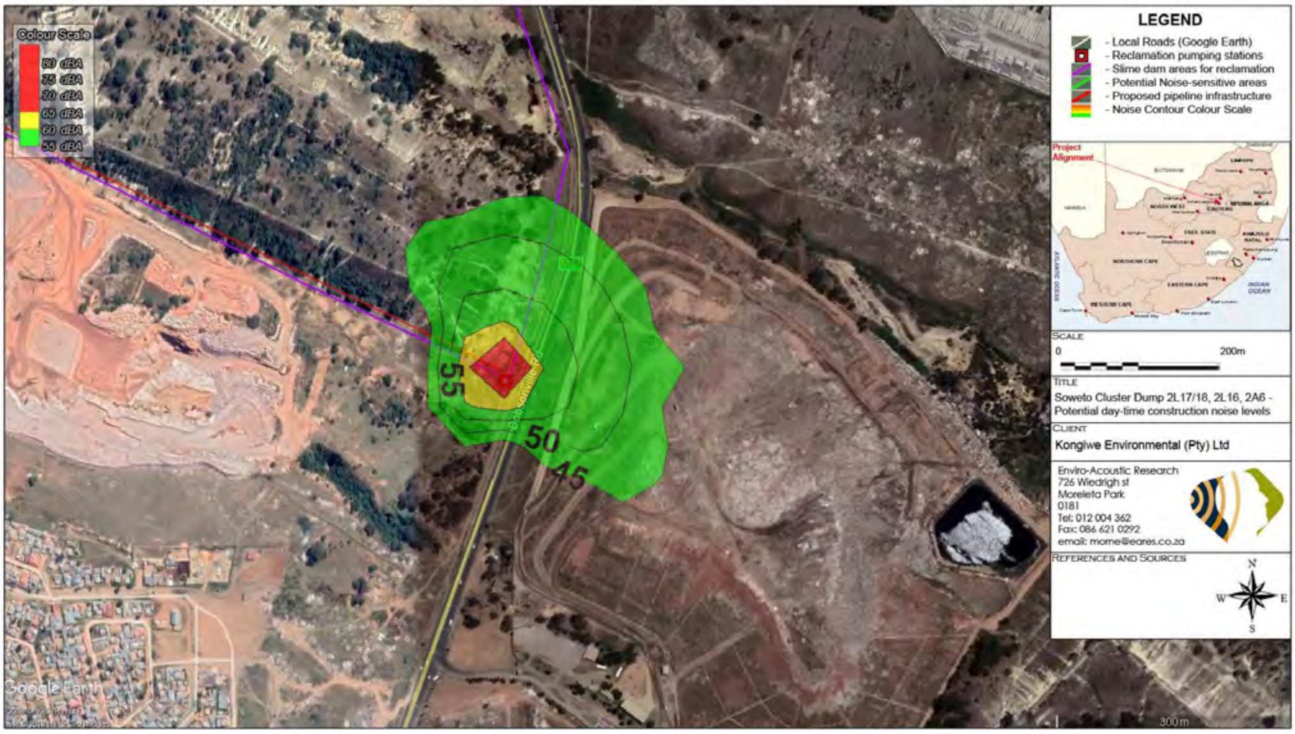


Figure 7-54: Projected conceptual daytime construction noise levels – Pump station infrastructure at Dump 2L17/18, 2L16, 2A6

Figure 7-55: Projected conceptual daytime construction noise levels – Pump station infrastructure at Dump 2L24

7.11.3.2 Operational Phase

A conceptual noise model was developed considering potential noises due to the operation of the slurry pumps, vibration screens, a water cannon and front-end loader loading sand.

This assessment considers both day- and night-time activities. This is likely the worst case scenario that can occur during the operational phase of the project. Noise rating level contours are illustrated in:

- Figure 7-56 (daytime) – Reclamation activities at Dump 2L20/21 and 2A8;
- Figure 7-57 (daytime) – Reclamation activities at Dump 2L17/18, 2L16 and 2A8;
- Figure 7-58 (daytime) – Reclamation activities at Dump 2L24;
- Figure 7-59 (night-time) – Reclamation activities at Dump 2L20/21 and 2A8;
- Figure 7-60 (night-time) – Reclamation activities at Dump 2L17/18, 2L16 and 2A8;
- Figure 7-61 (night-time) – Reclamation activities at Dump 2L24;

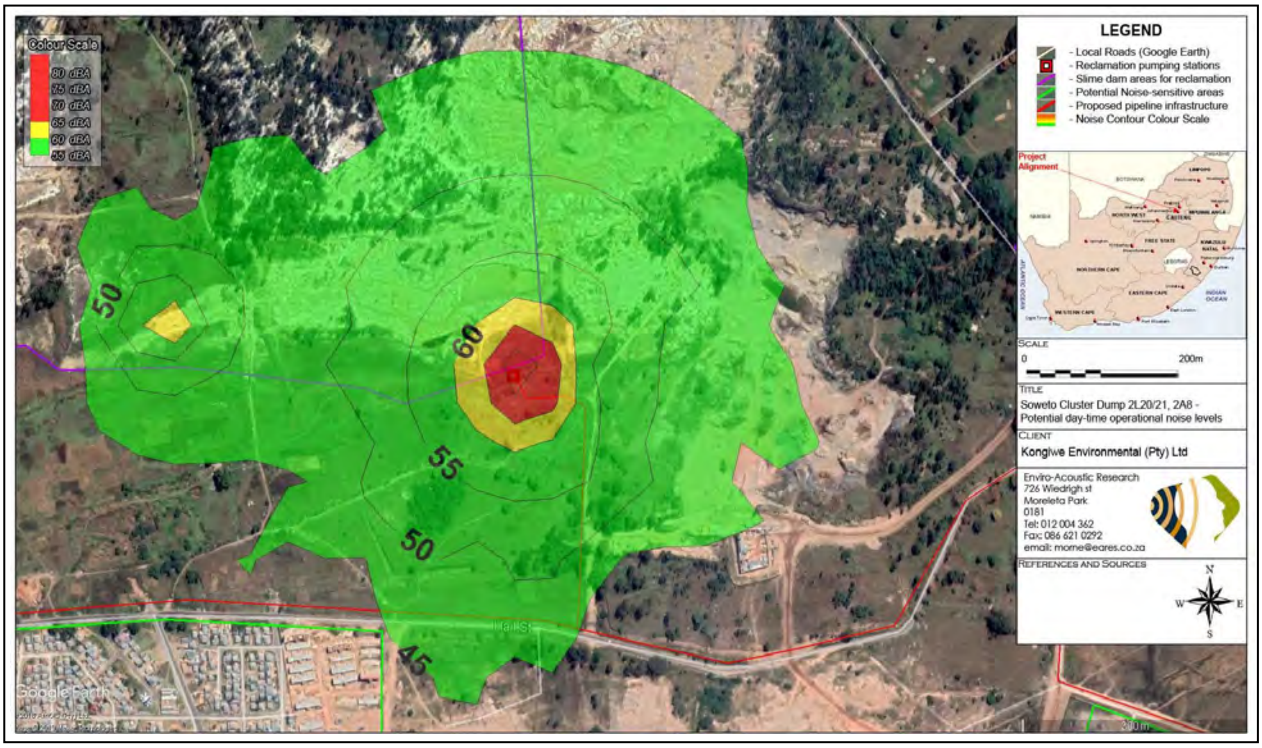


Figure 7-56: Projected conceptual daytime operational noise rating levels – Reclamation at Dump 2L20/21, 2A8

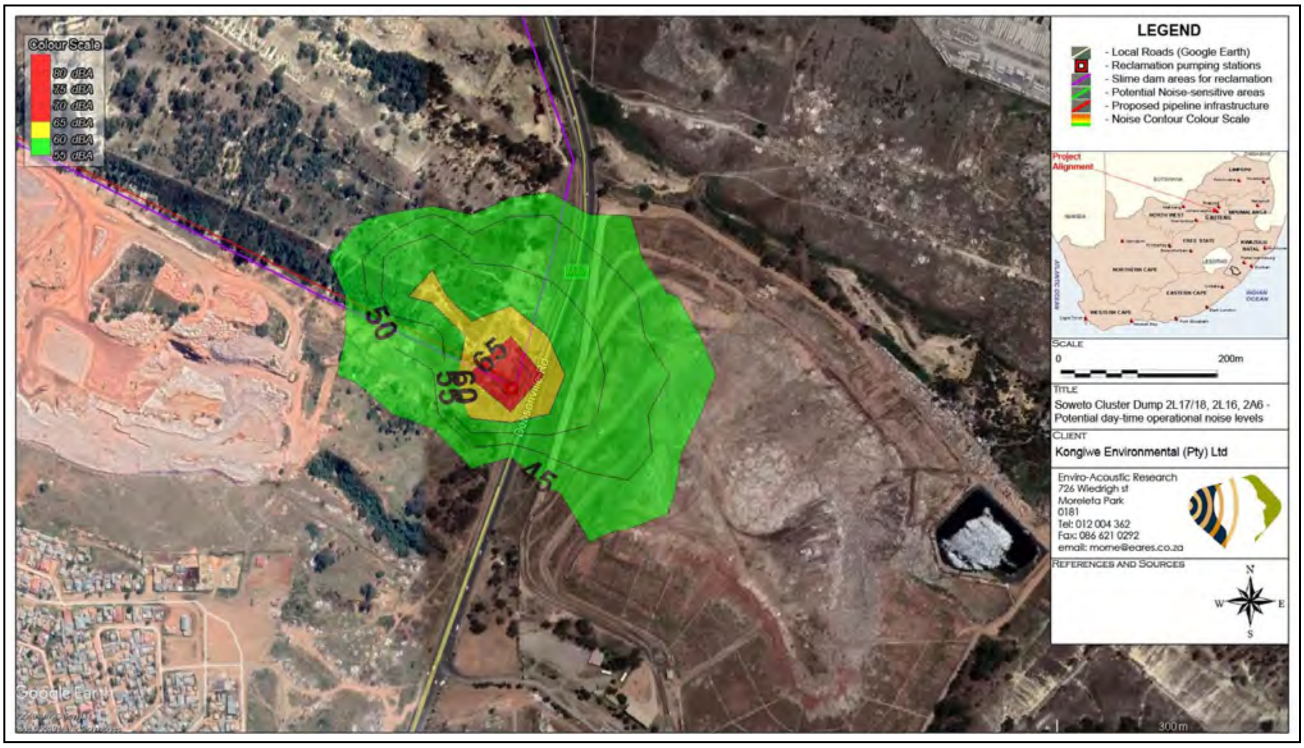


Figure 7-57: Projected conceptual daytime operational noise rating levels – Reclamation at Dump 2L17/18, 2L16 and 2A6

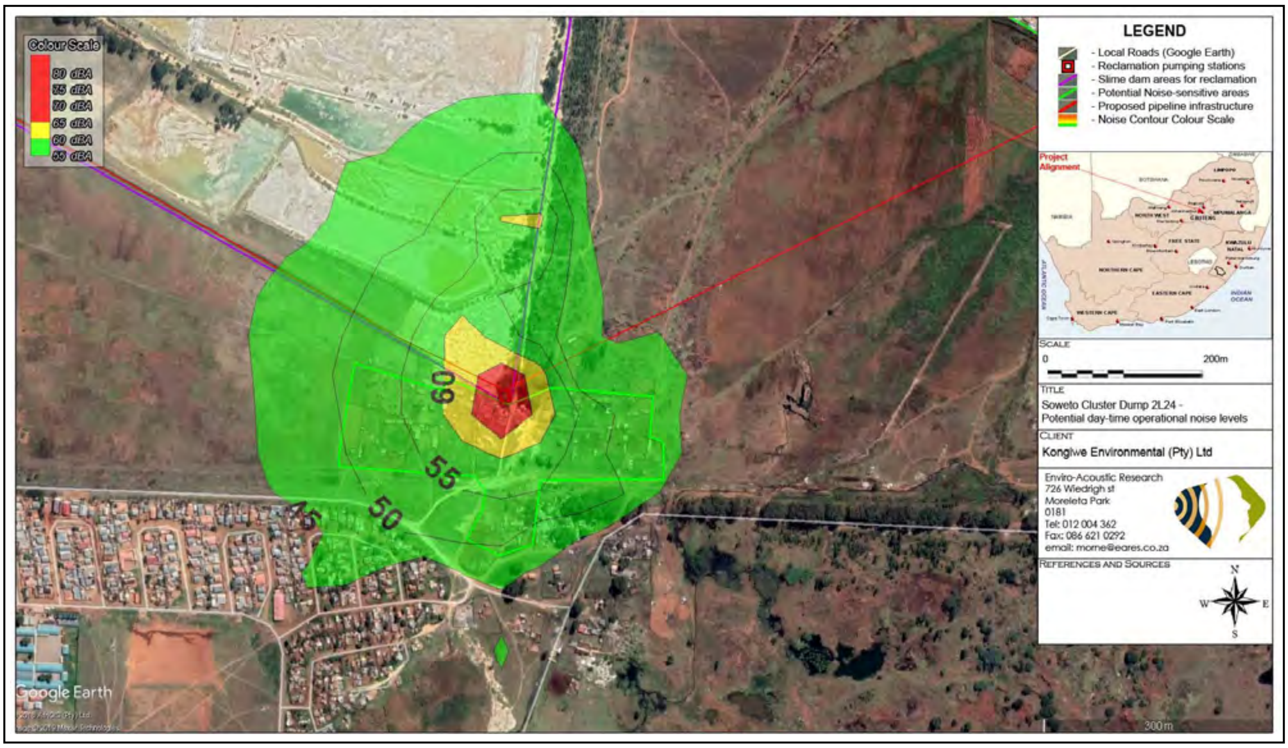


Figure 7-58: Projected conceptual daytime operational noise rating levels – Reclamation at Dump 2L24

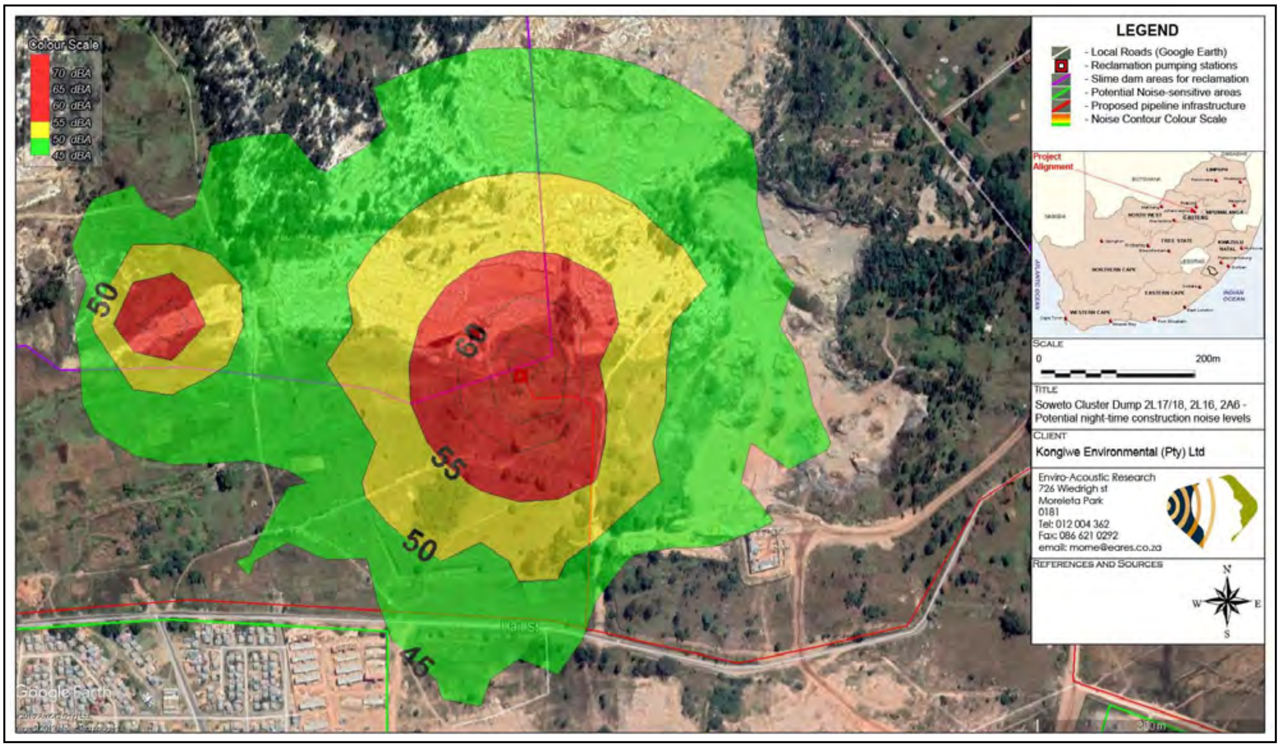


Figure 7-59: Projected conceptual night-time operational noise rating levels – Reclamation at Dump 2L20/21, 2A8

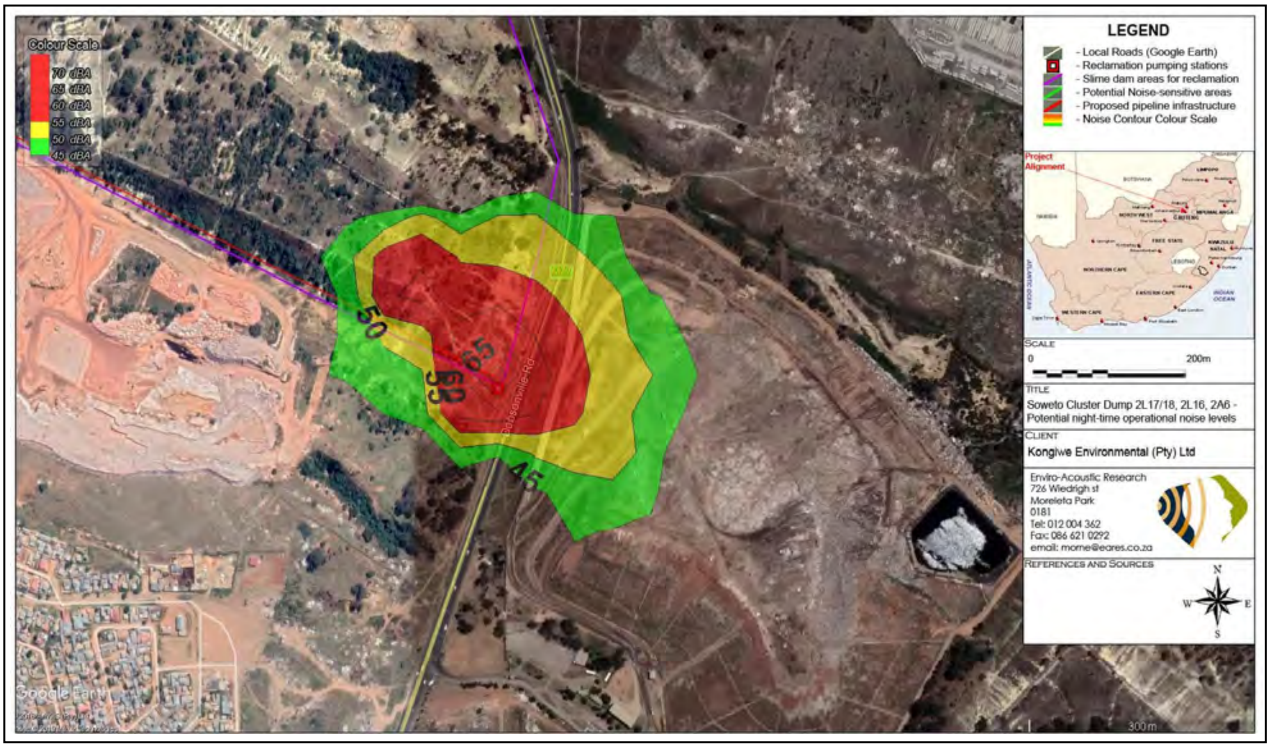


Figure 7-60: Projected conceptual night-time operational noise rating levels – Reclamation at Dump 2L17/18, 2L16 and 2A6

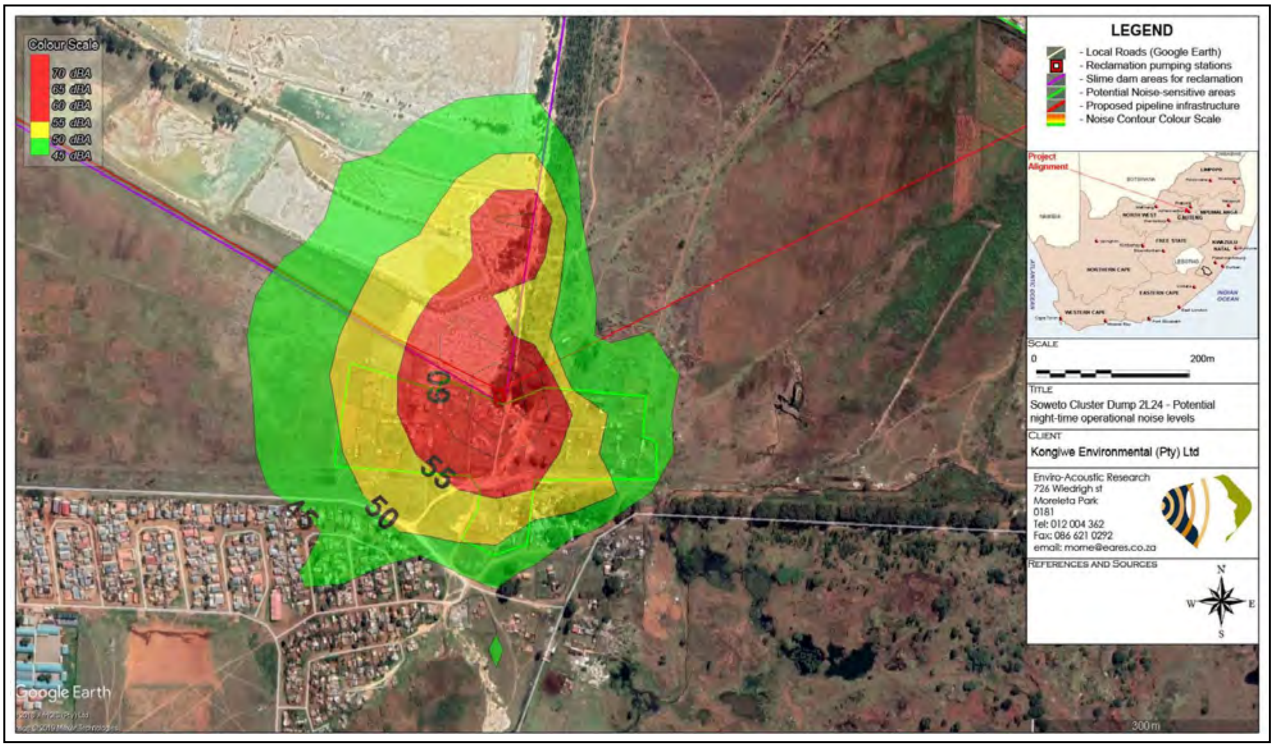


Figure 7-61: Projected conceptual night-time operational noise rating levels – Reclamation at Dump 2L24

7.11.3.3 Decommissioning and Closure Phase

The potential for a noise impact to occur during the decommissioning and closure phase will be much lower than that of the construction and operation phases and noise from the decommissioning and closure phases will not be investigated further.

7.12 Heritage and Palaeontology

Refer to Appendix D6 for the Heritage Impact Assessment (HIA)

The greater Roodepoort region has been affected by historical mining activities since the farms Vogelstruisfontein, Roodepoort, Langlaagte and the two portions comprising Paardekraal (in Krugersdorp) were proclaimed as public diggings by the then Zuid-Afrikaansche Republiek (ZAR) government in 1886. As a result, most of the Proposed Project footprint overlays highly disturbed terrain.

The archival and historical research has revealed that the entire area of the original farms now forming Roodepoort 236IQ & 237IQ, and Vlakfontein 238IQ, on which the historical slimes dams and sand dumps are situated, has been affected on a continual basis by historical mining activities, since c.1886/87 and was associated with several historical gold mine companies, the major one being Durban Roodepoort Deep. These mining activities have continued to the present day, both formally and informally (illegal). The ground affected by the proposed environmental authorisation application is therefore extremely disturbed. There is also high potential for the existence of heritage sites associated with the historical mining activities (e.g. historical mining structures, historical residential structures, and historical graves and burial grounds).

7.12.1 Heritage Resources

A controlled surface survey was conducted on foot and by vehicle over a period of one day by one heritage specialist from PGS, together with the traffic engineer and accompanied by a security officer. The fieldwork was conducted on the 21 August 2019. The track logs (in blue) for the survey are indicated in Figure 7-71.

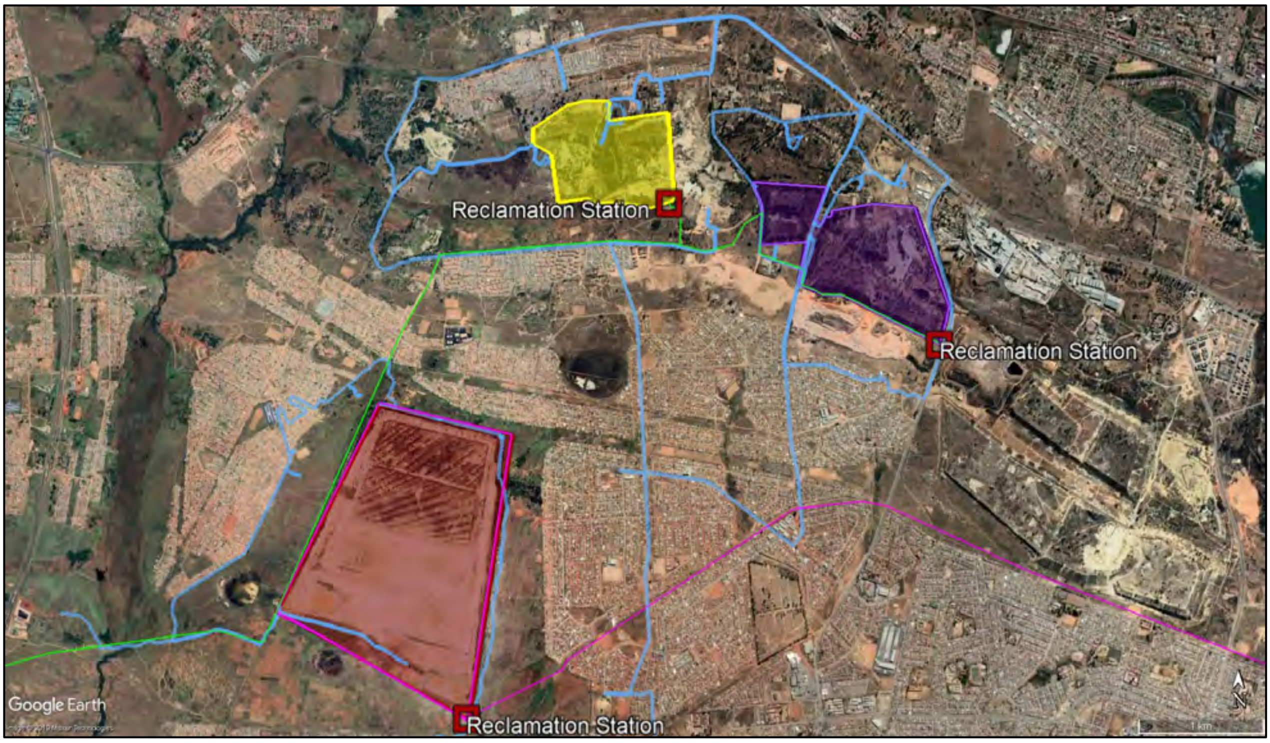


Figure 7-62: Track log recordings from site visit (21 August 2019). Note that portions of the area around the slimes dams/sand dumps were not surveyed due to inaccessibility and security issues

The HIA identified fourteen heritage resources and these are described in the table below. Their positions shown in Figure 7-67 and Appendix D7 of this EIA report. Eleven of these sites are historical structures or the remains of such structures, of which only two sites (**SC004** and **SC007**) are considered to have medium heritage significance and would require mitigation measures. The remaining historical structure sites (**SC001-003, SC006, SC008-011, SC013)** are considered to be of low to no heritage significance, and several of them have been recorded by previous heritage studies in the general area (du Piesanie 2014; Birkholtz 2018). Two of the sites identified are a burial ground (**SC005**) and possible graves (**SC014**), which are considered to have very high significance and would require mitigation measures. One of the sites is an informal church area (**SC012**) that is considered to be of Medium significance and would also require mitigation measures.

However, sites **SC002, SC004, SC006, SC007, SC009**, and **SC011** all contain structures or remains that are 60 years or older and will require a permit to be obtained if they are required to be demolished.

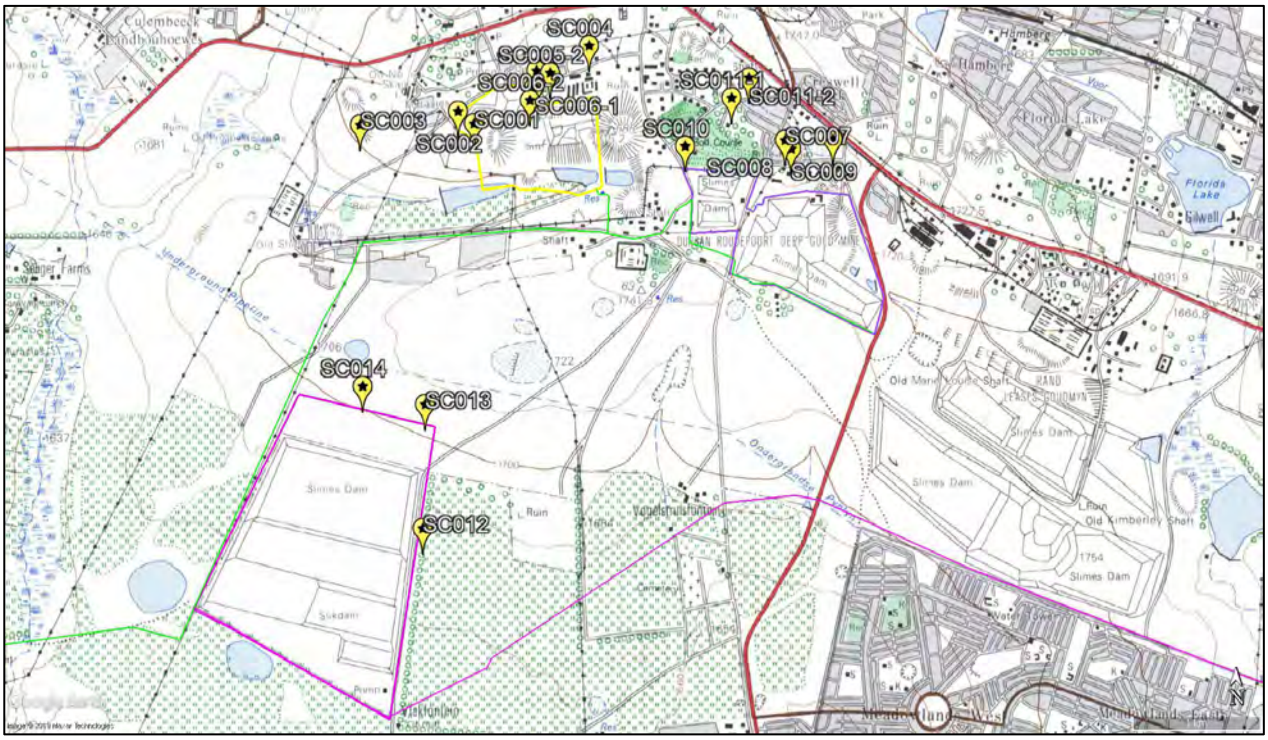


Figure 7-63: Identified heritage sites depicted as yellow icons, historic dump footprints shown as coloured polygons (yellow, purple, pink)

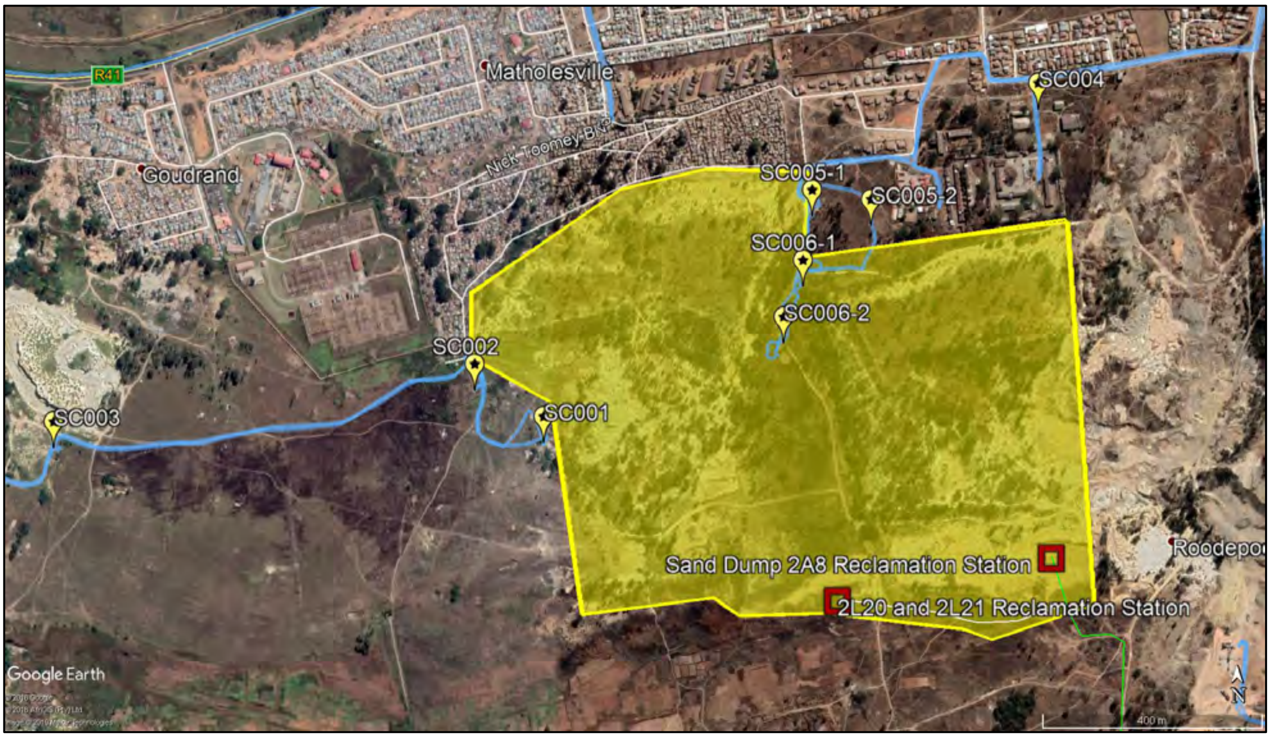


Figure 7-64: Historic slimes dams 2L20/21 and sand dump 2A8, showing heritage sites identified (yellow icons) and tracklogs (blue lines)

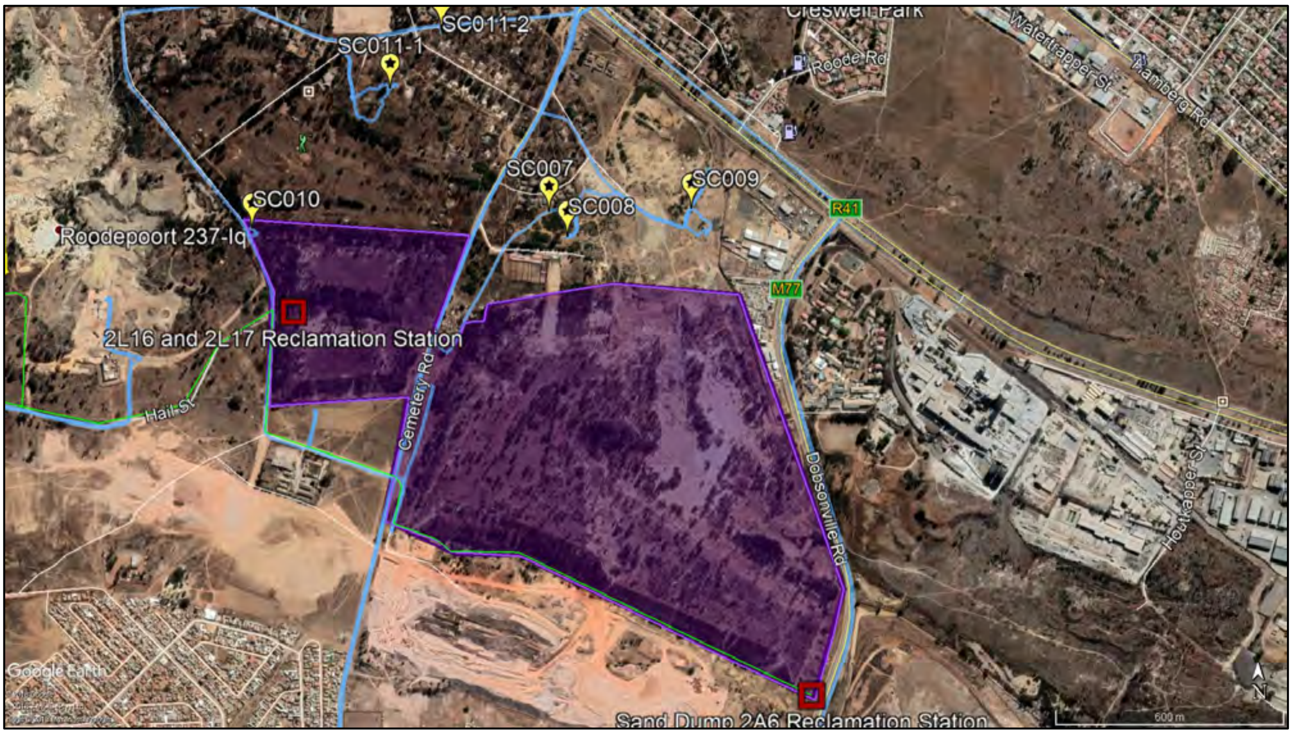


Figure 7-65: Historic slimes dams 2L16, 2L17 and 2L18 and sand dump 2A6, showing heritage sites identified (yellow icons) and tracklogs (blue lines)

Figure 7-66: Historic slimes dam 2L24, showing heritage sites identified (yellow icons) and tracklogs (blue lines)

Although several of the slimes dams/ sand dumps are older than 65 years and could technically be described as “man-made structures”, it is the considered opinion of the heritage specialist that there is no heritage significance attached to the actual slimes dams/sand dumps.

The HIA has noted that previous development and construction projects in the general area have identified and uncovered several unmarked burial grounds (i.e. two at Fleurfhof and one at Stormill). The heritage specialist concluded that there may be the possibility of historical graves existing under (or inside) five of the dumps. A chance find protocol for heritage resources has been developed for this project and is included in the EMPr.

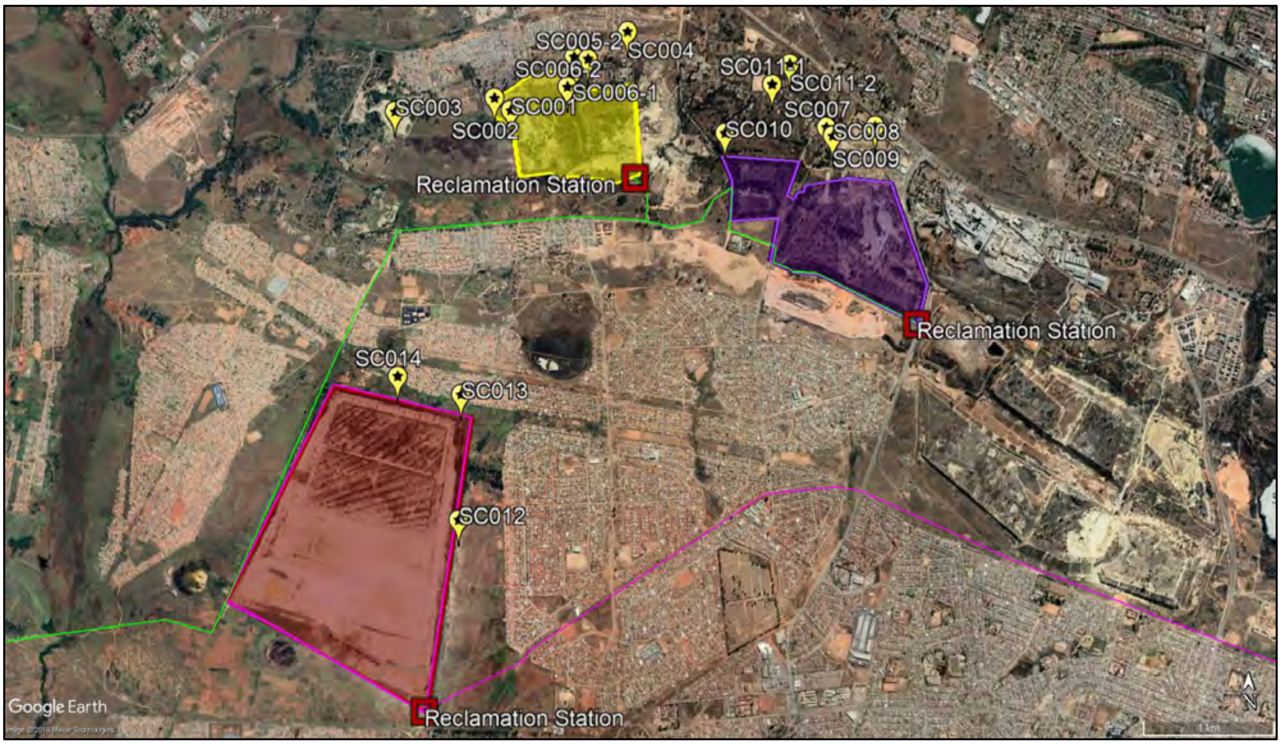


Figure 7-67: Locations of identified heritage sites (yellow icons) in relation to the three historic dump footprints (coloured polygons)

SITE[9] NUMBER	LAT	LON	DESCRIPTION	HERITAGE SIGNIFICANCE	HERITAGE RATING
SC001	S-26°10.557'	E 27°50.943'	The site comprises the demolished remains of several structures, most likely mine buildings. The remains comprise a few pieces of concrete wall and several rubble heaps. The remains are quite overgrown with long grass, pampas grass and other vegetation. The site is located at the base of the TSF, on the eastern side. No structures are depicted in this location on the historical topographic maps, up to 1977. Therefore, the structures are likely to be less than 42 years old. **The extent is approx. 0.50ha**.	Low	(Not Conservation Worthy) NCW

Remaining pieces of wall at SC001

Demolished rubble heaps at SC001

[9] Site in this context refers to a place where a heritage resource is located and not a proclaimed heritage site as contemplated under s27 of the NHRA.

SC002	S -26° 10.507'	E 27° 50.868'	The site comprises the stone and brick foundation remains of a rectangular structure and is located very close to the southernmost section of informal settlement and an area of illegal mining activity. A structure is depicted in this location on the 1943 and 1954 topographical maps but is depicted as a Ruin on the 1977 map. The remains are therefore older than 60 years and generally protected. **The structure measures approx. 10m x 7m.**	Low	IIIC
 **Remains of structure at SC002**					
SC003	S -26° 10.562'	E 27° 50.410'	The site comprises the remains of one or more buildings: A set of stairs and several heaps of rubble are all that remains. The site is located some distance to the east of the area where the slimes dams 2L20 and 2L21 are located but is noted in case it falls close to a proposed access road. An area marked “Murasies/Ruins” is depicted in this location on the 1943 topographical map. The extent is difficult to estimate but could be **approximately 20mx50m.**	Low	NCW.

View of the stairs and scattered rubble

SC004	S 26°10.239'	E27°51.481'	This site comprises an area with several old mine buildings, one of which is a very large historical mine compound. Some of the compound buildings are constructed of stone (earlier) and some of brick (later). The compound buildings are in a very dilapidated condition but are currently occupied. The four-five buildings situated immediately north of the compound are in a better condition than the ones inside the compound. At least one building seems to have been an old shop, and still has the original name on one side. The compound complex extends very close to the northern boundary of the dumps 2L20/21 and 2A8, within 10-15m. The 1943 topographical map depicts at least 12 structures in this location, labelled as Compound. On the 1954 map, the structures previously marked as a compound are now labelled “Hospitaal”. The numbers of structures outside the compound/hospital have also increased. The structure complex therefore seems to have functioned as a mine compound and hospital and contains structures that are 65 years or older and generally protected. This site is likely to be associated with Site SC005, which is an extremely large informal burial ground. **The approximate extent is 5.20ha**	Medium	IIIB

View of the buildings outside the old compound

View of the old compound entrance

View of the front of the old shop building

View of the name on the shop wall

View showing an old stone section of the compound

View showing some of the brick buildings in the compound

SC005-1 SC005-2	S-26°10.341' S-26° 10.350'	E 27° 51.235' E 27° 51.299'	The site comprises a very large burial ground, situated adjacent (west of) to the compound complex site, in the area between the slimes dam TL20/21 and the sand dump 2A8. An area used for dumping/storing soil and sand had been cleared on the west side. The graves on the west side are all stone-packed and are likely to be older than the graves on the east side. Several graves on the east side have formal dressings and granite or concrete headstones. It is estimated there could be between 1500-2000 graves or more. Most of the graves have stone-packed dressings. A few graves have formal headstones with inscriptions and dates which include: 1929, 1933, 1962, 1972 and 1985. Names from the inscriptions are all black African. The general area is overgrown with long grass, khakibos, pampas grass and stands of bluegum trees. The area also contains extensive dumping of building rubble and general household rubbish. An informal settlement is situated to the north-west and several historical houses are located a short distance to the north of the burial ground. **The site measures approximately 2ha (estimated from satellite imagery)**	High	IIIA

 **Headstone with one of the oldest dates (1929)**	 **Headstone with one of the recent dates (1985)**
 **View of some informal graves on the west side**	 **View of informal graves on the east side**

 **View showing some headstones on the east side**			 **View of building rubble**		
SC006	S-26° 10.408'	E 27° 51.225'	The site comprises the foundation remains of at least five structures: the structures were constructed of brick and concrete and could be the remains of a water purification plant or similar. The site is located immediately south of the burial ground, in the area between the slimes dam 2L20/21 and the sand dump 2A8. The structures are quite overgrown with grass and trees. Three structures are depicted in this location on the 1943 topographical map, while none are shown on the 1954 or 1977 maps. Three of the structures are therefore likely to be 60 years or older and generally protected. **The site extent is approximately 155m x 60m.**	Low	IIIC

 **View of one of the structure foundation remains**	 **View of one of the structure remains**

 View of another of the structure remains	 View of the circular base for a reservoir

7.12.2 Paleontology

The Proposed Project is underlain by the Turffontein and Johannesburg Subgroups, which are rated as Low to Zero Palaeontological Sensitivity on the SAHRIS palaeosensitivity map. These subgroups generally consist of quartzites and conglomerates formed by braided river systems, as well as pyritic sands, insignificant shales, and volcanics as well as debris-flow diamictites. Rock formations with a zero palaeontological sensitivity are unfossiliferous (Kongiwe 2019).

A basic palaeontological sensitivity was determined using the palaeosensitivity map on the SAHRIS database (South African Heritage Resources Information System) (http://www.sahra.org.za/sahris/map/palaeo). As can be seen in Figure 7-68 and Figure 7-69, the Soweto Cluster dumps occur in an area where the palaeontology is assessed as being almost **entirely of Low sensitivity (coloured blue) and no palaeontological studies are required**.

However, the area covered by the footprint of the **dump 2L24 is located over an area marked red (Very High Significance).** Since it is anticipated that there should be no excavation into the underlying geology and given that the area surrounding the dumps has been disturbed extensively in the past, it is recommended that an application for exemption from the standard requirement for a Palaeontological Impact Assessment be made to SAHRA.

Colour	Sensitivity	Required Action
RED	VERY HIGH	field assessment and protocol for finds is required
ORANGE/YELLOW	HIGH	desktop study is required and based on the outcome of the desktop study, a field assessment is likely
GREEN	MODERATE	desktop study is required
BLUE	LOW	no palaeontological studies are required however a protocol for finds is required
GREY	INSIGNIFICANT/ZERO	no palaeontological studies are required
WHITE/CLEAR	UNKNOWN	these areas will require a minimum of a desktop study. As more information comes to light, SAHRA will continue to populate the map.

Figure 7-68: SAHRIS palaeosensitivity ratings table

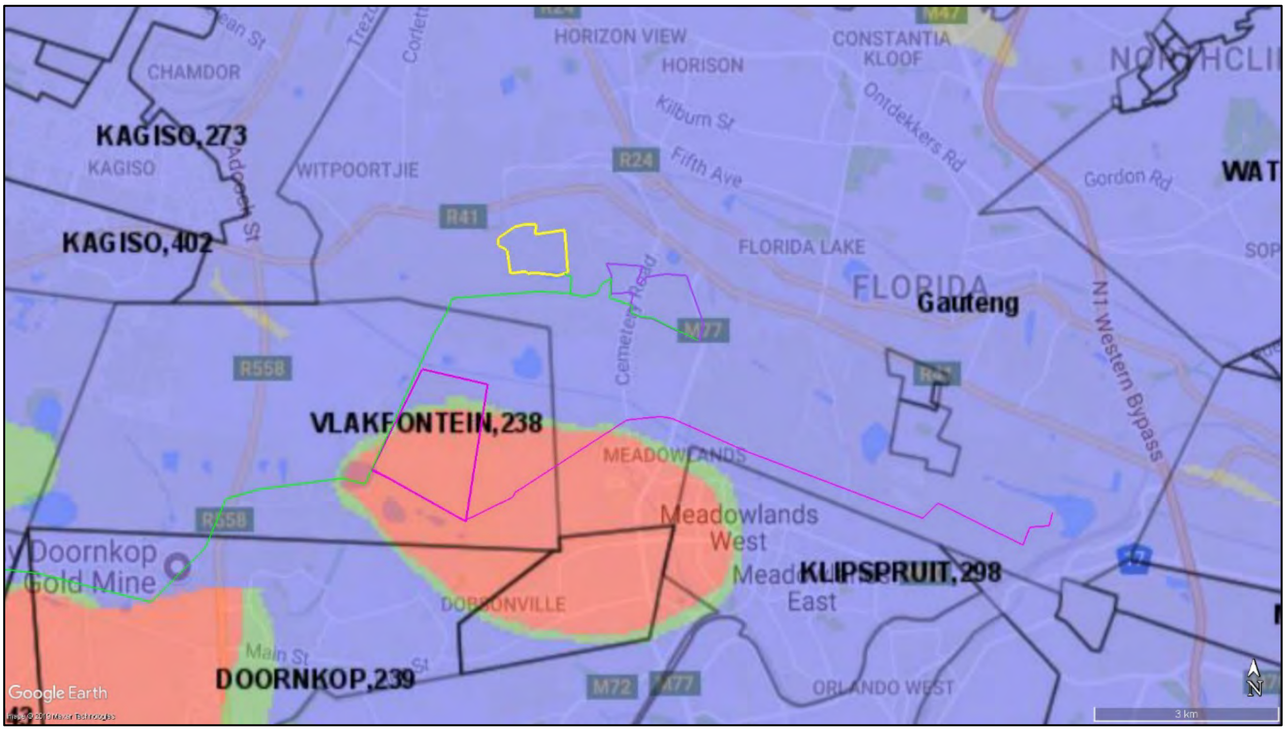


Figure 7-69: Overlay of the three historic dump footprints on the palaeosensitivity map from the SAHRIS database.

7.13 Social

Please refer to Appendix D7 to view the Social Impact Assessment (SIA)

The International Principles for Social Impact Assessment (SIA) (2015:iv) defines SIA as being "the processes of analysing, monitoring and managing the intended and unintended social consequences, both positive and negative, of planned interventions and any social change processes invoked by those interventions".

The following social parameters were considered to determine the likely social impacts:

- **Demographic processes** refer to the movement and structure of the local community;
- **Geographic characteristics** refer to the processes that affect the land uses of the local area;
- **Economic processes** refer to the economic activities with the affected project area;
- **Socio-cultural wellbeing**- refer to the processes that affect the local culture of an affected area, i.e. the way in which the local community live; and
- **Institutional, legal, political and equity**-refers to the processes that affect service delivery of the study area.

Without repeating what is contained in the SIA, this section aims to describe the socio-economic characteristics of the potentially affected area to develop an understanding of the broad social and economic conditions of the affected environment. The proposed Project has the potential to result in both positive and negative social impacts. As such, it is important that the socio-economic baseline conditions are understood to ensure accurate identification and assessment of potential impacts associated with the proposed project.

7.13.1 Project Area Demographics and Population characteristics

7.13.1.1 Site 1-Braamfischerville

Braamfischerville is located on the outskirts of Soweto, south west Johannesburg, some few kilometres away from Dobsonville (see figure 1) thus forming one of the 87 townships (Wikipedia contributors, 2009) found in Soweto characterized by formal and informal settlements, squatter settlements and shanty towns.

Braamfischerville is situated in the southern metropolitan part of Johannesburg and in the north-western part of Soweto. It is within region six and it is one of the 87 townships found in Soweto. The area is characterised by formal and informal settlements. Braamfischerville is predominantly composed of RDP houses, 30m2 on a 250m2 plot, consisting of an open plan, bedroom, lounge and kitchen, and a separate toilet (Moolla, 2008).

Braamfischerville was developed as a result of the relocation of families in the Alexandra Township Renewal Program from local government. It was established as a resettlement area for people who have been evicted form Alexandra (www.apf.org.za). It further grew as a result of other people who have relocated from Soweto and other parts of southern Johannesburg due to development of new Reconstruction and Development Programme (RDP) housing. It is reported that the first people to be allocated houses in Braamfischerville arrived in 2001).

7.13.1.2 Site 2 & 3-Matholesville, Sol Plaatjie, Goudrand (Roodepoort)

Matholesville is also known as Goudrand, the area is located in Roodepoort and comprises of a formal and informal settlements. The area is situated within the western region of the City of Johannesburg Metropolitan Municipality’s (CoJ) jurisdiction, on what is generally referred to as the gold mining belt between the Roodepoort Central Business District and Bramfischerville.

These were all informal settlements dotted by existing and old gold mines and mine dumps. The areas differ in size, but are generally characterised by mixed housing; predominantly informal housing, but also low cost government housing known as RDP houses and converted hostels, which were initially built for the gold mines in the area in the early 20th century, but which have since been abandoned and occupied by the urban poor.

The area is predominately characterised by illegal miners locally known as Zama-zamas-a Zulu expression meaning to “take a chance” or “try your luck”. *Zama-zamas* are South African, Malawian, Mozambican and Basotho miners.

7.13.1.3 The City of Johannesburg (CoJ)

The Soweto Cluster dumps fall under the jurisdiction of CoJ. According to the CoJ’s IDP 2018/2019, the City of Johannesburg is South Africa’s largest metropolitan municipality in terms of population, size and diversity of its economy. According to the Community Survey 2016, City of Johannesburg has a population of approximately **4 949 346,** about two-fifths of the figure in Gauteng. It is projected that the population could increase from the 4.9 million (2016) to 5.4 million (2021) and to 7.6 million (2037).

CoJ's population is mainly composed of a young population (persons aged 14 to 35 years) which constitute over 33.2% of the total population. The high youth population can be attributed to the fact that the youth are migrating to Johannesburg for better opportunities, the influx has led to high youth unemployment (approximately 40%) in Johannesburg.

7.13.2 Households and Housing

The area comprises a mix of formal and informal housing, according to the Community Survey 2016, there are about 1 853 369 households within CoJ. A total of 18% of the households are categorised as informal settlements. The IDP (2019:19) states that the number of households in the city has increased by an average annual rate of 3% from 2006 to 2016. Figure 7-70 below shows typical houses within the project area.

Figure 7-70: Typical houses in the project area

The IDP (2019: 20), states that housing backlog is a major concern for the City. Informal settlements and non-regulated backyard rental are some of the contributing aspects to CoJ's housing backlog. It is also mentioned that the City is making a concerted effort to address the issue of housing backlog. The City has number of projects such as the upgrading of informal settlements by re-blocking, alignment of shacks and providing basic services.

According to the Community Survey 2016, approximately 51.7% of the households within CoJ are fully paid or are being paid off. **Table 7-24** below gives an indication of the tenure status.

Table 7-24: Household ownership Source: Community Survey (2016)

DESCRIPTION	PERCENTAGE
Owned and fully paid off	38.1%
Rented from private individual	26.5%
Owned but not yet paid off	13.6%
Occupied rent free	12.8%
Other	6.4%

7.13.3 Education and Employment

It is estimated that approximately 46% of the population have completed matric or higher, about the same as the rate in Gauteng: 52.43%. About 5% have no formal education and about 40% have some secondary schooling, which is an area of concern which needs to be considered as part of the Adult Education and Training (AET). It has been established by Njong (2010: 1) that investment in education and human capital formation are essential for economic growth and poverty reduction. The inter-relationship between education and poverty can be understood in two ways. Firstly, investment in education increases the skills and productivity of poor households. It enhances the wage level as well as the overall welfare of the population. Secondly, poverty may constitute a major constraint to educational attainment. Njong (2010:1) further adds that it is documented in the literature that education and poverty are inversely related.

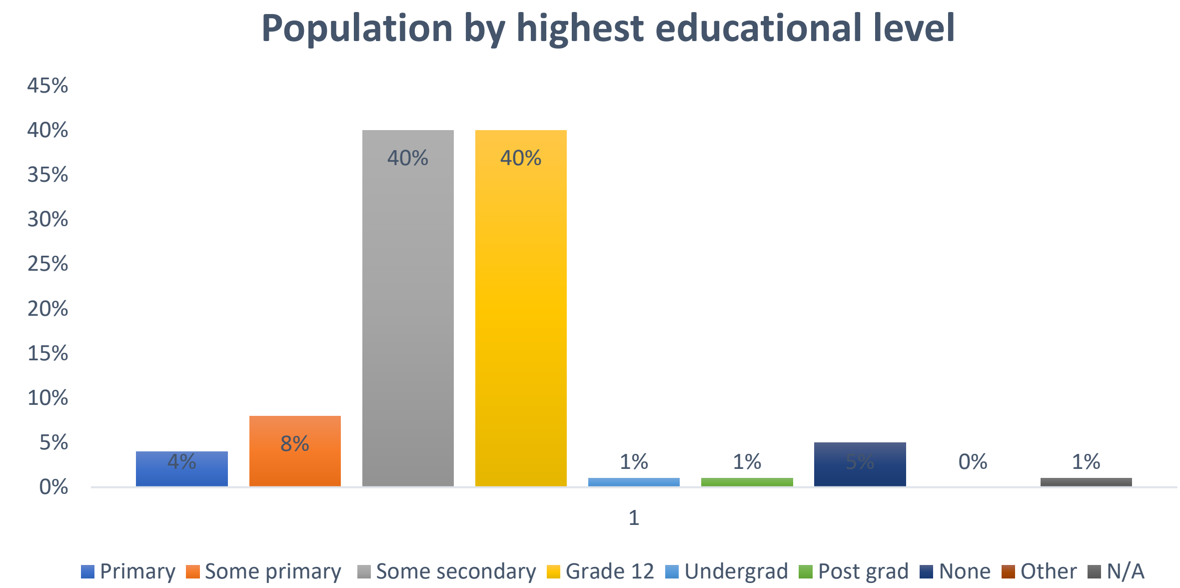


Figure 7-71: Population by highest education level. (Source: Community survey 2016)

About 52% of the population is employed which is slightly higher compared to Gauteng. The IDP review, 2018/2019 indicates that the CoJ's unemployment rate is 32.3%. According to the CoJ's Socio-Economic overview document 2016, If the expanded definition for "unemployment" term is taken into account, youth unemployment rate rises to alarming statistic of approximately 40%.

The high unemployment rate, (Molapo, Mutendi & Muthethwa, 2011-2012:4) indicated that this trend can be attributed to (amongst others) lack of education, increased number of economically inactive people, unbalanced fast population growth versus slow employment creation rate, and lack of access to information by poor and disadvantaged groups.

Unemployment is high within the project area, questions regarding employment opportunities were raised during consultations with surrounding community members. It is worth noting that during stakeholder meeting and interviews, young men and women were seen either loitering or hanging around the street corners. It was also reported that most of the youngsters have formal education but there are no employment opportunities. Two informants indicated that the lack of job opportunities has resulted in these youngsters resorting to drug abuse - particularly *nyaope*[10]. Mzizi (2018:22) indicates that there is a direct link between unemployment and drug abuse, he explains that unemployment has a damaging impact on psychological health. The psychological effects and the consequences of unemployment can result in substance abuse and alcoholism

7.13.4 Economy and Livelihoods

7.13.4.1 Formal Sector

According to Census (2011) data, a majority of the population was estimated to be employed in the formal sector- which is slightly higher than the rate in Gauteng (77%). Please refer to Figure 7-72 for an overview of the sector of employment in the project area.

7.13.4.2 Informal Sector

During interviews and site visit, artisanal mining was observed within the all three sites of the project area. Artisanal small-scale mining (ASM) or *Zama-zama* refers to the work of individuals and groups who mine for minerals using basic equipment, organised in small groups (ILO 2005). Informal ASM includes the absence of any permit to undertake mining, minimal use of safety equipment, and the selling of minerals informally. ASM an important livelihood activity for the urban poor, and that there are serious legal, safety, health risks associated with it. There is no firm data that quantifies the extent of ASM (especially in South Africa), or to determine the profile of miners.

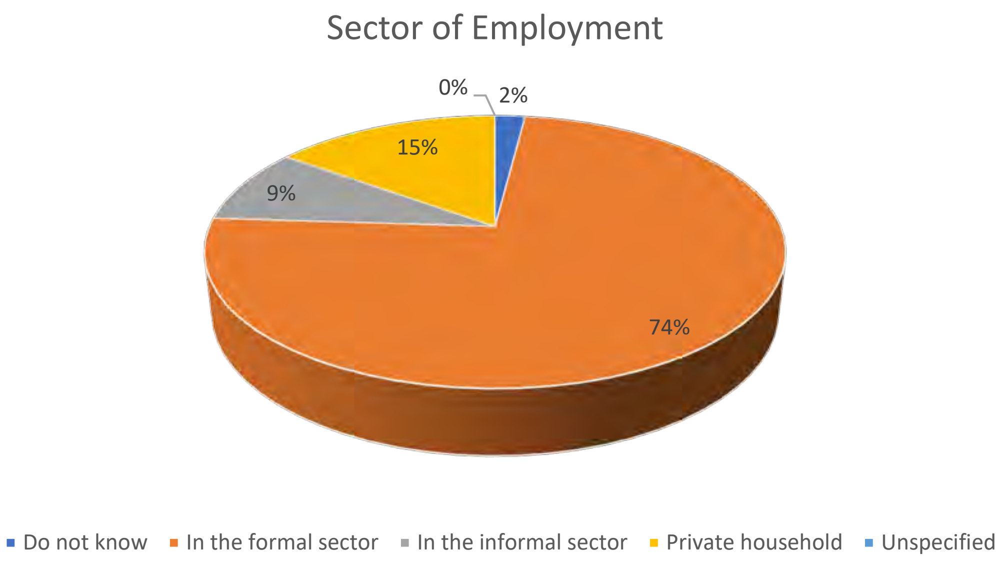


Figure 7-72: Sector of employment (Source: Community survey 2016). (Source: Community survey 2016)

[10] Nyaope is a drug made of heroin cut with methamphetamine, codeine and other substances reputedly ranging from anti-retroviral drugs to even powder from flat-screen televisions.

Types of informal trading such as scrap material collectors and street vendors were observed within the project area.

Scrap collector **Car wash** **Street Vendors**

Figure 7-73: Types of informal trading within the project site

7.13.5 Access to Services

- Water

Access to basic services (in terms of water supply) is relatively high, majority (98%) of the population get water from a regional or local service provider. 65% have access to piped water in their house and 29% have access to water in their yards. Only 3% of the population have access to piped water from community stands. Some residents rely on Jojo tanks as a source of water.

- Electricity

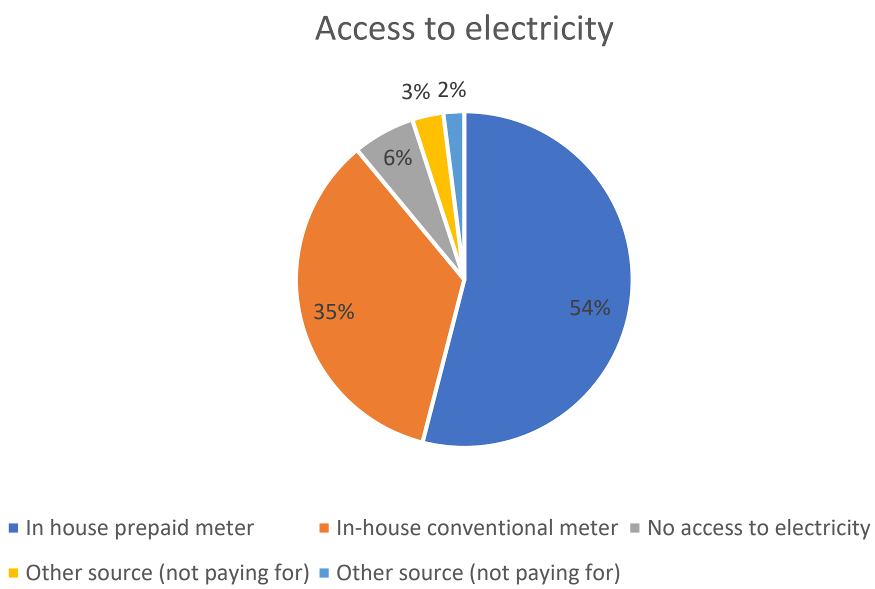


Figure 7-74: Population by electricity access. (Source: Community survey 2016)

- Toilets Facilities

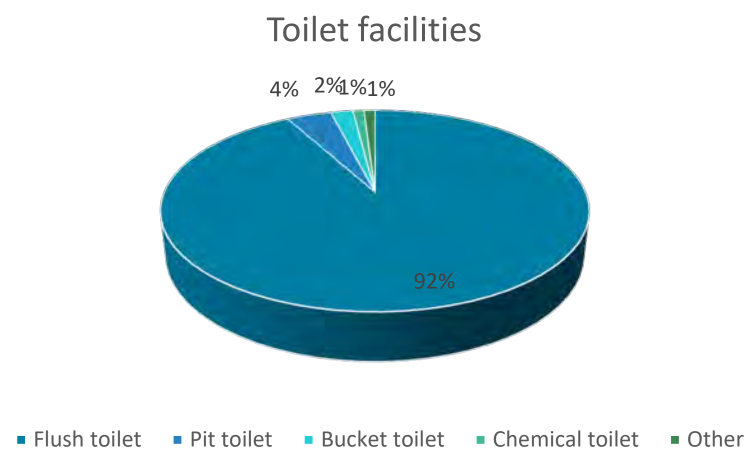


Figure 7-75: Access to toilet facilities. (Source: Community survey 2016)

- Refuse Disposal

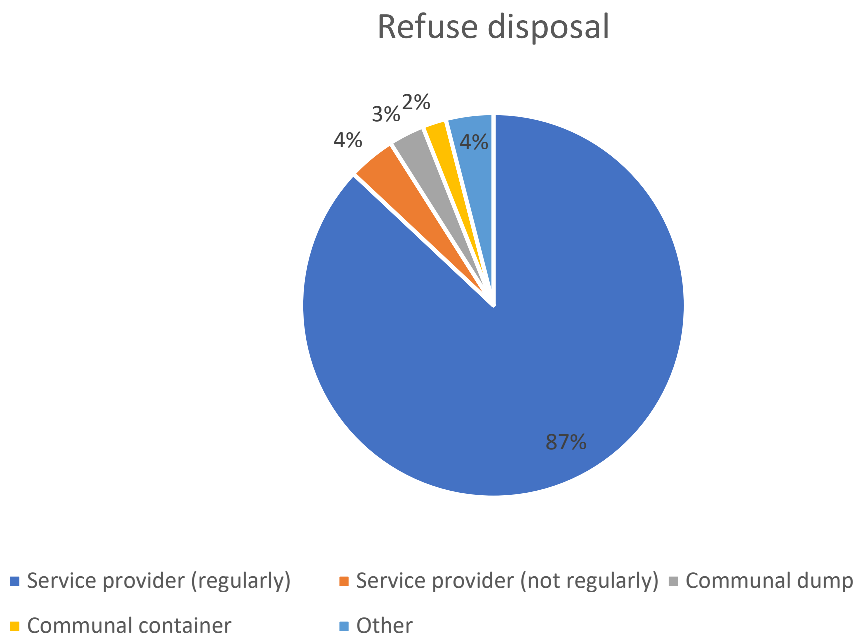


Figure 7-76: Refuse disposal. (Source: Community survey 2016)

7.13.6 Anticipated Social Impacts

The following social impacts are anticipated:

Table 7-25: Anticipated Social Impacts of the proposed project

POSITIVE IMPACTS	NEGATIVE IMPACTS
Availability of alternative land uses	Creation of informal settlements
Stimulation of economic growth	Safety Impacts;

POSITIVE IMPACTS	NEGATIVE IMPACTS
Job security and skills development (for current personnel)	Exposure to increased dust levels
	Impact on Viva settlement-possible relocation
	Impact on spatial development- future land use
	Increased nuisance factors

These have been explained in more detail below.

7.13.6.1 Job Security and Skills Development

It is understood that the proposed project will create minimal additional job opportunities (maximum of 10 employees) but will provide job security for the current personnel who are mostly from the City of Johannesburg. Employment opportunities include direct employment by the Project, indirect employment will be created by procuring local goods and services, induced employment generated through spending and associated job creation in the economy. Project related employment has the potential to considerably improve the livelihoods and income stability of employees and their dependants.

The Social Specialist concluded that the majority of the community members are in favour of the proposed project, however they are concerned about the lack of additional employment opportunities that can be realised from the proposed project.

In an effort to assist the community, Crown Gold offer access to tertiary education bursaries and experiential work such as internships. In addition, it is reported in their SLP for existing operations (2018-2022) that the mine takes cognisant of the fact that there is a need to develop qualified individuals from other sectors of the economy - whose communities have been affected by the mine.

7.13.6.2 Stimulation of Economic Growth

The proposed project may result in several economic benefits for local communities through direct and multiplier effects stimulated by capital expenditure and construction activities. The proposed project is likely to generate contracts for the purchase of equipment and other goods and services. The majority of these contracts will be for specialist goods and services, which will be provided by businesses within the project area. Procuring of specialist goods and services will likely generate more opportunities for Small, Medium and Micro sized Enterprises (SMMEs), provided they meet the procurement requirements as set out by the mine.

Stimulation of economic growth is not only limited to multiplier effects stimulated by capital expenditure and construction activities. According to the existing company's SLP (2018-2022:76), the company recognises that entrepreneurship is an effective and viable strategy to overcome the current desperate economic situation. In light of this, the company has a Broad-Based Entrepreneurship Programme that is open to all individuals that have a business, interested in improving their profitability or those who are interested in starting their own businesses.

In addition, the proposed project will contribute to the supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy.

7.13.6.3 Availability of Alternative Land Uses

The positive impact of the availability of land has been noted as part of the “need and desirability” of the proposed project. It is stated in the Final Scoping Report (FSR) (2019:42) that the clearing of land and subsequent removal of the mine dumps is considered extremely important and a positive benefit. The FSR further states that it is envisioned that the removal of these dumps could significantly reduce a source of water, land and dust pollution, as well as costs associated with the dumps’ maintenance. The land would be cleared to ground level and thereafter be available for future use.

Furthermore, the proposed project is in line with the CoJ’s Spatial Development Vision 2040, which aims to strengthen Soweto’s connection to the metropolitan core and other subcentres, including the mining belt development corridor. Although there will be availability of land, the end land uses should be sustainable and agreed upon with Interested and Affected Parties as they will be the future land users.

During stakeholder consultations and key informant interviews, some participants indicated that the removal of the dumps has an environmental benefit. However, there is another spectrum of pressing social issues associated with the dumps that cannot be overlooked, the dumps are currently unmanaged and therefore a crime hot spot. Informants have detailed how gruesome murders, horrifying rape and robbery incidents that have occurred in these mine dumps, these incidents have been widely reported in newspapers such as (Timeslive, 2018). The removal of the mine dumps is seen as a positive impact which is most welcomed by community members.

The positive impact associated with the removal of the dumps can only materialise once the land has been successfully remediated and an approved radiation land clearance certificate has been obtained in terms of the National Nuclear Regulations Act, (Act No. 47 of 1999) from the National Nuclear Regulator (NNR).

During the construction and operation phases, the land will not yet be available for alternative land uses, this impact has been assessed as part of the decommissioning phase

7.13.6.4 Creation of informal settlements

Sites 2 and 3 of the project area already consist of areas that are characterised by informal settlements (ie) Matholesville and Viva settlements. The creation of informal settlements is the result of many cumulative impacts, such as influences of other mines in the area, current socio-economic conditions such as lack of housing and poverty. In most instances the local communities would claim that the informal settlements are contributing directly to a number of problems. For example, some participants believe that these settlements lead to a higher crime rate in the area and put immense pressure on municipal services. It was also reported that residents from informal settlements illegally connect to the water supply pipelines, which results in intermittent water supply for community members.

7.13.6.5 Safety Impacts

Illegal mining was considered as a possible contributing factor to the safety impacts associated with the proposed project. After consultation with residents within the project area, it became clear that *zama-zama* target underground abandoned and ownerless mines. One informant indicated that *zama-zamas* do not have the specialised technology to extract gold from slimes dams and sand dumps. The reclamation of gold from these old tailings requires specialised technology, it is mentioned in the DRDGold Integrated Report (2018:17) that the company has invested in specialised technology to fine-grind gold-bearing material to achieve recovery efficiencies previously beyond the reach of typical metallurgical processes.

7.13.6.6 Increased Dust Levels and Rise in Associated Health Impacts

Concerns that the proposed project might increase dust levels during the construction and operational phases was recorded during public consultations, this concern was linked to compromised health for individuals in close proximity to the proposed project area. The dust usually contains fine particulate matter, which can be inhaled, causing damage to lung tissues. The dust also potentially contains a number of hazardous substances that can result in chemical toxicity.

TSFs with high level of radioactive material can cause radiological pollution. Collectively, the dust problem poses a significant health risk and reduces the quality of life for a large number of citizens. Furthermore, this undermines the credibility of the mining industry as a responsible corporate citizen (GDARD, 2012, ply). The approval of this project would eliminate the Soweto Cluster dumps as a source of air pollution upon completion.

7.13.6.7 Impact on the Viva Settlement

The proposed project has a direct impact on households erected close to Site 2. Nkosi (2016:144) provides evidence that a community's proximity to mine dumps is associated with increased risk of respiratory symptoms and diseases among the children and the elderly. Mine dumps are considered to be a major source of wind-blown dust that not only constitutes a nuisance but represents a risk to human health (Nkosi 2016: 144). A detailed impact assessment on human health is included as part of Kongiwe's Community Health Impact Assessment for the proposed Soweto Cluster (2019).

From a social point of view, all settlements/ houses close to the project area are impacted and the Viva Settlement is marked as a high-risk area due to its proximity to Site 2.

7.13.6.8 Increased Nuisance Factors and Changed Sense of Place

The construction of the proposed project might cause intrusion into the surrounding physical environment, which could impact on surrounding communities in various ways.

The Soweto Cluster dumps define the landscape of the area and this could influence and individual/community's sense of place. The reclamation of Site 1 (dump 2L24) will definitely result in a changed sense of place. Residents in the area refer to Site 1 as *Ntabamhlophe* which means a white mountain. *Ntabamhlophe* has become a landmark of the area. Although it is seen as a landmark, the health challenges it poses expedites the need to have the dump removed.

The removal of the dumps by means of reclamation process has a positive benefit as the removal of the slimes dams and sand dumps would result in the removal of a water, land and dust pollution source.

7.13.6.9 Attitude Formation

Attitudes are formed by means of people's perception, the way they interpret and assess the project. In this case attitude formation refers to the perception that people in the local community might form about the proposed project, which in turn would influence their attitude and behaviour towards the project. If the project had negative impacts or didn't offer benefits, attitude formation will result. Negative attitudes may result in interest group activity.

Based on an analysis of the interviews conducted during the HIA compilation, the majority of stakeholders have a positive attitude towards the project. It is possible that the positive attitude towards the project might change when the affected communities feel that they are no benefits for them (eg) lack of job opportunities and training programmes, effective CSI programmes and non- compliance with the SLP.

Attitude formation is not necessarily an impact but rather a change process that might have an economic impact on the project. For example, the lack of benefits (lack of employment opportunities, CSI initiatives, community development projects) might influence the 'buy-in' factor from community members which then compromises the applicant's social licence to operate in the area. If there are negative attitudes formed against the project, this might result in delays in project implementation, which affects the company's operating and financial as well as the positive impacts associated with the project.

7.14 Health

Refer to Appendix D8 of this EIA report for a review of the Community Health Impact Assessment (cHIA)

7.14.1 Methodology

7.14.1.1 Baseline Data Collection

A standardised approach was considered for the cHIA to ensure that evidence based recommendations supported the impact assessment and community health management plan. The data collection activities of the cHIA included a desktop literature review, participatory data collection through public participation, and direct observations from limited field-work.

7.14.1.2 Desktop Review

Desktop literature review to:

- Outline the City of Johannesburg's and Soweto community health profile from a desktop perspective including a literature review using a systematic approach;
- Inclusion of specific health regulations (included in Section 3 above); and
- Analyse other specialist studies (surface water, groundwater, air quality).

7.14.1.3 Field Visit

A field visit was undertaken to visualise the Project and location of communities in August 2019. The field visit provided an opportunity to visualise and assess the prevailing situation in the communities and their relation to the proposed Project. This was important to understand the potential areas of influence of the Project and the general living conditions in the communities living nearby the Project site

7.14.2 Determinants of Health

Determinants of health[11] are the broad range of personal, social, economic and environmental factors that determine individual and population health. The main determinants of health include:

- Income and social status;
- Employment and working conditions;
- Education and literacy;
- Childhood experiences;
- Physical environments;
- Social supports and coping skills;
- Healthy behaviours;
- Access to health services;
- Biology and genetic endowment;
- Gender;
- Culture; and
- Race / Racism.

Many factors combine together to affect the health of individuals and communities. Whether people are healthy or not, is determined by their circumstances and environment. To a large extent, factors such as where we live, the state of our environment, genetics, our income and education level, and our relationships with friends and family all have considerable impacts on health, whereas the more commonly considered factors such as access and use of health care services often have less of an impact. (WHO, 2019)

7.14.3 Affected Communities

An affected community is a defined community within a clear geographical boundary where project related health impacts may reasonably be expected to occur. When assessing potential impacts one must consider who might be affected, how they will be affected and the risks of exposure.

[11] See for example Canadian Health Department, 2019

7.14.4 Baseline Health

7.14.4.1 Health Status: City of Johannesburg

A common vision for the City of Johannesburg has been established as a "One City One Health System". The history of health care service delivery in Johannesburg has been characterised by fragmentation and poor quality care to communities. The 2019/2020 City of Johannesburg Integrated Development Plan (IDP) stated that primary focus is going to be on reducing the number of HIV/AIDS cases, managing tuberculosis (TB) infections, and ensuring healthy lifestyles. Of particular relevance to the health sector is the amplified risk of communicable diseases outbreaks (e.g. the outbreaks of H1N1 influenza, Rift Valley Fever, cholera, and measles despite the high immunisation coverage) and the social problems that come with unemployment: trauma and violence (xenophobia) and alcohol related illnesses.

A key focus area of the City's health thrust is ensuring that all the residents of the city have access to adequate primary health care, including access to safe and affordable medicines and vaccines as well as environmental health (CoJ IDP 2019/2020).

As read in the City of Johannesburg Health pages, R178-million has been budgeted for health services, and this amount is to increase in the medium term, reflecting larger allocations to the HIV/AIDS programme. The Johannesburg central Health Department has six units dealing with:

- Primary health;
- Communicable and non-communicable diseases;
- HIV/AIDS;
- Environmental health;
- Pharmaceutical services;
- Health Information System (HIS).

7.14.4.2 Health Status: Soweto

Relevant to this project and the surrounding community, the lack of adequate water and sanitation services is a health risk. In parts of Soweto, there is a lack in the supply of safe drinking water and adequate sanitation, and as a result, households without safe water and proper sanitation systems are more vulnerable to water borne diseases.

With specific reference to this project, the reclamation of the Soweto Cluster dumps would ameliorate the current sources of health risks emanating from the dumps. It is envisioned that, over time, there would be a reduction in dust pollution (air quality impacts) and an improvement in ground and surface water quality. Moreover, if the land is intended for residential or housing development, this would assist in de-risking the impacts of improper and poorly maintained municipal services.

7.14.4.2.1 Surface Water

Hydrospatial (Pty) Ltd (Hydrospatial) was appointed by Kongiwe to conduct a surface water study for the proposed reclamation and reprocessing of the Soweto Cluster dumps and associated infrastructure.

Seven surface water quality sampling was undertaken at 7 locations. The water quality results are summarised below:

- No water quality issues were noted for SW1;
- SW2 and SW4 exceeded a number of parameter limits and were found to have a low pH (acidic), high dissolved salts, high Total Suspended Solids (TSS) and turbidity, as well as being high in heavy metals. SW2 also had elevated levels of uranium. The water quality from these dumps are typical of Acid Mine Drainage (AMD);
- SW3 was high in Total Suspended Solids (TSS) and turbidity. The stream was not flowing at the time of sampling, and therefore, water was sampled from stagnant water, which may be the result of the high TSS and turbidity;
- SW5 was elevated in turbidity, fluoride, ammonium and iron;
- No major issues were noted at SW6, other than having slightly elevated dissolved salts, nitrate, orthophosphate and ammonium; and
- Parameters were within limits at SW7, except for ammonium which was slightly elevated.

The effects of water variables on the environment and humans is as follows:

- Low pH (acidic): Eye irritation, exacerbation of skin disorders, vomiting, diarrhoea, kidney disease, liver disease, stomach cramps, and nausea are among the leading health issues caused by the consumption of acidic water (WHO, 2002).
- High Total Suspended Solids (TSS): Nausea, vomiting, and diarrhoea in Infants, the elderly, and those with compromised immune systems. In extreme cases some pathogens may infect the lungs, skin, eyes, nervous system, kidneys, or liver and the effects may be more severe, chronic, or even fatal (Brunswick, year unknown).
- Elevated turbidity: Turbidity in not a major health concern, but high turbidity can interfere with disinfection and provide a medium for microbial growth. It also may indicate the presence of microbes in the water.
- High heavy metals typical of AMD: Health implications of heavy metals typical of AMD been discussed in detail in the impact assessment section.
- Elevated levels of uranium: Health implications of heavy metals typical of AMD been discussed in detail under in the impact assessment section.
- Elevated fluoride: Long term exposure to fluoride can produce effects on skeletal tissues (bones and teeth) (WHO, 2006). Long-term consumption of water containing elevated fluoride by pregnant woman has been linked to Down-Syndrome births.
- Elevated ammonium: No proposed health impacts for humans, but toxic for aquatic life.
- Elevated iron: Long Term overloading/consumption of iron can lead to "iron overload", which can lead to hemochromatosis, a severe disease that can damage the body's organs.
- Elevated nitrate: Elevated nitrates has been linked to foetal malformations ("blue baby syndrome") of unborn and born foetuses, as well as rare metabolic disorders in adults.

- Elevated orthophosphate12: Elevated phosphate intake can cause health problems, such as kidney damage and osteoporosis (Lenntech, 2017). White phosphorus can cause skin burns. While burning, white phosphorus may cause damage to the liver, the heart or the kidneys.

The current state of water quality in the Project affected surface water bodies is poor and stands to be improved once the sites have been rehabilitated.

7.14.4.2.2 Uranium Contamination and Radioactivity

Naturally-occurring radioactive materials (NORMs) are a common occurrence in our environment since the formation of the Earth. These could be of cosmic, terrestrial, or internal origin. They are generally available in the environment at levels that are not potentially harmful to human health. NORMs account for up to 85% of the annual dose exposure received by the world population [https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4924027/]. In certain cases, anthropogenic activities, such as mining, have produced wastes that contain radiation above background levels in the environment, a situation that has been of major concern for radiation protection [3]. Mining can contaminate soils over a large area through radiation exposure and other environmental contaminants [4]. This eventually affects humans through different radiation exposure pathways, either external or internal (*i.e.*, ingestion and inhalation pathways) (Mathuthu *et.al*, 2016).

Major mechanisms of radionuclides transport from potential primary contamination mining sources are the atmosphere, ground water sources, and surface water bodies. Gold mine tailings in the study area constitute a major source of NORMs pollution to the environment. Other sources are rock dumps, processing plants, return-water dams, storm water drainage systems, settling ponds, and evaporation dams. Radionuclides from these sources can either be leached into the underlying ground water aquifers or dissolved and drained through runoff into surface water bodies, thereby contaminating water sources (Mathuthu *et.al*, 2016).

It must be noted that no independent radiation study has been undertaken. Radiation Safety cases and studies are undertaken by the Applicant in accordance with the requirements set-out by the National Nuclear Regulator.

A study by MINTEK in 2016 presents the levels of various elements in the different regions of Gauteng (Table 7-26). The Soweto Cluster dumps are situated within the West Rand region.

Table 7-26: Average gold, uranium, sulphur and carbon analysis of typical dump samples (Mintek, 2016).

ELEMENT		EAST RAND	CENTRAL GAUTENG	WEST RAND	FREE STATE
Au	Gramm/tonne (g/t)	0.27	0.3	0.35	0.41

12 Phosphates are compounds composed of PO4 units. They are salts or esters of phosphoric acid. Orthophosphate is the simplest among other phosphates. It is composed of only one phosphate unit. Thus, it is also known monophosphate. Phosphates are naturally occurring minerals. These minerals are mined to get phosphorous required for the production of fertilizers (PEDIAA, 2017)

		(some with spots as high as 8 g/t)			
Uranium	g/t	19	Not determined	59	65
Sulphide	%	0.41	0.25	0.5	0.9
Sulphate	%	0.5	0.01	0.3	0.4
Total S	%	0.9	0.28	0.8	1.05
Total C	%	0.31	0.14	0.26	0.06

A study undertaken in 2019, which measured the uranium concentrations in hair sampled from barber shops in close vicinity of the project are showed elevated U levels that merit research on possible adverse health consequences. (Winde F, et.al. 2019).

7.14.4.2.3 Air Quality

There are an increasing number of research studies highlighting the impact of gases and air pollutants on humans. Many of these emissions, even in small quantities, have adverse effects on workers and neighbouring residents alike.

Particles (PM) can be classified by their aerodynamic properties into coarse particles, PM_{10} and fine particles, $PM_{2.5}$ (Harrison & Van Grieken, 1998). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002). It is the amount of fine dust and the chemical and mineralogical composition of the dust which will dictate the potential for health impacts (Schwegler, 2006).

Particle size is important for health because it controls where in the respiratory system a given particle is deposited. Fine particles are thought to be more damaging to human health than coarse particles, as they can penetrate deeper into the lungs (Manahan, 1991). Larger particles are deposited into the extrathoracic part of the respiratory tract while smaller particles are deposited into the smaller airways leading to the respiratory bronchioles (WHO, 2000).

In terms of health effects, particulate air pollution is associated with respiratory and cardiovascular morbidity, such as aggravation of asthma, respiratory symptoms and an increase in hospital admissions. Inhalable PM also leads to increased mortality from cardiovascular and respiratory diseases and from lung cancer (WHO, 2013). A study was undertaken to investigate the association between proximity to mine dumps and prevalence of chronic respiratory disease in people aged 55 years and older (Nkosi, Wichmann, & Voyi, 2015). Elderly people in communities 1-2 km (exposed) and ≥5 km (unexposed), from five mine dumps in Gauteng and North West Province, in South Africa were included in a cross-sectional study. The results showed that exposed elderly people had a significantly higher prevalence of chronic respiratory symptoms and diseases than those who were unexposed.

In the past, daily particulate concentrations were in the range 100 to 1 000µg/m^3 whereas in more recent times, daily concentrations are between 10 and 100µg/m^3. However, it has been found that overall, exposure-response can be described as curvilinear, with small absolute changes in exposure at the low end of the curve having similar effects on mortality to large absolute changes at the high end (WHO, 2000). Both short-term and long-term exposure to particulate matter in the air can have health impacts (Table 7-27).

Table 7-27: Short-term and long-term health effects associated with exposure to PM (WHO, 2004).

POLLUTANT	SHORT-TERM EXPOSURE	LONG-TERM EXPOSURE
Particulate matter	• Lung inflammatory reactions • Respiratory symptoms • Adverse effects on the cardiovascular system • Increase in medication usage • Increase in hospital admissions • Increase in mortality	• Increase in lower respiratory symptoms • Reduction in lung function in children • Increase in chronic obstructive pulmonary disease • Reduction in lung function in adults • Reduction in life expectancy • Reduction in lung function development

Short-term Exposure

There is good evidence that short-term exposure to particulate matter is associated with health effects (WHO, 2013). Health effects associated with short-term exposure to particulates include increases in lower respiratory symptoms, medication use and small reductions in lung function. Susceptible groups with pre-existing lung or heart disease, as well as elderly people and children, are particularly vulnerable. Exposure to particulate matter affects lung development in children, including reversible deficits in lung function as well as chronically reduced lung growth rate and a deficit in long-term lung function (WHO, 2011). There is no evidence of a safe level of exposure or a threshold below which no adverse health effects occur (WHO, 2013).

Long-term Exposure

Long-term exposure to low concentrations (~10µg/m^3) of particulates is associated with mortality and other chronic effects such as increased rates of bronchitis and reduced lung function (WHO, 2000). Studies have indicated an association between lung function, chronic respiratory disease and airborne particles. Relative risk estimates suggest an 11% increase in cough and bronchitis rates for each 10µg/m^3 increase in annual average particulate concentrations (WHO, 2000). Based on studies conducted in the USA, Europe and Canada, mortality is estimated to increase by 0.2–0.6% per 10 µg/m^3 of PM_{10} (WHO, 2005; Samoli, et al., 2008). $PM_{2.5}$ is a higher risk factor than the coarse part of PM_{10} (particles in the 2.5–10 µm range), especially as a consequence of long-term exposure. Long-term exposure to $PM_{2.5}$ is associated with an increase in the long-term risk of cardiopulmonary mortality by 6–13% per 10 µg/m^3 of $PM_{2.5}$ (Beelen, et al., 2008; Krewski, et al., 2009; Pope III, et al., 2002).

Background PM Concentrations

The closest air quality monitoring stations to the Soweto Cluster are the Mogale City, and Jabavu monitoring stations. The former is run by the West Rand District Municipality, while the latter is part of the City of Johannesburg network. The graph (compiled on the South African Air Quality Information System (SAAQIS) website) of the measured average daily PM_{10} ambient concentrations at these monitoring stations illustrates the high ambient concentrations of PM_{10} in the area, with several exceedances of the NAAQS (Figure 7-44) which highlights and confirms the concern about air quality in this area. The more recent measurements at Jabavu indicate that although ambient concentrations are high, they have decreased since 2012.

There are also four dustfall monitoring stations in the vicinity of the Soweto Cluster. They are called Zwane 7500, Majadibodu, Moroeroe L.P. School and Mrs Matswee House 1121. Both Zwane 7500 and Majadibodu lie approximately 500 m from 2L24. Although Moroeroe L.P. School and Mrs Matswee House 1121 are not specifically close to the Soweto Cluster TSFs, Moroeroe L.P. School is situated within 200 m of a TSF to the north, and Mrs Matswee House 1121 lies within 300 m of a reclaimed TSF footprint to the north-east and within 400 m of a TSF to the north-west. The four sets of monitoring results, therefore, provide a reasonable comparison between the impacts of a sparsely vegetated TSF, a TSF with a fair amount of vegetation and a TSF footprint after reclamation.

The graph of the measured monthly average dustfall rates at these monitoring stations (Figure 7-77) illustrates that at both Zwane 7500 and Majadibodu there have been several exceedances of the maximum of 600mg/m^2/day for residential areas set in the National Dust Control Regulations. The dustfall rates at Moroeroe L.P. School and Mrs Matswee House 1121 are generally lower and have not had exceedances in sequential months. The lack of vegetation on 2L24 can be considered a significant causal factor of the high exceedances measured nearby. Therefore, the removal of the Soweto Cluster TSFs can be expected to bring about a marked improvement of the air quality of the nearby residential areas.

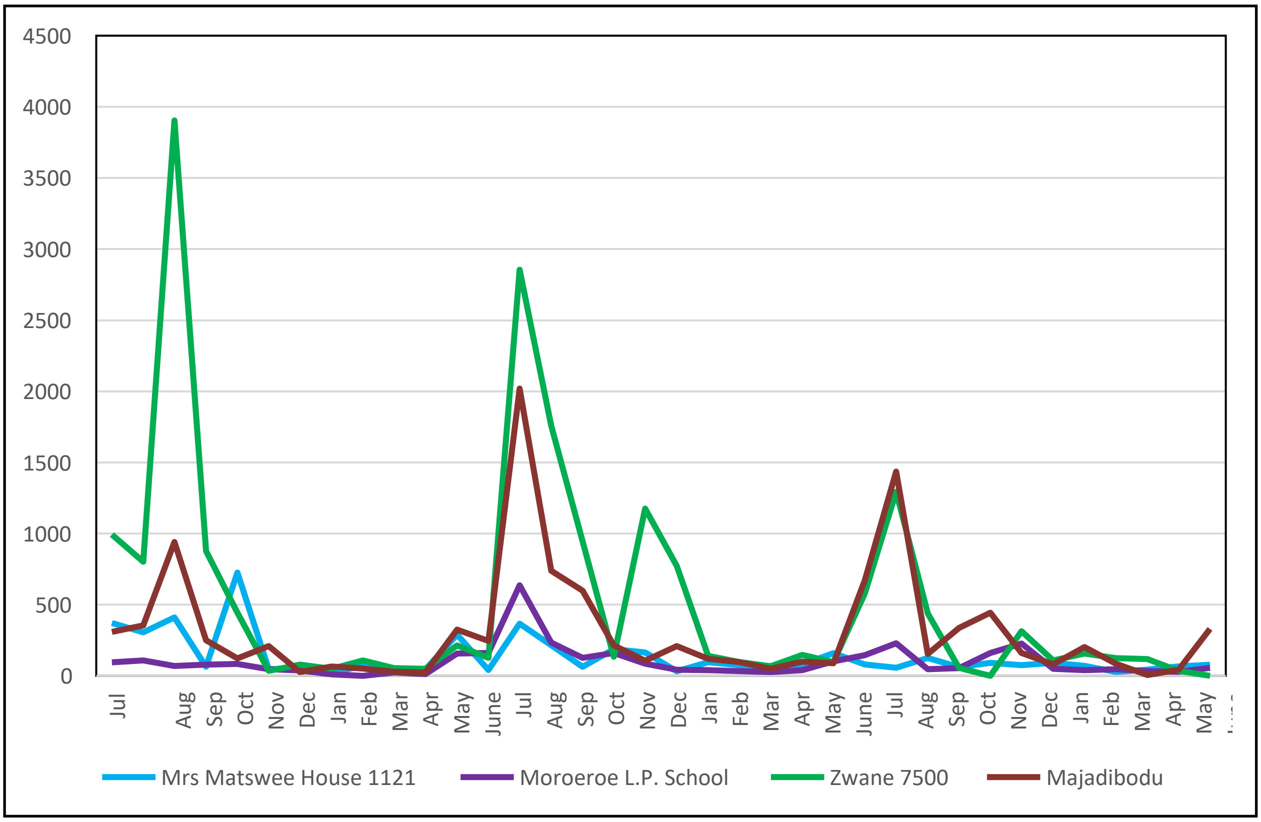


Figure 7-77: Monthly average dust deposition rates (mg/m^2/day) from July 2016 to June 2019.

Gondwana Environmental Solutions International was appointed by Kongiwe Environmental (Pty) Ltd to undertake an Air Quality Impact Assessment (AQIA) for the proposed construction and operational activities associated with the proposed Project. The main objective of the AQIA is to determine the potential impact of emissions from the construction and operational activities associated with the proposed Project on ambient air quality in terms of the criteria air pollutants and dust fallout.

Gondwana found that construction may be a short term source of dust emissions, and may have a temporary impact on local air quality. Erection of temporary infrastructure, stripping of vegetation and road construction are three examples of construction activities with emissions potential. However, dust emissions often vary substantially from day to day, depending on the level of activity, the specific operations, and the prevailing meteorological conditions.

The most significant pollutant that is generated from construction activities, clearing of vegetation, loading and unloading sand, hauling over unpaved road surfaces, and from wind erosion of TSFs is particulate matter (PM). PM with an aerodynamic diameter of less than 2.5 micrometers (µm) ($PM_{2.5}$) and particulate matter with an aerodynamic diameter of less than 10µm (PM_{10}) are criteria pollutants and are therefore subject to legislated control.

The AIQA modelling indicates that the reclamation of the sand dumps may be expected to cause increased PM emissions with exceedances of the NAAQS extending over approximately 250 m from the work face and the reclamation stations on windy days. However, the areas of impact do not extend over any residential areas.

The modelling indicates that the removal of the Soweto Cluster as a permanent pollution source will, in the long term, improve the air quality of the surrounding areas, and reduce the health risk of fine particulate matter inhalation for the surrounding communities.

7.15 Traffic Statement

Refer to Appendix D9 of this EIA report for a review of the Traffic Statement.

7.15.1 The current road network

The Road Classification and Access Management (RCAM) guideline 2010 provides for roads classification into the following six class systems:

- Class 1 Principal arterial
- Class 2 Major arterial
- Class 3 Minor arterial
- Class 4 Collector
- Class 5 Local street
- Class 6 Walkway

The first three classes (the arterials) are mobility roads, the second three classes are activity/access streets. A description of the existing road network is given in Table 7-28.

Table 7-28: Surrounding Road Network

ROAD NAME	ROAD CLASS	MANAGING AUTHORITY	ROAD FUNCTION	GENERAL
M77 Dobsonville Road (K102)	2	Gauteng Department of Roads and Transport (GAUTRANS)	Main corridor from K11 (Randfontein Rd/ Main Reef Rd) to Bram Fischerville (also including Randfontein and Carletonville in future based on planning).	This road bounds site 1 to the east and direct access to the site is proposed directly off this road opposite an existing access to the waste disposal site.
West End Street/ Hail Street	3	Johannesburg Roads Agency (JRA)	Functions as a distributor for the areas of Goudrand and Sol Plaatjes.	This road bounds site 2 to the south and direct access to the site is proposed directly off this road approx. 270m west of the mining operations access road
56th Street	3	Johannesburg Roads Agency (JRA)	Functions as part of a ring road and distributor for the area of Thulani.	This road bounds site 3 to the south and direct access to the site is proposed directly off this road approx. 750m east of the intersection with Mohajane Road.

7.15.2 Existing Traffic Demand

The Traffic specialist concluded that no traffic surveys were required given the traffic generated by the sites, the traffic distribution and project influence on existing traffic and road infrastructure is very limited. Considering the type of activities proposed, as well as the surrounding land-uses, it is expected that the critical traffic impact of the development will be during the weekday AM and PM peak traffic hours. The impact will be less than 15vph on each site, even during the construction phase.

7.15.3 Future Traffic Demand

Considering the existing and future planned surrounding road network, as well as the fact that the surrounding area is already somewhat developed, with large portions undeveloped, traffic growth at the proposed access positions to the sites will be average (3.0% - 4.0%). There are no future roads planned near the access positions, according to the JRA Road Master Planning and Gautrans Master Planning.

7.15.4 Trip Generation Conclusions (For all sites)

The expected trips to be generated by the proposed activities were based on trip rates as per the Applicant and COTO TMH17. The document recommends the following split for Heavy Industry (reclamation pump station) and trips are based on details provided by the client for the construction period:

- Weekday AM peak hour – 12 trips, with a 75:25 (in/out) directional split;

- Weekday PM peak hour – 10 trips, with a 25:75 (in/out) directional split.

As previously mentioned, the activities will include the construction and operation of a reclamation pump station. Based on this, the expected trips to be generated by the development during the weekday AM and PM peak traffic hours are indicated in Table 7-29 below. It is expected that all trips will be primary trips, and no adjustment factors were applied for mixed land-use, low vehicle ownership or transit nodes.

Table 7-29: Development Peak Hour Generated Trips

TMH17 CODE	LAND USE	EXTENT	AM PEAK			PM PEAK		
			In	Out	Total	In	Out	Total
120	Heavy Industry	1 pump station	9	3	12	2	8	10

7.15.5 Proposed Sites Access

The following access positions are proposed:

- **One (1) access to site 1** is proposed directly off Dobsonville Road M77 (K102), as indicated on Drawing 19050/AL/01 in the TIA Appendix D9. This access to the site is proposed opposite the existing waste disposal site access. The access must be 10m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from Dobsonville Road (M77) will have the right of way and a 'STOP' condition will be implemented for the proposed access. Proposed access details are shown on Drawing 19050/AL/01 in the TIA Appendix D9.
- **One (1) access to site 2** is proposed directly off West End Street/ Hail Street, as indicated on Drawing 19050/AL/02 in the TIA Appendix D9. This access to the site is proposed approx. 260m to the west of the mining operations access road. The access must be 10m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from West End Street/ Hail Street will have the right of way and a 'STOP' condition will be implemented for the proposed access. Proposed access details are shown on Drawing 19050/AL/02 in the TIA Appendix D9.
- **One (1) access to site 3** is proposed directly off 56th Street, as indicated on Drawing 19050/AL/03 in the TIA Appendix D9. This access to the site is proposed approx. 750m to the east of the intersection with Mohajane Road. The access must be 10m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from 56th Street will have the right of way and a 'STOP' condition will be implemented for the proposed access. Proposed access details are shown on Drawing 19050/AL/03 in the TIA Appendix D9.

7.15.6 Access Safety (For all Sites)

The following safety measures are proposed by the Traffic impact specialists:

- The current speed limit of 60km/h will be maintained, and the proposed speed limit signs are to be erected on both sides within 200m from the proposed.
- The proposed heavy vehicles turning signs is to be erected on both sides of the proposed accesses at least 100m from the proposed.

- The sight distance from the proposed access positions are 180m in both directions, this is more than the required sight distance for a 60km/h road as per COTO TMH16.
- In the event of slow-moving vehicles (abnormal sized trucks or loaded trucks) exiting the proposed access, a flag man will need to warn the traffic of the approaching danger and control the traffic approaching the proposed access to provide a safe and acceptable gap for the truck to enter the traffic.
- U-turn space will need to be provided on all sites to avoid dangerous movements within the traffic.
- A minimum stacking space of 24m (space for one truck) will need to be provided at the proposed accesses in front of any gate or boom, to avoid queueing onto the road and disrupting the traffic.

CHAPTER 8: IMPACT ASSESSMENT

8.1 Methodology for assessing the significance of Environmental Impacts

The impact significance rating process serves two purposes: firstly, it helps to highlight the critical impacts requiring consideration in the management and approval process; secondly, it shows the primary impact characteristics, as defined above, used to evaluate impact significance. As read within the DHSWS's Best Practice Guideline: G4 – Impact Prediction, there are three basic components that define an impact (or a risk). Figure 8-1 represents the relationship between these three components and their influence on the significance of a certain impact of a project.

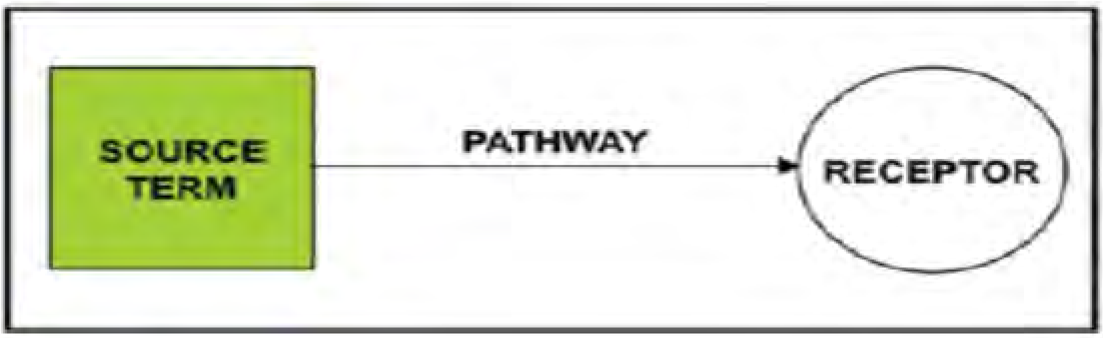


Figure 8-1:Impact prediction model.

The impact significance rating system is presented in Table 8-1, Table 8-2 and Table 8-3, and involves three parts:

- **Part A**: Define impact consequence using the three primary impact characteristics of magnitude, spatial scale/ population and duration;
- **Part B**: Use the matrix to determine a rating for impact consequence based on the definitions identified in Part A; and
- **Part C**: Use the matrix to determine the impact significance rating, which is a function of the impact consequence rating (from **Part B**) and the probability of occurrence.

8.1.1 Part A: Defining Consequence in Terms of Magnitude, Duration and Spatial Scale

Use these definitions to define the consequence in Part B.

Table 8-1: Consequence rating definitions.

IMPACT CHARACTERISTICS	DEFINITION	CRITERIA
Magnitude	Major -	Substantial deterioration or harm to receptors; receiving environment has an inherent value to stakeholders; receptors of impact are of conservation importance; or identified threshold often exceeded

IMPACT CHARACTERISTICS	DEFINITION	CRITERIA
	Moderate -	Moderate/measurable deterioration or harm to receptors; receiving environment moderately sensitive; or identified threshold occasionally exceeded
	Minor -	Minor deterioration (nuisance or minor deterioration) or harm to receptors; change to receiving environment not measurable; or identified threshold never exceeded
	Minor +	Minor improvement; change not measurable; or threshold never exceeded
	Moderate +	Moderate improvement; within or better than the threshold; or no observed reaction
	Major +	Substantial improvement; within or better than the threshold; or favourable publicity
Spatial scale or population	Site or local	Site specific or confined to the immediate project area
	Regional	May be defined in various ways, e.g. cadastral, catchment, topographic
	National/ International	Nationally or beyond
Duration	Short term	Up to 18 months.
	Medium term	18 months to 5 years
	Long term	Longer than 5 years

8.1.2 Part B: Determining Consequence Rating

Rate consequence based on definition of magnitude, spatial extent and duration.

Table 8-2: Consequence rating methodology.

MAGNITUDE	DURATION	SPATIAL SCALE/ POPULATION		
		Site or Local	Regional	National/ International
Minor	Long term	Medium	Medium	High
	Medium term	Low	Low	Medium
	Short term	Low	Low	Medium
Moderate	Long term	Medium	High	High
	Medium term	Medium	Medium	High
	Short term	Low	Medium	Medium
Major	Long term	High	High	High
	Medium term	Medium	Medium	High
	Short term	Medium	Medium	High

8.1.3 Part C: Determining Significance Rating

Rate significance based on consequence and probability.

Table 8-3: Significance rating methodology.

PROBABILITY (OF EXPOSURE TO IMPACTS)	CONSEQUENCE NEGATIVE			CONSEQUENCE POSITIVE		
	Low	Medium	High	Low	Medium	High
Definite	Medium	Medium	High	Medium	Medium	High
Possible	Low	Medium	High	Low	Medium	High
Unlikely	Low	Low	Medium	Low	Low	Medium

8.2 Impacts and Cumulative Impacts Identified

This Subchapter serves to provide insight on the major positive, negative and cumulative impacts associated with the development of the Soweto Cluster Project. The potential impacts are discussed per environmental feature/ aspect. For more detail please refer to the specialist study contained in the appendices.

No impacts have been assessed for traffic. The planned activities are supported from a traffic flow and traffic safety viewpoint, provided that the recommendations made in the traffic statement (Appendix D9) are implemented.

8.2.1 Construction Phase

Crown Gold will commence with the pre-construction and construction phase for its project related infrastructure in line with its approved environmental authorisations. During the construction phase the following activities will take place on site:

Table 8-4: Summary table of the Activities associated with the construction phase of the project

ACTIVITY	DESCRIPTION
Pre-Construction	
1	Conduct Radiation Survey
2	Removal of vegetation and site clearance
3	Preparation of access roads
Construction Phase	
4	Employment of workers (minimal)
5	Construction of Pump station
6	Construction of pipelines
7	Operation of construction machinery and vehicles
8	Temporary storage of construction materials and hazardous material such as contaminated soil
9	Instatement of waste management and dust control measures on site

8.2.1.1 Biodiversity (Fauna, Flora and Herpetology)

The impacts identified during the various ecological surveys that are having a negative ecological impact in the project area were identified, are listed below. Due to the nature (mainly built up urban environment) and locality of the project area, the impacts were extensive, especially within the transformed areas. Impacts in the project area include:

- Presence of alien and invasive plant species which have altered natural vegetation communities;
- Human encroachment;
- Dumping of building litter, general waste and sewerage run-off;
- Old Mine tailing and the associated run-off;
- Snaring and animal trapping/Poaching and hunting with dogs;
- Existing mining and urban infrastructure;
- Unregulated burning and excavations;
- Fencing; and
- Telephone lines and power lines within the vicinity of the project area.

The following potential impacts on the biodiversity were considered for the construction phase of the proposed development. This phase refers to the period during construction when the proposed features are constructed or upgraded. This phase is considered to have the largest direct impact on biodiversity. The following potential impacts to terrestrial biodiversity were considered:

- Destruction, further loss and fragmentation of the remaining natural vegetation community, including CBA: Important and ESA;
- Introduction of alien species, especially plants; and
- Displacement of faunal community due to habitat loss, direct mortalities and disturbance (road collisions, noise, dust, vibration and possible poaching).

Table 8-5: Assessment of significance of potential construction impacts of the development area pre- and post- mitigation.

IMPACT NO.	AFFECTED ENVIRONMENT	ACTIVITY	IMPACT DESCRIPTION	BEFORE MITIGATION SIGNIFICANCE	CUMULATIVE IMPACT	MITIGATION MEASURES / RECOMMENDATIONS	AFTER MITIGATION SIGNIFICANCE
CONSTRUCTION							
1	Biodiversity	Site clearance for development of new and upgrade of infrastructure as well as disturbances such as noise and dust	Loss of areas classified as CBA and ESA and high sensitivity areas	Medium	Yes	Avoid CBA and high sensitivity areas and implement buffer zones	Low
2	Biodiversity	Site clearance for development of new and upgrade of infrastructure as well as disturbances such as noise and dust	Loss of CR, EN and VU listed habitat (NBA, 2011)	Medium	Yes	Avoid high biodiversity sensitivity areas (natural vegetations & wetlands) and comply to prescribed buffer zones.	Low
3	Flora	Site clearance for development of new and upgrade of infrastructure as well as disturbances such as noise and dust	Encroachment of alien invasive plant species	Medium	Yes	An alien invasive plant management plan needs to be compiled and implemented during construction to prevent the growth of invasive plants on cleared areas	Low
4	Fauna	Site clearance for development of new and upgrade of infrastructure as well as disturbances such as noise and dust	Loss of habitat for potential SCC	Medium	Yes	Avoid high biodiversity sensitivity areas (natural vegetations & wetlands) and comply to prescribed buffer zones.	Low
5	Fauna	Site clearance for development of new and upgrade of infrastructure as well as disturbances such as noise and dust	Loss of potential SCC.	Medium	Yes	Avoid high biodiversity sensitivity areas (natural vegetation & wetlands) and comply to prescribed buffer zones; Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during construction.	Low

8.2.1.2 Wetlands

A risk assessment was conducted in line with Section 21 (c) and (i) of NWA to investigate the level of risk posed by the project. Table 8-6 lists the potential risks posed by the project to wetlands within the project area as well as those within the 500m regulated area surrounding it. The risk matrix provides risk significance ratings for scenarios both without and with successful implementation of mitigation.

As minimal built infrastructure (aside from the satellite reclamation stations) is required for the reclamation areas, the majority of construction-related activities are expected to centre on the installation of the two pipelines (50 cm diameter) set to convey clean water and process slurry to and from the reclamation areas respectively. The above ground design of these pipelines is preferential to below-ground installation as it poses less of disturbance risk to wetland soils, vegetation and flow regimes. Despite this, pipeline installation has the potential to result in several Moderate risks related to clearing of wetland vegetation along pipeline route, disruption of wetland soil profile through the installation of pipeline plinths, increased bare surfaces, runoff and potential for erosion. However, these risks can be reduced to a Low significance through mitigation. Both pipeline alternatives (1 and 2) represent viable options, however, the number of significant wetlands crossed would be reduced by opting for the east-bound route Alternative 2. Alternative 1, in contrast, crosses HGM 1, 2 and 3 some of the larger, more ecologically important systems within the project area. and is the less preferable option. If this route is ultimately opted for it is recommended that the Wonderfonteinspruit crossing be shifted marginally to align with the existing dam wall (as opposed to traversing the wetland as is currently the case).

The most important mitigations pertain to the pipeline construction. The specialist has made the following recommendations:

- Ensure pipeline alternative 1 spans the Wonderfonteinspruit via the proposed dam wall crossing point.
- Request the wetland shapefiles from TBC and use them to demarcate (on the ground) where the pipeline enters and exits the 30 m buffer assigned to the boundary of each wetland.
- In these wetland crossing areas restrict all pipeline construction activities to a 10 m corridor on either side of the route. Demarcate the construction corridor with high visibility plastic fencing and minimize unnecessary clearing of vegetation beyond this area.
- Pipelines crossings should preferably span the watercourses and be above-ground. This prevents disruptions to sub surface flow dynamics and allows the pipeline to be monitored for leaks. It should be noted that; as the pipeline is temporary, it will cross most wetlands on existing structures, thereafter it will be laid directly onto the ground without plinths or concrete. However, the pipeline must be secured and attached to existing structures avoiding direct risks. Preferably sleeved to avoid leaks and spills
- When a pipeline spans a water resource, it should be attached to any existing crossing or bridge structures. This will limit the need to disturb new areas of the systems with the construction of new structures.
- Do not situate any of the construction material laydown areas within any wetland.
- Document the soil profile on removal and check the order in which soil is replaced.

- Make sure that the soil is backfilled and compacted
- The number and size of supporting plinths must be kept to a minimum and avoid wetland areas and the associated buffer as much as possible.
- If the plinth support structures are needed for the pipeline to span a water resource, then plinths should be placed outside of preferential flow paths.
- Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility.
- Mixing of concrete must under no circumstances take place within the permanent or seasonal zones of the wetland.
- Pre-fabricated structures should be made use of (where possible) to avoid the mixing of these materials on site, reducing the likelihood of onsite contamination.

Table 8-6: DWS Risk Impact Matrix for the Soweto Cluster Project During Construction

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ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY: Flow Regime	SEVERITY: Water Quality	SEVERITY: Habitat	SEVERITY: Biota	SEVERITY: Total	SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
CONSTRUCTION																			
Site clearing and installation of pipelines.	Direct disturbance.	Disturbance of wetland vegetation along pipeline route.	Without	1	3	3	3	2.5	2	3	7.5	1	1	5	1	8	60	M	❖ Use the wetland shapefiles from TBC to demarcate (on the ground) where the pipeline enters and exits the 30 m buffer assigned to the boundary of each wetland. ❖ In these wetland crossing areas restrict all pipeline construction activities to a 10 m corridor on either side of the route. Demarcate the construction corridor with high visibility plastic fencing. ❖ Restrict all construction activities to within the proposed infrastructure area and minimize the disturbance footprint and the unnecessary clearing of vegetation outside of this area. ❖ Do not situate any of the construction material laydown areas within any wetland. ❖ No machinery should be allowed to parked in any wetlands. Pipelines crossings should span the watercourses above ground as is the current plan. This prevents disruptions to sub surface flow dynamics and allows the pipeline to be monitored for leaks; ❖ When a pipeline spans a water resource, it should be attached to any existing crossing or bridge structures. This will limit the need to disturb new areas of the systems with the construction of new structures.
			With	1	2	2	2	1.8	1	2	4.8	1	1	5	1	8	38	L	
		Disruption of wetland soil profile through the installation of pipeline plinths.	Without	3	2	2	1	2	2	4	8	1	1	5	2	9	72	M	❖ Document the soil profile on removal and check the order in which soil is replaced. ❖ Ensure that topsoil is appropriately stored and re-applied during trench backfilling. ❖ Make sure that the soil is backfilled and compacted ❖ The proposed pipeline will be aboveground. The number and size of plinths must be kept to a minimum, and
			With	2	1	1	1	1.3	1	1	3.3	1	1	5	2	9	29.25	L	

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ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY: Flow Regime	SEVERITY: Water Quality	SEVERITY: Habitat	SEVERITY: Biota	SEVERITY: Total	SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
																			avoid wetland areas and the associated buffer as much as possible ❖ If plinth support structures are needed for the pipeline to span a water resource, then plinths should be placed outside of preferential flow paths.
	Indirect wetland disturbance.	Increased bare surfaces, runoff and potential for erosion	Without	3	3	3	3	3	2	3	8	1	1	5	1	8	64	M	❖ Minimize unnecessary clearing of vegetation. ❖ Landscape and re-vegetate all large denuded areas as soon as possible. ❖ Appropriately stockpile topsoil cleared from the project area. ❖ Clearly demarcate construction footprint, and limit all activities to within this area ❖ Silt traps and fences must be placed in the preferential flow paths along the route to prevent sedimentation of the watercourse ❖ Temporary stormwater channels should be filled with aggregate and/or logs (branches included) to dissipate flows.
			With	2	2	2	2	2	1	1	4	1	1	5	2	9	36	L	
	Contamination.	Contamination of wetlands with hydrocarbons due to leaks and spillages from machinery, equipment & vehicles as well as Contamination and eutrophication of wetland systems with human sewerage and litter.	Without	1	4	2	2	2.3	1	1	4.3	1	1	5	2	9	38.25	L	❖ Make sure all excess consumables and building materials / rubble is removed from site and deposited at an appropriate waste facility. ❖ Appropriately contain any generator diesel storage tanks, machinery spills (e.g. accidental spills of hydrocarbons oils, diesel etc.) or construction materials on site (e.g. concrete) in such a way as to prevent them leaking and entering the environment. ❖ Mixing of concrete must under no circumstances take place within the permanent or seasonal zones of the wetland. Scrape the area where mixing and storage of sand and concrete occurred to clean once finished (preferably store on the south-eastern side of the project area). ❖ Pre-fabricated structures should be made use of (where possible) to avoid the mixing of these materials on site,
			With	1	4	2	2	2.3	1	1	4.3	1	1	1	2	5	21.25	L	
			With	1	1	1	2	1.3	2	2	5.3	1	1	5	2	9	47.25	L	
			With	1	1	1	1	1	2	2	5	1	1	5	2	9	45	L	

Andrew Husted Pr Sci Nat 400213/11																			
ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY					SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
				Flow Regime	Water Quality	Habitat	Biota	Total											
																			reducing the likelihood of onsite contamination.

8.2.1.3 Surface Water

The activities and impacts that are likely to occur during the construction phase are summarised in Table 8-7.

Table 8-7: Summary of activities and impacts for the construction phase.

ACTIVITY	IMPACT DESCRIPTION
Removal of vegetation and exposure of soils.	**Impact 1:** Erosion and consequent increase in Total Suspended solids (TSS) of surface water resources leading to deteriorated water quality.
Lay down of impermeable surfaces such as concrete.	**Impact 2:** Increased velocity in surface water runoff leading to erosion and consequent increase in TSS of surface water resources.
Alteration to the natural topography (excavations, shaft portal, dumps, etc.).	**Impact 3:** Alteration in surface water drainage patterns leading to erosion and consequent increase in TSS of surface water resources.

Table 8-8: Significance rating of construction impact 1.

NATURE OF IMPACT 1: The removal of vegetation will expose soils to water erosion that may lead to a deterioration in water quality of surrounding surface water in terms of increased TSS and turbidity		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Short term (construction phase period)	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	Minor
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Negative	
Irreplaceable loss of resources: (Yes or No)	Irreversible	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ None foreseen		
Mitigation measures ❖ Temporary erosion control measures that reduce flow velocity (e.g. runoff berms) should be implemented around construction areas; ❖ Clearance of vegetation must be limited as far as possible; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites.		

Table 8-9: Significance rating of construction impact 2.

NATURE OF IMPACT 2: Lay down of impermeable areas is likely to result in increased velocity in surface water runoff, that may lead to erosion and consequent increase in TSS of surface water resources		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**

Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Short term (construction phase period)	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	Minor
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None foreseen		
Mitigation measures ❖ Measures (energy dissipaters, detention dams, swales, etc.) that reduce flow velocity from impermeable areas should be implemented; ❖ Impermeable areas must not be constructed unnecessarily; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.		

Table 8-10: Significance rating of construction impact 3.

NATURE OF IMPACT 3: Changes in the topography are likely to result in an alteration in surface water drainage patterns leading to erosion and a consequent increase in TSS of surface water resources		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Short term (construction phase period)	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	Minor
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None foreseen		
Mitigation measures ❖ Stormwater management measures should be implemented around working areas; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites. Specific parameters that should be monitored include TSS and turbidity. They should be kept within the baseline water quality range.		

8.2.1.4 Groundwater

The Soweto Cluster is a combination of old tailings dams and sand dumps and negative water quality impacts have been observed in surface water resources around the dumps – surface sampling sites SW2 and SW4 (Hydrospatial, Surface Water Impact Assessment Report, September 2019) (Figure 2) (Table 4). The water bodies present acidic pH levels and the salt and metal concentrations are very high and exceed SANS 241 Drinking Water Limits, as well as the Klip River In-stream Water Quality Objectives. Unfortunately, no groundwater monitoring point exists in the area to define current groundwater qualities.

No additional impact is expected on the groundwater quantity and quality during the construction phase. Construction will be conducted in a relatively short period compared to the operational and post-closure phases. Impacts on the groundwater environment are therefore rated as Low.

Table 8-11: Construction Phase water quality impacts.

NATURE OF THE IMPACT: Impact on the local groundwater quality		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Short term	Short term
Magnitude *(Major, Moderate, Minor)*	Minor -	Minor +
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Low**	**Low**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and sanitation management problems. Refer to Chapter 10 of the Groundwater Impact Assessment	

Mitigation measures

- Implement a groundwater monitoring programme before reclamation starts. Dedicated groundwater monitoring boreholes are required to effectively measure the current groundwater status, impacts of the reclamation activities on the groundwater environment and changes in groundwater qualities and levels post closure.
- Develop sound surface runoff management plans to ensure that all dirty runoff is contained and diverted to the paddocks. No pooling of water on surface allowed.
- Ensure that paddocks are designed to contain all dirty water generated during the reclamation
- process, to prevent overflows and spillages.

8.2.1.5 Air Quality

Impacts expected to occur are the generation of nuisance dust during construction of the infrastructure. It is proposed that emissions must be monitored and if the increase in emissions from the reclamation activities cause the pre-operational phase dustfall levels to rise above the limits set by the National Dustfall Regulations, the mitigation programme will have to be increased until compliance is achieved.

Table 8-12: Construction Phase air quality impacts.

<table>
<tr><td colspan="3"><u>NATURE OF THE IMPACT 1:</u> Dust generated from soil stripping activities, construction of infrastructure and traffic on access roads</td></tr>
<tr><td>Acceptable rating level</td><td colspan="2">PM10
❖ 24-hour Average Concentrations: National Ambient Air Quality Standard of 75µg/m³
❖ Annual Average Concentrations: National Ambient Air Quality Standard of 40µg/m³
PM2.5
❖ 24-hour Average Concentrations: National Ambient Air Quality Standard of 40µg/m³
❖ Annual Average Concentrations: National Ambient Air Quality Standard of 20µg/m³</td></tr>
<tr><td></td><td>Impact Rating Without Mitigation</td><td>Impact Rating with Mitigation</td></tr>
<tr><td>Impact Status: (positive or negative)</td><td>Negative</td><td>Negative</td></tr>
<tr><td>Extent (Local, Regional, International)</td><td>Local</td><td>Local</td></tr>
<tr><td>Duration (Short term, Medium term, Long term)</td><td>Short term</td><td>Short term</td></tr>
<tr><td>Magnitude (Major, Moderate, Minor)</td><td>Minor -</td><td>Minor -</td></tr>
<tr><td>Probability (Definite, Possible, Unlikely)</td><td>Definite</td><td>Possible</td></tr>
<tr><td>Calculated Significance Rating (Low, Medium, High)</td><td>Medium</td><td>Low</td></tr>
<tr><td>Reversibility: (Reversible or Irreversible)</td><td colspan="2">Yes</td></tr>
<tr><td>Irreplaceable loss of resources: (Yes or No)</td><td colspan="2">No</td></tr>
<tr><td>Cumulative impacts (yes or no)</td><td colspan="2">No</td></tr>
<tr><td colspan="3">Mitigation measures
❖ Keep areas to be cleared as small as possible.
❖ Strict speed control of 40km/hr on all gravel roads;
❖ A strict speed limit of 20km/hr on site tracks
❖ Restriction of the use of storage piles.</td></tr>
</table>

8.2.1.6 Noise

Potential noise levels were calculated in section 8.1 of the Noise Impact Assessment (Appendix D5). The potential significance of the noise impacts is summarized in

Table 8-13 for the construction of the reclamation pump station and Table 8-14 for potential daytime maintenance or repair activities (for an arbitrary location).

It is the opinion of the specialist that the potential of a noise impact would be of a low significance.

Table 8-13: Impact Assessment: Construction Activities during the day at 2L17/18, 2L16, 2L6, 2L20/21,2L8

<table>
<tr><td colspan="3"><u>NATURE OF THE IMPACT 1:</u> Increased total noise levels in the area, changing existing ambient sound levels at receptors as a result of numerous simultaneous construction activities during the day</td></tr>
<tr><td>Acceptable Rating Level</td><td colspan="2">Urban noise district.
Use $L_{Req,D}$ of 55 dBA</td></tr>
<tr><td></td><td>Impact Rating Without Mitigation</td><td>Impact Rating</td></tr>
</table>

NATURE OF THE IMPACT 1: Increased total noise levels in the area, changing existing ambient sound levels at receptors as a result of numerous simultaneous construction activities during the day		
		with Mitigation
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	No mitigation required.
Duration *(Short term, Medium term, Long term)*	Noise levels will be elevated for the construction phase. **Short Term**	
Magnitude *(Major, Moderate, Minor)*	Daytime noise levels will be less than the acceptable noise rating level for a rural area. **Minor negative**	
Probability *(Definite, Possible, Unlikely)*	Ambient sound levels could be low at times and the activities may be audible but it will not be disturbing. **Unlikely**	
Calculated Significance Rating (Low, Medium, High)	**Low**	
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ Significance of the noise impact is Low and no additional mitigation measures are required.		

Table 8-14: Impact Assessment: Construction Activities during the day at 2L24

NATURE OF THE IMPACT 1: Increased total noise levels in the area, changing existing ambient sound levels at receptors as a result of numerous simultaneous construction activities during the day		
Acceptable Rating Level	Urban noise district. Use $L_{Req,D}$ of 55 dBA	
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Local**
Duration *(Short term, Medium term, Long term)*	Noise levels will be elevated for the construction phase. **Short Term**	Noise levels will be elevated for the construction phase. **Short Term**

NATURE OF THE IMPACT 1: Increased total noise levels in the area, changing existing ambient sound levels at receptors as a result of numerous simultaneous construction activities during the day		
Magnitude *(Major, Moderate, Minor)*	Daytime noise levels will be less than the acceptable noise rating level for a rural area. **Minor negative**	Daytime noise levels will be less than 55 dBA at the closest receptors living close to the reclamation activity. **Minor negative**
Probability *(Definite, Possible, Unlikely)*	Urban environment with high ambient sound levels at times. **Possible**	Urban environment with high ambient sound levels at times. **Possible**
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ Crown Gold can make use of berms to shield noise generators. ❖ the activity from the NSD that would reduce the noise levels.		

Table 8-15: Impact Assessment: Daytime Maintenance and Repair activities

NATURE OF THE IMPACT 2: Increased total noise levels in the area, changing existing ambient sound levels at receptors as a result of potential maintenance and repair activities during the day. Increased total noise levels in the area, changing existing ambient sound levels at receptors. Noise levels may be higher than ❖ 45 dBA within 2200 m from the activity; ❖ 50 dBA within 140 m; and ❖ 55 dBA within 100 m.		
Acceptable Rating Level	Rural noise district. Use $L_{Req,D}$ of 45 dBA	
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	No mitigation required.
Duration *(Short term, Medium term, Long term)*	Noise levels will be elevated for the construction phase. **Short Term**	
Magnitude *(Major, Moderate, Minor)*	Daytime noise levels may be higher than 55 dBA at the closest receptors living close to the existing pipeline alignment. **Major negative**	

***Probability** (Definite, Possible, Unlikely)*	The activity will be very temporary and the activities may be disturbing during the event. However, the activity will only be required for maintenance or repair (unlikely to occur). **Unlikely**	
Calculated Significance Rating (Low, Medium, High)	**Low**	
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ Significance of the noise impact is Low and no additional mitigation measures are required.		

8.2.1.7 Heritage and Palaeontology

The HIA identified fourteen heritage resources and these are described in the table below. Their positions are shown in Figure 7-67 and Appendix D7 of this EIA report. Eleven of these sites are historical structures or the remains of such structures, of which only two sites (**SC004** and **SC007**) are considered to have medium heritage significance and would require mitigation measures. The remaining historical structure sites (**SC001-003, SC006, SC008-011, SC013)** are considered to be of low to no heritage significance, and several of them have been recorded by previous heritage studies in the general area (du Piesanie 2014; Birkholtz 2018). Two of the sites identified are a burial ground (**SC005**) and possible graves (**SC014**), which are considered to have very high significance and would require mitigation measures. One of the sites is an informal church area (**SC012**) that is considered to be of Medium significance and would also require mitigation measures. However, sites **SC002, SC004, SC006, SC007, SC009**, and **SC011** all contain structures or remains that are 60 years or older and will require a permit to be obtained if they are required to be demolished.

Although several of the slimes dams/ sand dumps are older than 65 years and could technically be described as “man-made structures”, it is the considered opinion of the heritage specialist that there is no heritage significance attached to the actual slimes dams/sand dumps.

The HIA has noted that previous development and construction projects in the general area have identified and uncovered several unmarked burial grounds (i.e. two at Fleurfhof and one at Stormill). The heritage specialist concluded that there may be the possibility of historical graves existing under (or inside) five of the dumps. A chance find protocol for heritage resources has been developed for this project, and is included in the EMPr.

It is possible that cultural material will be exposed during construction and may be recoverable, keeping in mind delays can be costly during construction and as such must be minimised. It is also possible that some alterations may take place during the construction phase of the project and these must be catered for. Temporary infrastructure developments, such as construction camps and laydown areas, are often changed or added to the project as required. In general, these are low impact developments as they are superficial, resulting in little alteration of the land surface.

During the construction and operation phase, it is important to recognize any significant material being unearthed, making the correct judgment on which actions should be taken. It is recommended that a chance find procedure be implemented. A chance find protocol has been included into the EMPr. Impacts have been assessed for the construction and operation phase.

Table 8-16: Impacts on possible heritage resources during the construction phase

No.	Affected Environment	Activity	Impact Description	BEFORE MITIGATION Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE	Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
CONSTRUCTION AND OPERATION																	
1	SC004	Construction	Destruction of historical mining compound complex	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	Implement 30m buffer around site If buffer zone cannot be maintained then appropriate mitigation measures will need to be enacted	*Minor -*	*Medium Term 18 months - 5 years*	*Site or Local*	Low	*Possible*	Low
2	SC007	Construction	Destruction of historical mine houses	*-Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Unlikely*	Low	Yes	Implement a 30m buffer zone around site	*Minor -*	*Medium Term18 months- 5 years*	*Site or Local*	Low	*Unlikely*	Low
3	SC005	Construction	Destruction of burial ground	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	Implement 30m buffer around site If buffer zone cannot be maintained then appropriate mitigation measures will need to be enacted with social consultation	*Moderate--*	*Medium Term18 months- 5 years*	*Site or Local*	Medium	*Possible*	Medium
4	SC014	Construction	Destruction of possible graves	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	Yes	Archaeological monitoring and possible exhumation and relocation	*Minor -*	*Short-term < 18 months*	*Site or Local*	Low	*Possible*	Low
5	SC012	Construction	Destruction of religious site/ living heritage	*Moderate*	*Short term <18 months*	*Site or Local*	Low	*Possible*	Low	Yes	Social consultation regarding alternative site	*Minor -*	*Short-term < 18 months*	*Site or Local*	Low	*Possible*	Low
6	SC001	Construction/ Operation	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low	No	No mitigation required	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low
7	SC002	Construction	Destruction of historical structure	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	Yes	Permit from PHRAG required for destruction	*Minor -*	*Medium term 18 months - 5 years*	*Site or Local*	Low	*Possible*	Low

8	SC003	Construction	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Unlikely*	Low	No	No Mitigation required	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Unlikely*	Low
9	SC006	Construction	Destruction of historical structure	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	Permit from PHRAG required for destruction	*Minor -*	*Medium term 18 months - 5 years*	*Site or Local*	Low	*Possible*	Low
10	SC008	Construction	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low	No	No Mitigation required	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low
11	SC009	Construction	Destruction of historical structure	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Definite*	Medium	Yes	Permit from PHRAG required for destruction	*Minor -*	*Medium term 18 months - 5 years*	*Site or Local*	Low	*Possible*	Low
12	SC010	Construction	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low	No	No Mitigation required	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low
13	SC011	Construction	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Unlikely*	Low	Yes	No Mitigation required	*Minor*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low
14	SC013	Construction	Destruction of historical structure	*Minor -*	*Short term >18 months*	*Site or Local*	Low	*Definite*	Medium	No	No Mitigation required	*Minor*	*Short term >18 months*	*Site or Local*	Low	*Possible*	Low

8.2.1.8 Social Impact

Refer to Chapter 7, section 7.13.6 for a description of the anticipated social impacts of the proposed project.

Table 8-17: Impacts on Job security and skills development

NATURE OF THE IMPACT 1: Job Security and Skills Development		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Positive**	**Positive**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Moderate +	Major +
Probability	Definite	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	

Residual impacts

- The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience;
- Improved economic development;
- Increased capacity to develop and maintain livelihood strategies.

Mitigation measures

- Establish targets for employment and training;
- Effective implementation of training and skills development initiatives;
- It is recommended that as part of the CSI programme, the contractor makes use of local labour as and when required;
- Equip employees with the required skills and competencies to effectively implement their employment responsibilities and progress to higher levels of employment within the company;
- Comply with the Skills Development Act, (Act No.97 of 1998);

Table 8-18: Impacts of stimulating economic growth.

NATURE OF THE IMPACT 2: Stimulation of economic growth		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Low +	Major +
Probability	Definite	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	N/A	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	

NATURE OF THE IMPACT 2: Stimulation of economic growth
Residual impacts ❖ Developed local economy and local community members.
Mitigation measures ❖ Preference should be given to capable subcontractors who based within the local municipal area; ❖ Crown Gold to source local suppliers, HDSAs and Small, Medium and Micro-sized Enterprises (SMMEs) ❖ Encourage the company's existing suppliers to enter into a Joint Venture (JV) with local SMMEs to aid with the transfer of skills; ❖ Use the Department of Trade and Industry's (DTI) codes of good practice to guide the procurement process; ❖ Align skills development to build capacity of SMMEs.

Table 8-19: Safety Impacts for employees and communities

NATURE OF THE IMPACT 3: Creation of Informal settlements		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Short term	Short term
Magnitude	Moderate-	Moderate-
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Medium**
Reversibility: (Reversible or Irreversible)	Not applicable	
Irreplaceable loss of resources: (Yes or No)	Not applicable	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Increased perceptions of unsafety		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals; ❖ Crown Gold to collaborate with the CoJ and implement CoJ's land use management system to prevent illegal settlements.		

Table 8-20: Safety Impacts for employees and communities

NATURE OF THE IMPACT 4: Safety Impacts		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**

NATURE OF THE IMPACT 4: Safety Impacts		
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Moderate-
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes, strain on infrastructure and services is likely to persist.	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Increased perceptions of unsafety.		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals; ❖ Community members, including illegal miners, should be made aware of the hazards of accessing mine dumps through safety signs at the reclamation and deposition sites.		

Table 8-21: Increased dust levels and rise in associated health impact.

NATURE OF THE IMPACT 5: Increased dust levels and rise in associated health impacts		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Definite	Definite
Calculated Significance Rating	**High**	**Medium**
Reversibility:	Irreversible	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Compromised quality of life		
Mitigation measures ❖ Dust suppression techniques should be used to limit the amount of dust created during construction; ❖ It is also essential that dust fall out monitoring must be undertaken to monitor dust fall from the project; ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders;		

NATURE OF THE IMPACT 5: Increased dust levels and rise in associated health impacts
❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.

Table 8-22: Impacts on the Viva Settlement

NATURE OF IMPACT 6: Impacts on the Viva Settlements		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Medium Term
Magnitude	Possible	Possible
Probability *(Definite, Possible, Unlikely)*	Major-	Minor -
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Altered sense of place		
Mitigation measures ❖ When reclamation is to start, resettlement of people should be re-evaluated and conducted in a lawful manner on a case by case basis if required; ❖ The applicant to liaise with the CoJ and the property owner to address the issue of illegal settlers		

Table 8-23: Impacts on the spatial development and future land-use of the site

NATURE OF IMPACT 7: Impacts on the spatial development and future land-use of the site		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Medium term
Magnitude	Major-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Delayed development and increase on current housing backlogs		
Mitigation measures ❖ As far as possible avoid encroachment of pipelines on other development opportunities; ❖ Pipelines to be constructed away from homesteads, buildings and railway lines;		

NATURE OF IMPACT 7: Impacts on the spatial development and future land-use of the site
❖ Applicant to liaise with property developers (Dino Properties) to determine the exact stage of the Goudrand residential development.

Table 8-24: Impacts of increased nuisance factors

NATURE OF IMPACT 8: Increased nuisance factors and changed sense of place		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Altered sense of place		
Mitigation measures ❖ Minimise all nuisance factors such as noise, air quality and implement all mitigation measures as specified in the relevant specialist studies; ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors' ❖ Demarcate site with a 50 metre buffer; ❖ Implement stakeholder engagement as required by the National Heritage Resources Act, No 25 of 1999, in developing practical management measures to avoid further damage to the burial ground and allow community access.		

Table 8-25: Attitude Formation

NATURE OF IMPACT 9: Attitude formation could result in delays during project implementation and construction.		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Short Term	Short Term
Magnitude	Major-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	

NATURE OF IMPACT 9: Attitude formation could result in delays during project implementation and construction.	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature
Can impacts be enhanced: (Yes or No)	No
Residual impacts ❖ Negative perceptions associated with the applicant	
Mitigation measures ❖ To ensure effective consultation with community members during construction and operation of the proposed Project, it is advised that the applicant establishes a Community Consultation Forum that will comprise elected community representatives and aims to disseminate project information to community members.	

8.2.1.9 Community Health

8.2.1.9.1 Acid Mine Drainage

Historically the sources of pollution associated with slimes dumps and tailings facilities include:

- ❖ Contaminated storm water runoff;
- ❖ Seepage water from the dump, possibly containing high sulphates and metals; and
- ❖ Recharge of contaminated water by means of seepage from the dumps/TSF and any unlined storm water channels.

Groundwater quality will be negatively affected with the formation of AMD during the reclamation activities. The old tailings material contains pyrite minerals and when exposed to oxygen and water during reclamation it results in the formation of acidic conditions. The risk of groundwater contamination during the hydraulic mining will be low in view of the existing impacts, as long as the surface water management and containment guidelines are followed during the reclamation process.

The sulphate plume in the subsurface is generally limited to the weathered zone and will extend in a south-easterly direction. The concentration of pollutants will decrease as it moves further away from the site due to dispersion and dilution. Removal of the dump should however have a long-term positive impact on the groundwater quality, as the source of contamination is removed.

Monitoring of groundwater quality and water levels is recommended (up- and downgradient of the TSF) with continuous review and updating of the monitoring network based on the monitoring results.

Table 8-26: Impact Evaluation – Water Pollution

NATURE OF IMPACT 1: Ingestion of contaminated surface and groundwater. Surface water and groundwater pollution during reclamation as result of AMD water seeping into the aquifers and rivers		
Extent *(Local, Regional, International)*	Regional	Regional
Duration *(Short term, Medium term, Long term)*	Long Term > 5 years	Long Term > 5 years
Magnitude *(Major, Moderate, Minor)*	Major -	Major +

<table>
<tr><th colspan="3">NATURE OF IMPACT 1: Ingestion of contaminated surface and groundwater. Surface water and groundwater pollution during reclamation as result of AMD water seeping into the aquifers and rivers</th></tr>
<tr><td>Probability (Definite, Possible, Unlikely)</td><td>Definite (due to what is currently occurring at the site)</td><td>Possible</td></tr>
<tr><td>Calculated Significance Rating (Low, Medium, High)</td><td>High</td><td>High</td></tr>
<tr><td>Impact Status: (positive or negative)</td><td>Negative</td><td>Positive</td></tr>
<tr><td>Reversibility: (Reversible or Irreversible)</td><td colspan="2">Irreversible</td></tr>
<tr><td>Irreplaceable loss of resources: (Yes or No)</td><td colspan="2">No</td></tr>
<tr><td>Can impacts be enhanced: (Yes or No)</td><td colspan="2">Yes</td></tr>
<tr><td colspan="3">Residual impacts
❖ None</td></tr>
<tr><td colspan="3">Mitigation measures
❖ Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted to the paddocks and emergency control dams. No pooling of water on surface allowed.
❖ Monitor groundwater quality in all boreholes identified.
❖ Ensure that emergency control dams can contain all dirty water generated during the reclamation process to prevent overflows and spillages.</td></tr>
</table>

8.2.1.9.2 Uranium Contamination and Radioactivity

Local communities might already be exposed to low background levels of potentially hazardous materials (e.g. dust, particulate matter, heavy metals).

Tailings deposits resulting from gold and uranium mining in the Witwatersrand basin often contain elevated levels of radioactive and chemo-toxic heavy metals.

Through seepage, dissolved uranium and other metals migrate from tailings deposits via groundwater into adjacent fluvial systems (Winde *et al*., 2004). The contamination of streams by adjacent slimes dams poses a particular risk for the health of people in informal settlements where polluted stream water is often consumed without appropriate treatment.

Uranium can also be passed on to humans either through the inhalation of fine dust particles from tailings.

High levels of uranium have well documented health risks. The potential for adverse health effects related to releases of radionuclides is directly related to the population density near the mine or processing facility.

The proposed reclamation Project would be removing the existing mine dumps, thus lessening the current exposure to radioactive dust.

Table 8-27: Impact Evaluation - Radiation

NATURE OF IMPACT: Impacts of radioactivity from dust emanating from the TSF on human health		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	Negative	Positive
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Major-	Major +
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	High	**High**
Impact Status: (positive or negative)	Negative	Positive
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Health impacts suffered from when the dumps were in existence		
Mitigation measures ❖ Ensure all staff are equipped with appropriate PPE. ❖ Undertake any health test as required by the NNR.		

8.2.1.9.3 Air Quality

Particulate Matter (PM)

Emissions from the slimes dams and sand dumps in the current, undisturbed state are expected to be causing elevated ambient concentrations of both PM_{10} and $PM_{2.5}$ in downwind areas on windy days. Exceedances of the NAAQS may be expected up to 450 m from the northern cluster. This particularly affects the residents of Matholesville who reside within this area of impact. The size and lack of vegetation on 2L24 means that the area of impact surrounding this TSF is larger, with modelled exceedances of the NAAQS occurring over greater distances than for the northern cluster. The communities of Bram Fischerville to the north, Braamfischerville Township 14 to the west, Braamfischerville Phase 2 to the east and Thulani to the south are potentially affected if they are on the downwind side of the TSF on particularly windy days.

The modelling indicates that the reclamation of the sand dumps may be expected to cause increased PM emissions with exceedances of the NAAQS extending over approximately 250 m from the work face and the reclamation stations on windy days. However, if mitigated efficiently, the areas of impact should not extend over any residential areas.

The modelling of the slimes dams of the northern cluster indicates that, if reclamation of the TSFs is conducted conservatively, with the band stripped of vegetation not exceeding a width of 15 m and a length of 200 m, the area of impact is unlikely to increase significantly from the status quo emission situation.

The modelling of 2L24 indicates that because of the sparse vegetation on this slimes dam, large areas are already experiencing exceedances of the NAAQS caused by emissions from this TSF on windy days. Therefore, although increasing the width of the bands of stripped vegetation from 15 to 30 m will increase emissions during the initial phase of the project, emissions will decrease progressively as the slimes dam is removed. Furthermore, working on a larger section at a time will shorten the project duration which will benefit the surrounding communities.

The modelling indicates that the removal of the Soweto Cluster as a permanent pollution source will, in the long term, improve the air quality of the surrounding areas, and reduce the health risk of fine particulate matter inhalation for the surrounding communities.

Table 8-28: Impact Evaluation - PM

NATURE OF IMPACT 1: Respiratory and other health issues as a result of PM inhalation. Stripping of vegetation from the surface of TSFs, loading and unloading of sand from sand dumps and hauling of sand over unpaved roads causes the emission of particulate matter into the air, thus increasing existing ambient air concentrations of criteria pollutants (both PM_{10} and $PM_{2.5}$) at receptors.		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long Term > 5 years	Long Term > 5 years
Magnitude *(Major, Moderate, Minor)*	Moderate -	Major +
Probability *(Definite, Possible, Unlikely)*	`Possible (The undisturbed dumps are already emitting PM.**)**	Definite
Calculated Significance Rating (Low, Medium, High)	**Medium**	**High**
Impact Status: (positive or negative)	Negative	Positive
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None		
Mitigation measures ❖ Restricting the stripped band to a width of 15 m for the northern cluster and 30 m for 2L24; ❖ Either restricting the stripped band to a length of 200 metres or wet suppression of the band; ❖ Either restricting the amount of material removed from each of the two sand dumps to 1 300 t per day or using a conveyor to transport the material from the work face or turning the material to slurry and piping it from the work face; ❖ Avoiding the use of temporary storage piles; ❖ Reducing drop height in the transfer of sand to the conveyors; ❖ Strict speed control of 40km/hr on all gravel roads;		

NATURE OF IMPACT 1: Respiratory and other health issues as a result of PM inhalation. Stripping of vegetation from the surface of TSFs, loading and unloading of sand from sand dumps and hauling of sand over unpaved roads causes the emission of particulate matter into the air, thus increasing existing ambient air concentrations of criteria pollutants (both PM_{10} and $PM_{2.5}$) at receptors.
❖ A strict speed limit of 20km/hr on site tracks ❖ Removing all tailings material down to 'red earth' as the area of work progresses, and not leaving remnants of tailings material behind.
Cumulative impacts ❖ Emissions from the reclamation of the Soweto Cluster are predicted to only produce a limited increase in ambient concentrations of PM10 and PM2.5. In the long term, removal of the TSFs will ameliorate the air quality of the surrounding areas.

8.2.2 Operational Phase

This section comprises of the description of potential impacts associated with the proposed operation of the reclamation project on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, and then with mitigation measures.

The following activities are planned by the Applicant for the operation phase of the project.

Table 8-29: Summary table of the Activities associated with the operational phase of the project

ACTIVITY	DESCRIPTION
Operational Phase	
1	Reclamation Activities (including concurrent rehabilitation)
2	Operation of pipes
3	Operation of Pump Station

8.2.2.1 Biodiversity

The following potential impacts were considered on biodiversity (fauna and flora) during operational phase:

- Continued encroachment and displacement of the natural vegetation community due to alien invasive plant species and erosion;
- Erosion and dust dispersal;
- Water runoff and acid mine drainage;
- Continued displacement and fragmentation of the faunal community; and
- Infringement by humans into the few remaining natural grassland and wetlands areas, with associated impacts such as poaching, litter as well as introduction of diseases and feral species such as cats.

Table 8-30: Significance rating of operational impacts on Biodiversity during operation

IMPACT NO.	AFFECTED ENVIRONMENT	ACTIVITY	IMPACT DESCRIPTION	BEFORE MITIGATION SIGNIFICANCE	CUMULATIVE IMPACT	MITIGATION MEASURES / RECOMMENDATIONS	AFTER MITIGATION SIGNIFICANCE
OPERATION							
1	Biodiversity	Reclamation of tailing facility	Erosion and dust	High	Yes	Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces and not conducting activities on windy days which will increase the likelihood of dust being generated.	Medium
2	Biodiversity	Reclamation of tailing facility	Water and acid mine drainage	High	Yes	Acid mine drainage needs to be mitigated and the spread must be restricted; runoff of water must be limited by installing gabions and drainage systems.	Medium
3	Flora	Reclamation of tailing facility	Encroachment of alien invasive plant species	Medium	Yes	Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive plants on cleared areas.	Medium
4	Fauna	Reclamation of tailing facility	Continued displacement and fragmentation of the faunal community	Medium	Yes	Mitigation measures can be added to infrastructure such as flappers to powerlines to avoid bird strikes; Monitoring impacts of operational activities on fauna so that adaptive management practises can be implemented if required; Implement speed control measures on all roads to prevent road killings; Implement training to ensure that all staff are aware of faunal sensitivity. Put protocols in place to deal with fauna that are encountered during operation.	Low

8.2.2.2 Wetlands

Of somewhat greater significance will be the risks associated with the reclamation of the Soweto Clusters during the operational phase. Although any wet areas within the Soweto cluster dumps areas themselves should be considered artificial due to the extreme levels of transformation within them, each of the three reclamation sites does, however, have a wetland draining from one of their sides (clearly identifiable as such by the natural and well defined inward draining topography among other indicators (e.g. soil mottling and wetland vegetation). These wetlands include HGMs 2, 3 and 7. It must be noted, however, that extent to which these systems are being fed by water infiltration through the mine dump as opposed to subsurface inputs from their upstream catchments remains unclear.

The removal of dumps may remove a water input but there remains the possibility that some wetland area will persist. These systems have the potential to be impacted by the reclamation process and given their proximity. Two highly probable and potentially significant impacts were identified for which mitigation is limited and the residual impact considered Moderate. These include, exacerbated contamination of downstream watercourses through the upheaval and liberation of accumulated toxins trapped in the sediments as well as sedimentation and increased turbidity in downstream watercourses and the cumulative risk from upstream reclamation projects to downstream users. However, these impacts ought to be temporary and should only last the lifetime of the reclamation activities with the long-term benefits associated with rehabilitation outweighing the short-term impacts associated with reclamation (in theory). However, this is entirely contingent on the responsible party's commitment (in this Case Crown Gold Recoveries (Pty) Ltd) to reinstatement.

The most important mitigation measures included by the specialist include:

- Mitigation is limited and reinstatement is critical, as per the WUL requirements. Commission and implement a wetland reinstatement and monitoring plan.
- The plan must be presented to and approved by the relevant authorities (i.e. DWS head office Pretoria).
- It is imperative that a budget be allocated for the planned reinstatement efforts and likewise that it be approved by the relevant authorities.
- Given the nature of the project mitigations limited and contamination of downstream watercourses is highly probable. However, as above this is likely to be a temporary impact which, following effective implementation of planned reinstatement, should ultimately result in the removal / reduction of an existing source of wetland contamination.
- Although a trench already exists around 2L24 it is recommended that the depth and suitability of all temporary cut-off trenches around the Soweto Cluster dumps be assessed and deepened and / or widened if deemed necessary to help contain contaminants that are mobilised during the reclamation process and prevent contaminated tailings material from ending up in the downstream watercourses namely HGMs 2 and 7 and ultimately the Klip River.
- Stay within the proposed reclamation areas and avoid extending earthmoving activities outside of these areas.
- Monitor water quality in HGM 2, 3 and 7. Begin several months prior to construction commences to establish the pre-construction baseline.

- Within the reclamation areas identify areas of higher soil saturation and the preferential flow paths. Take measures to effectively steer clear of these areas or divert these flows around the reclamation area.
- Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses.

Table 8-31: DWS Impact Rating Matric for impacts anticipated during the operational phase

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ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY: Flow Regime	SEVERITY: Water Quality	SEVERITY: Habitat	SEVERITY: Biota	SEVERITY: Total	SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
OPERATION																			
Reclamation activities	Direct loss	Loss of wetlands and associated organic material and vegetation through site excavation.	Without	4	4	3	3	5	3	5	13	2	2	5	3	12	156	H	❖ This ought to be a temporary impact that will only last the lifetime of the reclamation activities. However, this is entirely contingent on the responsible party's commitment (in this Case Crown Gold Recoveries (Pty) Ltd to reinstatement as, due to the nature of the project, mitigation during operation is limited in this regard. ❖ A wetland monitoring plan must be commissioned. The study must make use of independent and appropriately qualified professionals. ❖ The historical wetland regime needs to be investigated and considered when determining the final land use. ❖ The plan must be effectively implemented and its efficacy monitored and the approach adapted accordingly.
			With	3	3	3	3	5	3	4	12	2	2	5	3	12	144	M	
	Contamination.	Heightened contamination of downstream watercourses through the upheaval and liberation of toxins accumulated / trapped in the sediments.	Without	4	5	3	3	5	3	5	13	3	3	5	3	14	182	H	❖ Given the nature of the project mitigation is limited and contamination of downstream watercourses is highly probable. However, as above this is likely to be a temporary impact which following effective implementation of carefully planned reinstatement should ultimately result in the removal / reduction of an existing source of wetland contamination. ❖ Check depths and widths of cut-off trenches around reclamation areas to ensure they are sufficient to effectively trap sediments and contaminants. ❖ Stay within the proposed reclamation areas and avoid extending earthmoving activities outside of these areas. ❖ Attempt to limit the wetting of sediments with water canons in the very height of the rainy season or immediately before predicted major rainfall events / fronts. Attempt to keep wetting to minimum (i.e. proportional to what can be
			With	3	3	3	3	5	3	4	12	2	2	5	3	12	144	M	

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ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY					SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
				Flow Regime	Water Quality	Habitat	Biota	Total											
																			conveyed through pipelines to the processing facility) ❖ Work systematically targeting one area at a time while re-instating the recently completed area as the operation progresses. Reinstatement in this manner will allow for problems or inadequacies to be identified and rectified in the successive reinstatement phases. ❖ Monitor water quality in HGM 2 and 5 on a weekly basis. Begin several months prior to construction commences to establish the pre-construction baseline.
	Flow path modification	Flow impediment leading to flooding, backlogging or wetland drowning upstream of the reclamation activities	Without	4	2	2	2	2.5	2	4	8.5	1	1	5	2	9	76.5	M	❖ Within the reclamation areas identify areas of higher soil saturation and the preferential flow paths. Take measures to effectively steer clear of these areas or divert these flows around the reclamation area. ❖ Avoid completely blocking off flow paths with excavated material.
			With	1	2	2	2	1.8	2	1	4.8	1	1	5	2	9	42.75	L	
		Flow concentration leading to increased erosion and scouring downstream of the reclamation activities	Without	4	2	2	2	2.5	2	4	8.5	1	1	5	2	9	76.5	M	❖ Water leaving the site should do so via appropriately engineered stormwater structures that serve to spread and dissipate flows to prevent the erosion of downstream watercourses.
			With	1	2	2	2	1.8	2	1	4.8	1	1	5	2	9	42.75	L	
	Sedimentation	Sedimentation and increased turbidity in downstream watercourses	Without	4	4	2	2	3	2	4	9	1	1	5	2	9	81	M	❖ Silt traps and fences must be placed in the preferential flow paths stemming from the reclamation areas ❖ Eroded stormwater channels should be filled with soil and/or logs (branches included) to dissipate flows.
			With	4	3	2	2	2.8	2	3	7.8	1	1	5	2	9	69.75	M	
	Inputs and contamination.	Pipeline leaks increased water inputs and contamination (leaks on slurry pipeline)	Without	1	2	2	2	1.8	2	2	5.8	1	1	5	2	9	51.75	L	❖ Conduct regular inspections along the pipeline route and fix leaks timeously.

8.2.2.3 Surface Water

During the operational phase, hydraulic reclamation will take place, whereby water cannons are used to convert the dry tailings on the TSF into slurry, which will flow in open channels downslope to a slurry sump, located at the lowest point of the site. The slurry will then be pumped and will ultimately end up at the CPP where it will be processed.

The activities and impacts that could potentially occur during the operational phase are summarised in Table 8-32.

Table 8-32: Summary of activities and impacts for the operational phase

ACTIVITY	IMPACT DESCRIPTION
Uncontrolled runoff from hydraulic reclamation activities and flooding of the site due to high rainfall.	**Impact 1:** Slurry runoff into the downslope stream impacting on water quality and sedimentation.
Poor maintenance of stormwater infrastructure.	**Impact 2:** Silted channels, slurry sump and emergency stormwater dams/paddocks, as well as eroded berms, leading to spills into the downslope streams impacting on water quality and sedimentation

The ratings and proposed mitigation measures for the impact indicated in Table 8-32, are indicated in Table 8-33.

Table 8-33: Significance rating of operational impact 1.

NATURE OF IMPACT 1: Slurry runoff from hydraulic reclamation activities and high rainfall have the potential to impact on water quality and sedimentation of the downslope streams		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Medium term (operational phase)	Medium term (operational phase)
Magnitude *(Major, Moderate, Minor)*	Major	Minor
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None, as the impact will cease after the operational phase.		
Mitigation measures ❖ Implementation of the proposed SWMP detailed in the EMPr. It must be ensured that the stormwater system is designed, constructed and operated, to ensure that it does not spill more than once in 50 years, to be compliant with GN R704 Regulations.		

Table 8-34: Significance rating of operational impact 2

NATURE OF IMPACT 2: Poor maintenance of the berms, channels, slurry sump and paddocks, leading to runoff of slurry into the downslope streams, impacting on water quality and sedimentation		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Medium term (operational phase)	Medium term (operational phase)
Magnitude *(Major, Moderate, Minor)*	Major	Minor
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None, as the impact will cease after the operational phase.		
Mitigation measures ❖ Implementation of the stormwater monitoring system detailed in the EMPr.		

8.2.2.4 Groundwater

In order to incorporate uncertainty in the permeabilities of the aquifers present, the likely, and possible minimum and maximum extent of sulphate plumes associated with the project were evaluated for each scenario listed below. All simulations were undertaken at the hand of sulphate concentrations. The following scenarios were tested as part of the project:

- An estimation of the extent of groundwater pollution at the end of the operational phase of the project;
- An estimation of the long-term impact of the project; and
- An estimation of the long-term impact if the project is not implemented.

8.2.2.4.1 Groundwater Quality

Historically the sources of pollution associated with the Soweto Cluster TSFs include:

- Contaminated storm water runoff;
- Seepage water from the existing paddocks, possibly containing high sulphates and metals; and
- Recharge of contaminated water by means of seepage from the TSF and any unlined storm water channels.

Groundwater quality will be negatively affected with potential increase in salt loads, especially sulphate concentrations during the reclamation activities. The old tailings material contains pyrite minerals and when exposed to oxygen and water during reclamation it results in the formation of acidic conditions. The risk of groundwater contamination during the hydraulic mining will be low in view of the existing impacts, as long as the surface water management and containment guidelines are followed during the reclamation process.

Available water balance information suggests that the seepage from the dumps included in the assessment could leak into the underlying aquifers at rates of between 0.4 and 40% of the MAP. Under average conditions, the leachate is expected to impact on groundwater quality during the operational phase. The historical impact of tailings deposition is however expected to continue to prevail during the operational phase and have a more significant impact on groundwater quality compared to that of tailings reprocessing. For this reason, the zone of impact in which groundwater quality could be unacceptable and exceed the acute health limit of 500 mg/L will remain significant during the operational phase, as indicated in Figure 13. This could have a major negative impact on groundwater resources in the area. It is however noted that no boreholes were located around the various dumps during the fieldwork phase of this project and that it is unlikely that groundwater is abstracted for use in the region.

Contaminated groundwater is furthermore expected to add to the salt load the wetlands and streams. The magnitude of this impact cannot be assessed with certainty with the available dataset, but sulphate concentrations significantly exceeding 500 mg/L may reach the wetlands associated with the footprints of the dumps in the study. The non-perennial streams associated with the northern slimes dams may also be impacted by the increase in salt load. As mentioned above, the increase in salt load as a result of the operational phase of the project is expected to be much less than that as a result of historical tailings deposition.

The implementation of sound house-keeping during the operational phase of the project, including the containment, reuse and recycling of slurry water, is expected to reduce impacts on groundwater quality associated with the project, possibly resulting in an impact of medium significance. Groundwater mitigation measures proposed are listed below.

Removal of the Soweto Cluster should however have a long-term **positive impact** on the groundwater quality, as the source of contamination is removed. Monitoring of groundwater quality and water levels is recommended (up- and downgradient of the different slimes dams and sand dumps) with continuous review and updating of the monitoring network based on the monitoring results.

Table 8-35: Operational Phase water quality impacts.

NATURE OF THE IMPACT: Groundwater pollution during reclamation as result of AMD water seeping into the aquifers		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Positive**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Major -	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible

NATURE OF THE IMPACT: Groundwater pollution during reclamation as result of AMD water seeping into the aquifers		
Calculated Significance Rating (Low, Medium, High)	High	Medium
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and sanitation management problems.	

Mitigation measures

- Dolomite has the capacity to buffer the acid generated.
- Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted to the paddocks. No pooling of water on surface allowed.
- Monitor groundwater quality in all boreholes installed. Should monitoring results indicate a loss of groundwater to private user, Crown Gold must supply the user with an equal water resource. The groundwater monitoring network efficiency must be assessed and new monitoring boreholes drilled, if required.
- If rain water is present and does not evaporate within a few weeks, then the paddocks are to be pumped prior to AMD forming.
- Ensure that paddocks can contain all dirty water generated during the reclamation process to prevent overflows and spillages.

8.2.2.4.2 Groundwater Quantity

The proposed slimes dams and sand dump reclamation will not have any significant impacts on the groundwater quantity (see table 16 of the Groundwater impact study in Appendix D4).

The reclamation activities will be driven by water jetting. Large volumes of water are used in the process. There is a possibility that water will seep into the underlaying formations, but the additional recharge should be negligible and should have no impact on the groundwater table elevation.

New groundwater monitoring boreholes are required to monitor groundwater level fluctuations over time.

Table 8-36: Operational Phase water quantity impacts.

NATURE OF THE IMPACT: Reduction in aquifer yield		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative (only due to current conditions)**	**Positive**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Minor -	Minor +
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	Low	Medium
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and	

NATURE OF THE IMPACT: Reduction in aquifer yield	
	sanitation management problems. Refer to Chapter 10.
Mitigation measures ❖ Monitor groundwater levels in all boreholes.	

8.2.2.4.3 Deposition of Reworked Tailings at the RTSF

In terms of placing of the reworked tailings at the RTSF facility, a detailed assessment was completed by the Crown Gold to assess the impacts associated with placement of additional tailings material at the deposition sites and as such is not evaluated in this report

8.2.2.5 Air Quality

The level of dustfall has been raised as a concern by Interested and Affected Parties. The AIQA concluded that the emissions from the TSFs in the current, undisturbed state, are expected to be causing elevated ambient concentrations of both PM_{10} and $PM_{2.5}$ in downwind areas on windy days.

The report found that exceedances of the NAAQS may be expected up to 450 m from Site 2 (2L20/21, 2A6). This particularly affects the residents of Matholesville who reside within this area of impact. The size and lack of vegetation on 2L24 means that the area of impact surrounding this TSF is larger, with modelled exceedances of the NAAQS occurring over greater distances than for the northern cluster. The communities of Bram Fischerville to the north, Braamfischerville Township 14 to the west, Braamfischerville Phase 2 to the east and Thulani to the south are potentially affected if they are on the downwind side of the TSF on particularly windy days.

Lastly, the AIQA modelling indicates that the reclamation of the sand dumps may be expected to cause increased PM emissions with exceedances of the NAAQS extending over approximately 250 m from the work face and the reclamation stations on windy days. However, the areas of impact do not extend over any residential areas

Table 8-37: Operational Phase air quality impacts.

NATURE OF THE IMPACT 1: Loading and unloading of sand from sand dumps, operational vehicles causing dust as they drive on site, pre-processing of sand from a conveyor to a reclamation station within the dump footprint to create a slurry.		
Acceptable rating level **PM_{10}** ❖ 24-hour Average Concentrations: National Ambient Air Quality Standard of 75µg/m^3 ❖ Annual Average Concentrations: National Ambient Air Quality Standard of 40µg/m^3 **$PM_{2.5}$** ❖ 24-hour Average Concentrations: National Ambient Air Quality Standard of 40µg/m^3 ❖ Annual Average Concentrations: National Ambient Air Quality Standard of 20µg/m^3		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**

Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Moderate	Moderate
Probability *(Definite, Possible, Unlikely)*	Definite	Definite
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Medium**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes	
Mitigation measures ❖ Recommendation of the stripped band to a width of 15 metres; ❖ Strict speed control of 40km/hr on all gravel roads; ❖ A strict speed limit of 20km/hr on site tracks ❖ Restriction of the use of storage piles; ❖ At the Project reclamation sites, material must be removed to 'red earth'. Remnants of tailings material must not be left behind which could be exposed to wind erosion. Further mitigation measures which could be implemented if dustfall monitoring indicates the necessity includes: Restricting the length of the strip under reclamation and wet suppression of the 15-m-wide band stripped for reclamation.		

8.2.2.6 Noise

The noise impact assessment for the operational phase is based on the assumption that the mitigation measures recommended for the construction phase were implemented, which could include:

- relocation of NSD within 200m from reclamation activities; alternatively
- development of berms between the closest NSD and reclamation activities

Table 8-38: Impact Assessment: Operational Activities during the day for all dumps

NATURE OF THE IMPACT 1: Increased total noise levels in the area during the day, changing existing ambient sound levels at receptors.		
Acceptable Rating Level	Rural noise district. Use $L_{Req,D}$ of 45 dBA	
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the day. **Site or Local**	No mitigation required.
Duration *(Short term, Medium term, Long term)*	Noise levels will be elevated for the operational phase. **Long Term**	
Magnitude *(Major, Moderate, Minor)*	Daytime noise levels will be less than the acceptable noise rating level for a rural area. **Minor negative**	
Probability *(Definite, Possible, Unlikely)*	Ambient sound levels could be low at times and the activities may be audible but it will not be disturbing. **Unlikely**	

NATURE OF THE IMPACT 1: Increased total noise levels in the area during the day, changing existing ambient sound levels at receptors.		
Calculated Significance Rating (Low, Medium, High)	**Low**	
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ Significance of the noise impact is Low and no additional mitigation measures are required.		

Table 8-39: Impact Assessment: Operational Activities at night

NATURE OF THE IMPACT 2: Numerous simultaneous night-time operational activities resulting in increased total noise levels in the area, changing existing ambient sound levels at receptors		
Acceptable Rating Level	Rural noise district. Use $L_{Req,D}$ of 45 dBA	
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the night. **Site or Local**	The project will not impact on the ambient sound levels further than 1,000 m from the activity during the night. **Site or Local**
Duration *(Short term, Medium term, Long term)*	Noise levels will be elevated for the operational phase. **Long Term**	Noise levels will be elevated for the operational phase. **Long Term**
Magnitude *(Major, Moderate, Minor)*	Night-time noise levels will be higher than the urban rating level at the closest NSD. **Major negative**	Night-time noise levels may be higher than the urban rating level at times at the closest NSD. **Moderate negative**
Probability *(Definite, Possible, Unlikely)*	While ambient sound levels may be high at times, activities would be clearly audible and could impact on the closest NSD at times. **Possible**	Activities may be clearly audible and could impact on the closest NSD at times. **Possible**
Calculated Significance Rating (Low, Medium, High)	**High**	**Low**
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ The significance rating is due to the very precautious significance rating criteria (see Table 6-7 of the		

NATURE OF THE IMPACT 2: Numerous simultaneous night-time operational activities resulting in increased total noise levels in the area, changing existing ambient sound levels at receptors
Noise Impact Assessment – Appendix D5). There has been a number of other reclamation projects at various locations without noise complaints, with a site visit to other existing projects highlighting that actual noises from the pump system are low. Loading sand with a FEL may create noises at night that some NSD may find disturbing. ❖ Crown Gold can make use of berms to shield the activity from the NSD that would reduce the noise levels.

8.2.2.7 Heritage and Palaeontology

See Table 8-16 in the construction phase.

8.2.2.8 Social Impact

The following impacts are expected during the operational phase of the project.

Table 8-40: Impacts on Job security and skills development

NATURE OF THE IMPACT 1: Job Security and Skills Development		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Positive**	**Positive**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate +	Major +
Probability	Possible	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ The residual impacts associated with the creation of employment and business opportunities and training during the operational phase is that it benefits the local economy; ❖ Acquired transferable skills that could potentially be used with other businesses; ❖ The residual impacts associated with the creation of employment and business opportunities and training during the construction phase is that the workers can improve their skills by gaining more experience; ❖ Improved economic development; ❖ Increased capacity to develop and maintain livelihood strategies.		
Mitigation measures ❖ Establish targets for employment and training; ❖ Aim to absorb the youth (as the area has a high dependency ratio); ❖ Effective implementation of training and skills development initiatives; ❖ It is recommended that as part of the CSI programme, the contractor makes use of local labour as and when required; and		

NATURE OF THE IMPACT 1: Job Security and Skills Development
❖ Comply with the Skills Development Act, (Act No.97 of 1998);

Table 8-41: Impacts of stimulating economic growth.

NATURE OF THE IMPACT 2: Stimulation of economic growth		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Minor +	Major +
Probability	Possible	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	N/A	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ Local suppliers will have gained experience and exposure to meeting standards of quality and scale that could be transferrable to business opportunities.		
Mitigation measures ❖ Preference should be given to capable SMMEs who are based within the local municipal area; and ❖ Consider measures recommended to maximise benefits from local employment, skills and economic development.		

Table 8-42: The creation of informal settlements

NATURE OF THE IMPACT 3: Creation of Informal settlements		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Short term	Short term
Magnitude	Moderate-	Major -
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Not applicable	
Irreplaceable loss of resources: (Yes or No)	Not applicable	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Increased perceptions of unsafety		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence;		

NATURE OF THE IMPACT 3: Creation of Informal settlements
❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals; ❖ Crown Gold to collaborate with the CoJ and implement CoJ's land use management system to prevent illegal settlements.

Table 8-43: Safety Impacts for employees and communities

NATURE OF THE IMPACT 4: Safety Impacts		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Moderate-
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	High	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes, strain on infrastructure and services is likely to persist.	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Increased perceptions of unsafety.		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals; ❖ Community members, including illegal miners, should be made aware of the hazards of accessing mine dumps through safety signs at the reclamation and deposition sites. ❖ Steps are taken to monitor high-risk areas to be constantly monitored to minimise the opportunity for illegal activities.		

Table 8-44: Increased dust levels and rise in associated health impact.

NATURE OF THE IMPACT 5: Increased dust levels and rise in associated health impacts		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Probable	Probable
Calculated Significance Rating	High	**Medium**

NATURE OF THE IMPACT 5: Increased dust levels and rise in associated health impacts	
Reversibility:	Irreversible
Irreplaceable loss of resources:	Yes
Can impacts be enhanced:	No
Residual impacts ❖ Compromised quality of life	
Mitigation measures ❖ Implement effective dust suppression techniques; ❖ It is also essential that continuous air quality monitoring must be undertaken to monitor emissions from the project. ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	

Table 8-45: Impacts on the Viva Settlement

NATURE OF IMPACT 6: Impacts on the Viva Settlements		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Medium Term
Magnitude	Possible	Possible
Probability *(Definite, Possible, Unlikely)*	Major-	Minor -
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Altered sense of place		
Mitigation measures ❖ When reclamation is to start, resettlement of people should be re-evaluated and conducted in a lawful manner on a case by case basis; ❖ The applicant to liaise with the CoJ and the property owner to address the issue of illegal settlers.		

Table 8-46: Impacts on the spatial development and future land-use of the site

NATURE OF IMPACT 7: Impacts on the spatial development and future land-use of the site		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Medium term
Magnitude	Major-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Delayed development and increase on current housing backlogs		
Mitigation measures ❖ As far as possible avoid encroachment of pipelines on other development opportunities;		

Table 8-47: Impacts of increased nuisance factors

NATURE OF IMPACT 8: Increased nuisance factors and changed sense of place		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Short Term
Magnitude	Moderate-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Altered sense of place		
Mitigation measures ❖ To minimise all nuisance factors such as noise, air quality. ❖ Implement all mitigation measures as specified in the relevant specialist studies; ❖ To make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ To liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.		

Table 8-48: Attitude Formation

NATURE OF IMPACT 9: Attitude formation could result in delays during project implementation		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Short Term	Short Term
Magnitude	Major-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	High	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Negative perceptions associated with the applicant		
Mitigation measures ❖ To ensure effective consultation with community members during construction and operation of the proposed Project, it is advised that Crown Gold establishes a Community Consultation Forum that will comprise elected community representatives, and aims to disseminate project information to community members; ❖ Develop sustainable CSI initiatives and community development projects.		

8.2.2.9 Community Health

Refer to impacts assessment in Section 8.2.1.9.

8.2.3 Decommissioning Phase

This section comprises of the description of potential impacts associated with the closure, decommissioning and rehabilitation activities on the biophysical, socio-economic and heritage and cultural environment. These descriptions are followed by the impact tables which contain the assessment of the significance of each identified impact without, then with mitigation measures.

The following activities are planned by the Applicant for the decommissioning phase of the project.

Table 8-49: Summary table of the Activities associated with this decommissioning phase of the project

ACTIVITY	DESCRIPTION
Decommissioning Phase	
1	Decommissioning and Rehabilitation activities: Demolition of temporary infrastructure such as: screens, the pump station and pipelines, and Rehabilitation of the project area.

8.2.3.1 Biodiversity

The following potential impacts were considered on biodiversity (including flora and fauna):

- Further impacts due to the spread and/or establishment of alien and/or invasive species;
- Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust and noise); and
- If reinstatement is not done correctly erosion and dust dispersal is a major impact as it can result in habitat loss as well as impact the growth and health of both fauna and flora.

Table 8-50: Assessment of significance of potential decommissioning of the development pre- and post- mitigation

IMPACT NO.	AFFECTED ENVIRONMENT	ACTIVITY	IMPACT DESCRIPTION	BEFORE MITIGATION	CUMULATIVE IMPACT	MITIGATION MEASURES / RECOMMENDATIONS	AFTER MITIGATION
				SIGNIFICANCE			SIGNIFICANCE
DECOMMISSIONING							
1	Flora	Decommissioning activities	Encroachment of alien invasive plant species and erosion	Medium	Yes	Implementation of alien invasive plant management plan needs to be continued during decommissioning to prevent the growth of invasive plants on reinstatement areas; The area must be developed as soon as the dump has been removed to prevent erosion of the area.	Low
2	Fauna	Decommissioning activities	Loss of species of conservation concern	Medium	Yes	All infrastructure that could have a negative impact on faunal species (powerlines etc) needs to be decommissioned and removed.	Low
3	Biodiversity	Decommissioning activities	Loss of habitat and impact on the growth and health of both fauna and flora	Medium	Yes	Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces.	Low

8.2.3.2 Wetlands

The following potential impacts were considered during the decommissioning, particularly during rehabilitation.

- Potential loss or degradation of wetlands or adjoining terrestrial habitat through inappropriate closure.

Table 8-51: DWS Risk Impact Matrix for the Soweto Cluster Project During Decommissioning

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ACTIVITY	ASPECT	IMPACT	ALTERNATIVE	SEVERITY: Flow Regime	SEVERITY: Water Quality	SEVERITY: Habitat	SEVERITY: Biota	SEVERITY: Total	SPATIAL SCALE	DURATION	CONSEQUENCE	FREQUENCY OF ACTIVITY	FREQUENCY OF IMPACT	LEGAL ISSUES	DETECTION	LIKELIHOOD	SIGNIFICANCE	RISK RATING	CONTROL MEASURES
DECOMMISSIONING																			
Decommissioning of the operation	Rehabilitation	Potential loss or degradation of wetlands or adjoining terrestrial habitat through inappropriate closure.	Without	4	5	4	4	4.3	3	5	12	3	3	5	3	14	171.5	H	Develop and implement a reinstatement and closure plan. Appropriately reinstatement the project area as per the WUL requirements.
			With	1	1	1	1	1	2	2	5	1	1	5	2	9	45	L	

8.2.3.3 Surface Water

It is likely that the site will be rehabilitated and vegetated with indigenous grass species. The activities and impacts that are likely to occur during the closure and rehabilitation phase are summarised in Table 8-52.

Table 8-52: Summary of activities and impacts for the closure phase.

ACTIVITY	IMPACT DESCRIPTION
Exposure of soil during the closure and rehabilitation phase, once all tailings material has been removed.	**Impact 1:** Erosion and consequent increase in TSS of surface water resources leading to deteriorated water quality

The ratings and proposed mitigation measures for the impact indicated in Table 8-52, are provided in Table 8-53.

Table 8-53: Significance rating of closure impact 1

NATURE OF IMPACT 1: The exposure of soil once all tailings material has been removed, has the potential to be washed into the downslope streams, impacting on water quality and sedimentation		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Short term (less than 18 months)	Short term (less than 18 months)
Magnitude *(Major, Moderate, Minor)*	Moderate	Minor
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ Possible, unless rehabilitated immediately.		
Mitigation measures ❖ Stormwater management measures should be left in place until rehabilitation is complete, or until the site has been commercially developed with a specifically designed SWMP for the development. ❖ Temporary erosion control measures that reduce flow velocity (e.g. paddocks and runoff berms) should be implemented at the site; and ❖ Water quality monitoring must continue upstream and downstream until the site has been fully rehabilitated and/or redeveloped.		

8.2.3.4 Groundwater

8.2.3.4.1 Groundwater Quality

Groundwater quality is expected to improve as the source of contamination will be removed and the dump footprints will be rehabilitated. Sulphate concentrations in the immediate vicinity of the footprints may reduce by between 800 and 4,000 mg/L as a result of dump removal and rehabilitation. Under these conditions, the water table mound under the various footprints should start to level out. The zone of impact over which sulphate concentrations would exceed acute health standards will reduce in the long-term, but is not expected to dissipate. Historical groundwater contamination will most likely continue to move through the aquifers. The removal of the dumps is however expected to reduce the zone of impact in the long-term.

The impact as a result of the reclamation is anticipated to be positive after the waste material and sand have been removed. A soil and groundwater assessment study are recommended for the footprint areas, when all tailings material has been removed to determine the status of these environments.

Table 8-54: Decommissioning Phase water quality impacts.

NATURE OF THE IMPACT: Water quality impacts when dump has been removed		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Minor +	Moderate +
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Medium**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and sanitation management problems.	
Mitigation measures ❖ Dolomite has the capacity to buffer the acid generated. ❖ Monitor groundwater quality in all boreholes. ❖ Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted to the paddocks.		

8.2.3.4.2 Groundwater Quantity

There will be no impacts on the groundwater quantity during decommissioning. The reclamation activities and addition of water will have stopped and any form of seepage to the subsurface will reduce and ultimately stop, apart from precipitation.

NATURE OF THE IMPACT: Reduction in aquifer yield		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term

Magnitude *(Major, Moderate, Minor)*	Minor +	Moderate +
Probability *(Definite, Possible, Unlikely)*	Definite	Definite
Calculated Significance Rating (Low, Medium, High)	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and sanitation management problems.	
Mitigation measures ❖ Monitor groundwater levels in all boreholes.		

8.2.3.5 Air Quality

Impacts expected to occur are the generation of nuisance dust during removal of the infrastructure and pipeline. It is proposed to establish a dust management plan in consultation with the environmental manager and include dust suppression as part of the contractor's responsibility.

Table 8-55: Closure and Decommissioning Phase air quality impacts.

NATURE OF THE IMPACT 1: Dust generated from removal of surface infrastructure and rehabilitation activities		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Short term	Short term
Magnitude *(Major, Moderate, Minor)*	Minor -	Minor -
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Yes	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	No	
Mitigation measures ❖ Strict speed control of 40km/hr on all gravel roads; ❖ A strict speed limit of 20km/hr on site tracks ❖ Keep cleared surfaces humid when undertaking earth moving rehabilitation activities. ❖ Removing all tailings material down to 'red earth' as the area of work progresses, and not leaving remnants of tailings material behind.		

8.2.3.6 Noise

Final decommissioning activities will have a noise impact lower than either the construction or operational phases. This is because decommissioning and closure activities normally take place during the day using minimal equipment (due to the decreased urgency of the project). While there may be various activities, there is a very small risk for any additional noise impact.

8.2.3.7 Heritage and Palaeontology

No impacts are envisioned for decommissioning.

8.2.3.8 Social Impact

This project phase will involve downscaling of the workforce once rehabilitation of all sites is complete. Although there will be downscaling during this phase, some community members would have worked on the site, and will constitute a reserve of trained workforce.

Table 8-56: Impacts on Job security and skills development

NATURE OF THE IMPACT 1: Job Security and Skills Development		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate +	Major +
Probability	Possible	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ The residual impacts associated with the creation of employment and business opportunities and training during the operational phase is that it benefits the local economy; ❖ Acquired transferable skills that could potentially be used with other businesses		
Mitigation measures ❖ Offer a post retrenchment programme designed to equip those that have been retrenched with knowledge and skills; ❖ Post retrenchment programme can include computer courses, soft skills, construction and moving machinery.		

Closure of the Project is expected to reduce economic development and diversification. Some people will have increased capacity to continue to develop and maintain livelihood strategies while others may struggle with the transition. Once the LED projects are implemented, this should contribute to cushioning the negative impacts of downscaling.

8-57: Impacts of stimulating economic growth.

NATURE OF THE IMPACT 2: Stimulation of economic growth		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Moderate+	Major+

NATURE OF THE IMPACT 2: Stimulation of economic growth		
Probability	Possible	Definite
Calculated Significance Rating	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	Not applicable	
Irreplaceable loss of resources: (Yes or No)	Not applicable	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ Developed economy; ❖ Increased capacity to develop and maintain livelihood strategies		
Mitigation measures ❖ Preference should be given to capable subcontractors who based within the local municipal area; ❖ Crown Gold to source local suppliers, HDSAs and Small, Medium and Micro-sized Enterprises (SMMEs) ❖ Encourage the company's existing suppliers to enter into a Joint Venture (JV) with local SMMEs to aid with the transfer of skills; ❖ Use the Department of Trade and Industry's (DTI) codes of good practice and guidelines from the Mining Charter to guide the procurement process; ❖ Align skills development to build capacity of SMMEs.		

From an environmental and social perspective, the proposed project is a positive impact. As indicated by van Rensburg (2016: 367), the benefit of reclamation projects would not only be to extract the additional economical value from the tailings, but the reclamation projects also provide a second opportunity to process the tailings more responsibly with regard to leaving behind a less toxic, more stable area and also to release the land back for redevelopment.

The positive impact of the availability of land has been noted as part of the "need and desirability" of the proposed project. It is stated in the Final Scoping Report (FSR) (2019:42) that the clearing of land and subsequent removal of the mine dumps is considered extremely important and a positive benefit. The FSR further states that it is envisioned that the removal of these dumps could significantly reduce a source of water, land and dust pollution, as well as costs associated with the dumps' maintenance. The land would be cleared to ground level and thereafter be available for future use.

The proposed project is in line with the CoJ's Spatial Development Vision 2040, which aims to strengthen Soweto's connection to the metropolitan core and other subcentres, including the mining belt development corridor. Although there will be availability of land, the end land uses should be sustainable and agreed upon with Interested and Affected Parties as they will be the future land users.

During stakeholder consultations and key informant interviews, some participants indicated that the removal of the dumps has an environmental benefit. However, there is another spectrum of pressing social issues associated with the dumps that cannot be overlooked, the dumps are currently unmanaged and therefore a crime hot spot. Informants have detailed how gruesome murders, horrifying rape and robbery incidents that have occurred in these mine dumps, these incidents have been widely reported in newspapers such as (Timeslive, 2018). The removal of the mine dumps is seen as a positive impact which is most welcomed by community members.

The positive impact associated with the removal of the dumps can only materialise once the land has been successfully rehabilitated and obtain an approved radiation land clearance certificate in terms of the National Nuclear Regulations Act, (Act No. 47 of 1999) from the National Nuclear Regulator (NNR).

During the construction and operation phases, the land will not yet be available for alternative land uses, this impact has been assessed as part of the decommissioning phase.

Table 8-58: Safety Impacts for Availability of Alternative Land-Use

NATURE OF THE IMPACT 3: Availability of Alternative Land-Use		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate+	Major+
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	Not applicable	
Irreplaceable loss of resources: (Yes or No)	Not applicable	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Availability of land for development purposes		
Mitigation measures ❖ The land should be rehabilitated according to the EIA and EMPr; ❖ The land should be assessed for radiation in conjunction with the NNR; ❖ If not deemed sterile or a health risk, Crown Gold, together with landowners, property developers, the City of Johannesburg and the DMRE should investigate the use of land for community upliftment or residential development.		

Table 8-59: Creation of informal settlements

NATURE OF THE IMPACT 4: Creation of Informal settlements		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Short term	Short term
Magnitude	Moderate-	Major -
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Not applicable	
Irreplaceable loss of resources: (Yes or No)	Not applicable	
Can impacts be enhanced: (Yes or No)	No	

Residual impacts ❖ Increased perceptions of unsafety
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals; ❖ Crown Gold to collaborate with the CoJ and implement CoJ's land use management system to prevent illegal settlements.

Table 8-60: Safety Impacts for employees and communities

NATURE OF THE IMPACT 5: Safety Impacts		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Moderate-
Probability *(Definite, Possible, Unlikely)*	Possible	Definite
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes, strain on infrastructure and services is likely to persist.	
Can impacts be enhanced: (Yes or No)	No	
Residual impacts ❖ Increased perceptions of unsafety.		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ Crown Gold to collaborate with local authorities (City of Johannesburg Metropolitan Municipality, the local South Africa Police Services, the relevant landowner and the Community Policing Forum to establish standard operating procedures for the control and/or removal of unauthorised individuals;		

Table 8-61: Increased dust levels and rise in associated health impact.

NATURE OF THE IMPACT 6: Increased dust levels and rise in associated health impacts		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status:	**Negative**	**Negative**
Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Probable	Probable

NATURE OF THE IMPACT 6: Increased dust levels and rise in associated health impacts		
Calculated Significance Rating	High	**Low**
Reversibility:	Irreversible	
Irreplaceable loss of resources:	Yes	
Can impacts be enhanced:	No	
Residual impacts ❖ Compromised quality of life		
Mitigation measures ❖ Implement effective dust suppression techniques; ❖ It is also essential that continuous air quality monitoring must be undertaken to monitor emissions from the project. ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.		

The proposed pipelines at Site 2 (2L20/21) might hamper the proposed housing development Goudrand Ext 5 to 19. According to the Gauteng Department of Human Settlements: Mega Structures report (2019:17), the proposed Goudrand development is a mixed-use and commercial development with a potential of between 20 000 and 25 000 housing units, after mining rehabilitation. The proposed housing development seems to be in line with the City's project of upgrading of informal settlements. The Goudrand project is backed by the Gauteng government and the Department of Human Settlements, it is aimed at addressing the need for affordable housing and seeks to close the gaps, whilst redefining future cities in line with the dictates of the National Development Plan, and the Gauteng City Region (GCR) strategy.

Although it is envisaged that the proposed housing development will commence after mining rehabilitation, the applicant needs to take cognisance of development opportunities so that the project does not lead to the forfeiting of development opportunities.

Table 8-62: Impacts of increased nuisance factors

NATURE OF IMPACT 9: Increased nuisance factors and changed sense of place		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent	Local	Local
Duration	Long term	Short Term
Magnitude	Moderate-	Minor -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	This impact can result in consequences that will have irreplaceable losses of a physical and emotional nature	

Can impacts be enhanced: (Yes or No)	No
Residual impacts ❖ Altered sense of place	
Mitigation measures ❖ Minimise all nuisance factors such as noise, air quality and implement all mitigation measures as specified in the relevant specialist studies; ❖ Make available, maintain and effectively implement a grievance/complaint register that is easily accessible to all neighbours and affected stakeholders; ❖ Liaise openly and frequently with affected stakeholders to ensure they have information about activities that will generate nuisance factors.	

Linked to community health, is concern regarding exposure to radiation and its impacts on human health. During the public consultations, concerns with regards to exposure to high levels of radiation and the direct impact on human health was raised. According to existing data, it is not anticipated that there will be any radiation issues on the proposed project site. Crown Gold has previously conducted walk-over surveys and it was found that the radiation levels are low.

Once the operational phase has been completed, it is not anticipated that there will be any nuisance factors caused by the project.

8.2.3.9 Community Health

Refer to impacts assess in Section 8.2.1.9.

8.2.4 Post-Decommissioning Impacts

The following activities are expected to occur during the post-closure phase of the project.

Table 8-63: Summary table of the Activities associated with this post-closure phase of the project

ACTIVITY	DESCRIPTION
	Post-Closure
1	Rehabilitation and Monitoring.

8.2.4.1 Surface Water

It is unlikely that any negative impacts will occur as a result of reclamation after rehabilitation has taken place, or if the site is commercially developed. The removal of the tailings material is likely to result in a positive impact on the surrounding watercourses.

8.2.4.2 Groundwater

8.2.4.2.1 Groundwater Quality

Overall, there should be an improvement in the groundwater qualities post closure as the source of contamination has been removed. Rehabilitation of the soil in the footprint area of the historical TSF is required to stabilise the pH and minimise infiltration of contaminated water.

Table 8-64: Post Closure Phase water quality impacts

NATURE OF THE IMPACT: Groundwater quality impacts after dump is removed		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Impact Status: (positive or negative)	**Positive**	**Positive**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Minor +	Moderate +
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**High**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Combined impact with other mining activities in the area, as well as landfill sites, industrial activities and waste and sanitation management problems	
Mitigation measures ❖ Monitor groundwater quality in all boreholes. ❖ Maintain sound surface runoff management. No pooling of water on surface allowed.		

8.2.4.2.2 Groundwater Quantity

No impact is expected on the water quantity post-reclamation.

8.2.5 Cumulative Impacts

A cumulative impact can be defined as an impact on the environment which results from the incremental impact of an action (i.e. mining) when added to other past, present and reasonably foreseeable future actions, regardless of who (i.e. private individual, government agency, industrial business, agricultural business, etc) undertakes such actions.

Cumulative impacts associated with this type of mining development could lead to initial, incremental or augmentation of existing types of environmental degradation, due to existing similar activities in the area, including impacts on the air, soil and water present within available habitat. Pollution of these elements might not always be immediately visible or readily quantifiable, but incremental or fractional increases might rise to levels where biological attributes could be affected adversely on a local or regional scale. In most cases are these effects are not bound and is dispersed or diluted over an area that is much larger than the actual footprint of the causal factor. Similarly, developments in untransformed and pristine areas are usually not characterised by visibly significant environmental degradation and these impacts are usually most prevalent in areas where continuous and long-term impacts have been experienced.

The nature of the development is such that pollution and degradation of the surrounding areas are expected to some extent, but this is incredibly difficult to quantify initially and will require monitoring and management throughout the life of the project. Cumulative impacts are, for this very reason, assessed over the entire lifespan of the project operation. Since the cumulative impacts can occur at any point within any of the identified phases it is preferable to present them separately to understand what aspects will require monitoring and management throughout the life of the project as well as after successful closure and decommissioning (i.e. such as when the area is operated as another functional entity like agricultural practises).

8.2.5.1 Surface Water

The dumps are located in a catchment that is highly impacted by mining and industrial activities. The implementation of a sound SWMP is crucial to contain contaminated runoff on the operational area of the site. The monitoring and maintenance of the implemented SWMP is of utmost importance, to ensure spillages into the downslope watercourses do not occur. Should this not be done, then the proposed project has the potential to cumulatively impact on the already deteriorated water quality within the catchment.

The cumulative impact of the proposed project on the surface water quality of the catchment is rated in Table 8-65.

Table 8-65: Cumulative impact rating for surface water quality

NATURE OF IMPACT: The proposed project has the potential to cumulatively impact on the surface water quality of the catchment		
	Impact Rating Without Mitigation	**Impact Rating With Mitigation**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Medium term (project will be less than 5 years)	Medium term (project will be less than 5 years)
Magnitude *(Major, Moderate, Minor)*	Major	Minor
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts • None, the tailings material will be removed once the project is finished.		

NATURE OF IMPACT: The proposed project has the potential to cumulatively impact on the surface water quality of the catchment
Mitigation measures • Effective stormwater management that captures and contains all site runoff as proposed in the surface water report, and in accordance with GN R704 Regulations; • Water quality monitoring upstream and downstream of the proposed project.

8.2.5.2 Groundwater

Cumulative impacts result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities (e.g. discharges of high salt or metal loads to a river that combine to cause a reduction in the use of the resource that is greater than the additive impacts of each pollutant). Cumulative impacts can occur from the collective impacts of individual minor actions over a period and can include both direct and indirect impacts.

The Soweto Cluster dumps are near other mining activities, industrial activities, a landfill site, and surrounded by residential developments. Cumulatively all these activities contribute to the surface water quality impacts identified at the Soweto Cluster and could also impact the groundwater resources, especially in terms of quality.

The outcome of the Soweto Cluster reclamation groundwater assessment indicates that the reclamation activities will have an overall positive impact on the receiving environment.

Monitoring boreholes (indicated in section 13 of the Groundwater report: Appendix D4) around the dump footprint areas are required to assess the implications that dump reclamation will have on the aquifers and to identify if poor quality groundwater will reach a sensitive receptor. The monitoring data recorded as reclamation operations progress must be used to update the monitoring programme

8.2.5.3 Air Quality

Emissions from the reclamation of the Soweto Cluster are predicted to only produce a limited increase in ambient concentrations of PM_{10} and $PM_{2.5}$. In the long term, removal of the TSFs will ameliorate the air quality of the surrounding areas.

8.2.5.4 Noise

Being an urban area there are other noises in the area which may cumulatively raise the noise levels with up to 3 dBA.

8.2.5.5 Heritage and Palaeontology

No significant cumulative impacts are envisaged.

8.2.5.6 Social Impact

From a social perspective, some of the most significant cumulative impacts relate to the following aspects:

- The cumulative impacts associated with economic investment: Over time the local economy will be influenced by the proposed Soweto Cluster project, Goudrand housing development and the West Wits mining operation. The proposed projects will result in increased expenditure, which will most likely benefit smaller businesses, suppliers and contractors.
- Cumulative impacts associated with industry training: An increase in the levels of skills present in the community will increase employment opportunities and will strengthen local economic development. Development of skills can be transferred to other sectors which will increase the potential for employment opportunities.

8.2.5.7 Community Health

A cumulative impact can be defined as an impact on the environment which results from the incremental impact of an action (i.e. mining) when added to other past, present and reasonably foreseeable future actions, regardless of who (i.e. private individual, government agency, industrial business, agricultural business, etc) undertakes such actions.

8.2.5.7.1 Surface Water

The dumps are located in a catchment that is highly impacted by mining and industrial activities. The implementation of a sound SWMP is crucial to contain contaminated runoff on the operational area of the site. The monitoring and maintenance of the implemented SWMP is of utmost importance, to ensure spillages into the downslope watercourses do not occur. Should this not be done, then the proposed project has the potential to cumulatively impact on the already deteriorated water quality within the catchment.

8.2.5.7.2 Groundwater

The Soweto Cluster dumps are near other mining activities, industrial activities, a landfill site, and surrounded by residential developments. Cumulatively all these activities contribute to the surface water quality impacts identified at the Soweto Cluster and could also impact the groundwater resources, especially in terms of quality.

The outcome of the Soweto Cluster reclamation groundwater assessment indicates that the reclamation activities will have an overall positive impact on the receiving environment.

8.2.5.7.3 Air Quality

Emissions from the reclamation of the Soweto Cluster are predicted to only produce a limited increase in ambient concentrations of PM_{10} and $PM_{2.5}$. In the long term, removal of the TSFs will ameliorate the air quality of the surrounding areas.

8.3 Specialist Studies Conclusions and Recommendations

The preceding sections of Chapter 8 of this report together with the specialist studies contained within Appendices D of this EIA provide a detailed assessment of the potential impacts that may result from the reclamation and reprocessing of the Soweto Cluster project.

This section aims to conclude the environmental assessment providing a summary of the results and conclusions of the assessment of the project as found in the Specialist Studies. In so doing, it draws on the information gathered as part of the EIA process, the knowledge gained by the environmental specialists and the EAP and presents a combined and informed opinion of the environmental impacts associated with the project.

No environmental fatal flaws were identified in the detailed specialist studies conducted, provided that the recommended mitigation measures are implemented. These measures include, amongst others, the avoidance of highly sensitive features within the project site by the development footprint and the undertaking of monitoring, as specified by the specialists.

The potential environmental impacts associated with Proposed Project identified and assessed through the EIA process include:

8.3.1 Biodiversity and Wetlands

The completion of a study, in conjunction with the detailed results from the survey means that there is a high confidence in the information provided. The survey, which was completed, and the corresponding studies resulted in good site coverage, within the proposed footprint area, assessing the major habitats and ecosystems, obtaining a general species (fauna and flora) overview and observing the major current impacts.

It is clear from the regional ecological overview, as well as the baseline data collected to date that the project area has been altered (historically and currently) by mining activities but to a larger extent the human encroachment with the associated impacts. It can be concluded that the majority of the area covered by habitats associated with the development have a low sensitivity, only the wetlands and natural grassland have a high sensitivity. It is imperative that the mitigations be strictly followed and adhered to to decrease the impact the proposed project is expected to have on the environment.

Six wetland HGM units were identified within the 500m regulated area surrounding the proposed infrastructure options. Two of these systems (HGM1 and 2) are potential peatlands and should be dealt with sensitively. The least hydrologically impacted system are the depressions (HGM 5) which due to their largely isolated and endorheic (inward draining) nature have remained less affected by effluent discharge and were rated as Moderately Modified (class: C). HGM 2 was classified as Largely Modified (class: D). All other HGM units were rated as Seriously Modified (class E) mainly on account of the artificially increased flows, extent hardened surfaces within their catchments and presence of impeding features. Due to the longstanding impacts, none of these systems can be considered particularly sensitive, however, some are considered ecologically important. These include HGMs 1, 2, 3 and 5 which were rated as having a High ecological importance on account of their size, presence peat (HGM 1 and 2), open water, dense emergent vegetation and overall habitat diversity which, like the Blesbokspruit, may support large congregations of local and migratory waterfowl and may provide suitable habitat for some of the regions potentially occurring conservation important species.

From a risk perspective pipeline alternative 1 represent a viable option. Operation of the reclamation facility, however, poses more direct and potentially adverse risks to receiving wetlands. Each of the three reclamation sites have a wetland draining from one of their sides. namely HGMs 2, 3 and 5. These systems have the potential to be indirectly impacted by sedimentation and harmful toxicants liberated during the excavation of the gold bearing sediments. However, these impacts should temporary and should only last the lifetime of the reclamation activities with the long-term benefits associated with reinstatement outweighing the short-term impacts associated with reclamation (in theory). However, this is entirely contingent on Crown Gold Recoveries (Pty) Ltd's commitment to reinstatement as mitigation is somewhat limited. It is important that a wetland reinstatement and monitoring plan be commissioned and implemented. The plan and budget must be approved by the relevant authorities (i.e. DWS head office Pretoria). It is also recommended that a temporary cut-off trench be excavated around the Soweto Cluster dumps to help contain contaminants. Reinstatement should occur in a phased approach as operation progresses to allow for problems or inadequacies to be identified and rectified in the successive reinstatement phases. Monitor water quality in HGM 2, 3 and 5. Begin several months prior to construction commences to establish the pre-construction baseline

Considering the findings of the respective studies, from a terrestrial ecology perspective no fatal flaws were identified for the proposed project. Should the avoidance and mitigation measures prescribed be implemented, the significance of the considered impacts for all aspects is expected to be low. It is thus the opinion of the specialists that the project can proceed, but only if the prescribed mitigation measures and recommendations are implemented.

From a wetland perspective this project may cause temporary contamination of downstream watercourses during operation, and if authorised, every measure should be taken to minimise such contamination by following the prescribed mitigation stipulated in this, the water use licence and all relevant best practice guidelines and legislation regarding the reinstatement of contaminated land.

8.3.2 Surface Water

In conclusion, the most important aspect to prevent negative impacts from a surface water perspective, is to ensure that a sound stormwater management plan is implemented prior to the commencement of reclamation activities, in accordance with the conditions stipulated in GN R704. Maintenance of stormwater measures is of utmost importance and should be conducted as outlined in this EIA and EMPr, as well as within the Surface water specialist report. The removal of the dumps is expected to have a positive impact in the long-term on the surrounding watercourses.

Should the mitigation measures and recommendations provided in this report be implemented, then from a surface water perspective, the proposed project can commence. The following is a summary of the recommendations provided in the report:

- The current stream crossing position for the proposed pipeline is relocated either slightly north or south, as it currently traverses a large section of the floodline. This will result in less disturbance to the floodplain and channel;
- The proposed pipeline should be constructed above the 1:100 year floodline. Any supporting pipeline structures proposed within the floodline, should be constructed to withstand a 1:100 year flood;
- Any proposed infrastructure should as far as possible be located outside of the 1:100 year floodline and 100 m watercourse buffer, whichever is the greatest between the two. It must be noted that these are historical dumps that were created prior to GN R704, however, it is proposed that exemption from GN R704 is obtained for any infrastructure proposed within the floodline or within 100 m of a watercourse;
- The SWMP detailed in this EIA and EMPr is implemented, and that all conditions specified in GN R704 are taken into account;
- The impact mitigation measures provided under Chapter 8 of the EIA (as read with the Surface water impact assessment) are implemented; and
- The monitoring plans recommended in this report are implemented.

8.3.3 Groundwater

The lack of boreholes and detailed groundwater and aquifer information in the area makes it difficult to quantify the impacts associated with the reclamation activities as there are no users or monitoring sites to measure against. The surface water bodies close to the various dump indicate quality impacts, but due to dilution and precipitation the quality impacts seem to reduce further away from the slimes dams and sand dumps.

8.3.3.1 The estimated extent of pollution at the end of the operation phase

The extent of the plumes presented in the Figure 8-2 below are based on the area over which sulphate concentrations are expected to exceed 500 mg/L, based on the assumptions made. A concentration of 500 mg/L represents the SANS241:2015 Drinking Water Standard for acute health. At concentrations exceeding this standard, sulphate concentrations would pose an unacceptable health risk. The model was used to estimate the extent of pollution at the end of the operational phase. Three permeability scenarios are presented. These include the likely extent of the sulphate plume, based on the provisional calibration of the model. Also shown are the possible minimum and maximum extent of the sulphate plume, based on permeability variations.

The results of simulations are as follows and presented in :

- Historical impacts associated with the slimes dams included in the assessment are expected to significantly influence groundwater contamination during the operational phase. At the start of the operational phase, groundwater contamination would most probably have occurred over the assumed 75-year life of the slimes dams and sand dumps.

- Under likely conditions, the plumes may have migrated 1 to 1,5 km from the slimes dams situated on the Witwatersrand Supergroup (Wits) formations around 2L20/21, 2L18/18 and 2L16. Analysis of seepage from 2L16 suggests sulphate concentrations as high as 9,000 mg/L.
- The movement of sulphate contamination associated with 2L20/21 and 2A8 may be retarded in a southerly direction by the Booysens shale. If the permeability of the shale is low, as was assumed, it is likely that the shale band may act as an aquitard, reducing the risk of groundwater contamination moving in a southerly direction. In this area, the contamination is expected to migrate in a westerly direction towards the Klip River. Under likely permeability conditions, groundwater with sulphate concentrations exceeding 500 mg/L are not expected to reach the river during the operational phase of the project.
- Contamination associated with 2L17/18 and 2L16 are likely to extend south of the Booysens shale, as these dumps are located outside the shale, or close to its boundary.
- The movement of contamination in the dolomitic aquifer will be controlled by its porosity. The extent of pollution and the end of the operational phase is however smaller, compared to that in the Wits formations, due to a larger porosity and a lower groundwater flow gradient. Under the assumptions, it is not likely that the sulphate would migrate further than 600 m from 2L24 during the operational phase.
- The expected plumes associated the lower range of the permeabilities for the rock formations could migrated 300 to 700 m from the dumps situated on Wits formations, by the end of the operational phase of the project. In the dolomitic aquifer, the plume may migrate approximately 300 m from 2L24, under low permeability conditions.
- If high permeabilities exist in the rock formations, the sulphate plumes in the Wits formations aquifers associated with 2L20/21, 2A8, 2L17/18 and 2L16 may migrate more than 1.5 km from the dumps. It is further likely that preferential flow of contamination along the contact with the Booysens shale may reach the Klip River to the west under these conditions.

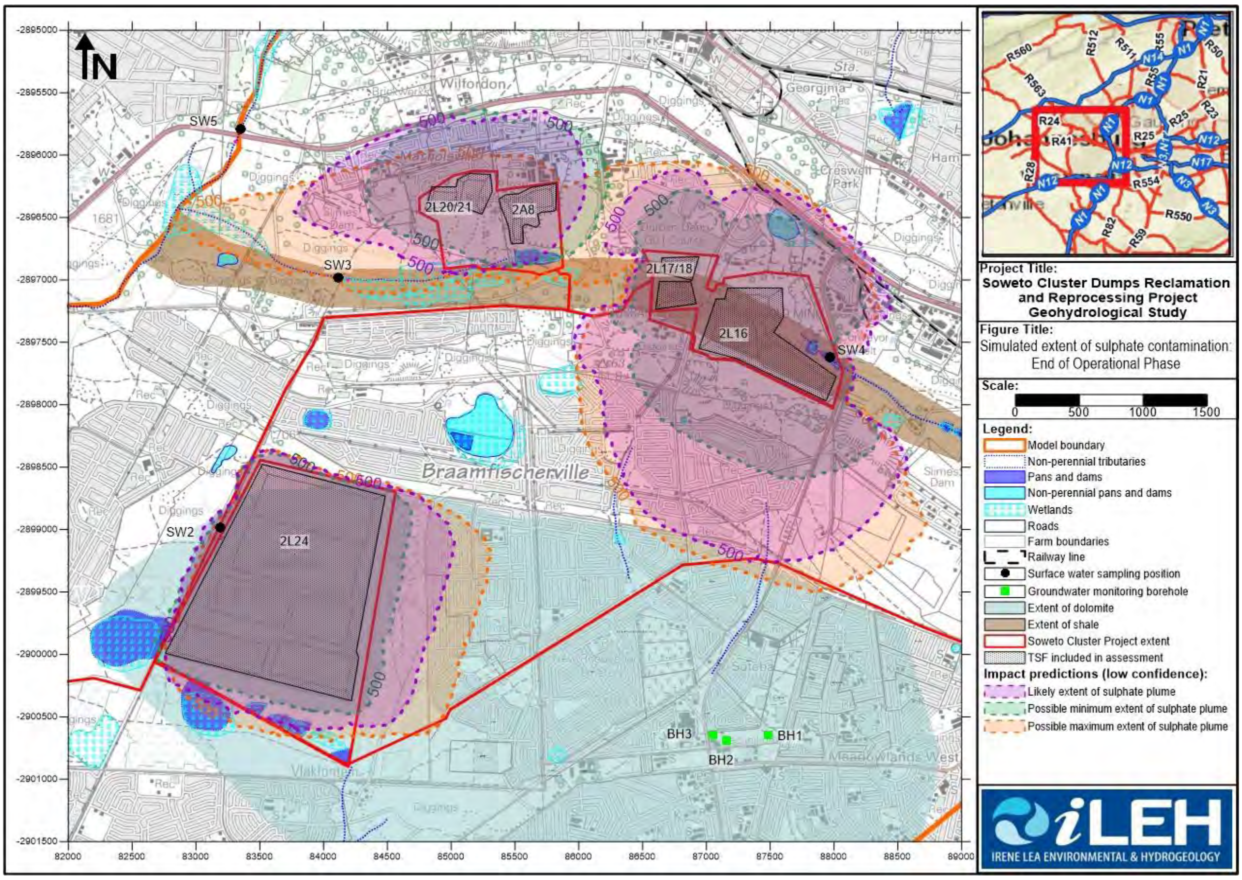

Figure 8-2: Simulated extent of sulphate plumes at the end of the operational phase. The pipeline to the east is no longer considered.

8.3.3.2 The long-term extent of pollution

The model was used to estimate the potential long-term impact of the project on groundwater quality. During the rehabilitation phase, it was assumed that all tailings material would be removed and that the footprints would be rehabilitated. The reprocessing of tailings and rehabilitation of the footprints would thus remove the source of groundwater contamination in the long-term.

The results of simulations are presented in Figure 8-3 and Figure 8-4.The figures delineate the likely, minimum and maximum extent of sulphate pollution associated with the project. As mentioned above, the 500 mg/L sulphate concentration contour was used to delineate the plumes. The following has been found:

- For all scenarios the extent of the zone of impact in the aquifers will increase. This is thought to be result of historical sulphate contamination that would continue to move through the aquifers.
- At the dumps, sulphate concentrations are expected to reduce from 2,800 - 9,000 mg/L within the footprints to 2,000 - 5,000 mg/L, as demonstrated in the groundwater specialist report. Although sulphate concentrations are still expected to exceed acceptable concentrations within the 100-year simulation period, the removal of and rehabilitation of the dump footprints will reduce the salt load to the aquifers. This, in return is expected to have a positive impact on wetlands and streams that are fed by groundwater. Due to the significantly higher source term assigned to the dumps in the

northern part of the project area, the most significant sulphate contamination is expected to occur in this area.

- Movement of contamination associated with 2L24 is expected to be restricted to the extent of the dolomitic aquifer.
- The extent of sulphate contamination is likely to reduce from 1 to 1,5 km at the end of the operational phase for likely permeability conditions, to less than 1 km in the long-term as a result of tailings removal and rehabilitation of the footprints. Despite this, there is a risk that the plumes may reach the Klip River in the long-term, under likely permeability conditions.
- Under lower permeability conditions, the plumes are not expected to extend more than 500 m from 2L24 in the dolomitic aquifer. Similar conditions are expected in the Wits aquifers associated with 2L20/21 and 2A8. Due to the high source concentrations associated with 2L17/18 and 2L16 and the fact that these dumps straddle the Booysens shale, plumes may migrate more than 1 km under low permeability conditions.
- Under high permeability conditions, the spread of contamination, especially in the Wits aquifers, could be significant. Plumes are expected to reach the Klip River and migrate more than 2 km in an easterly direction

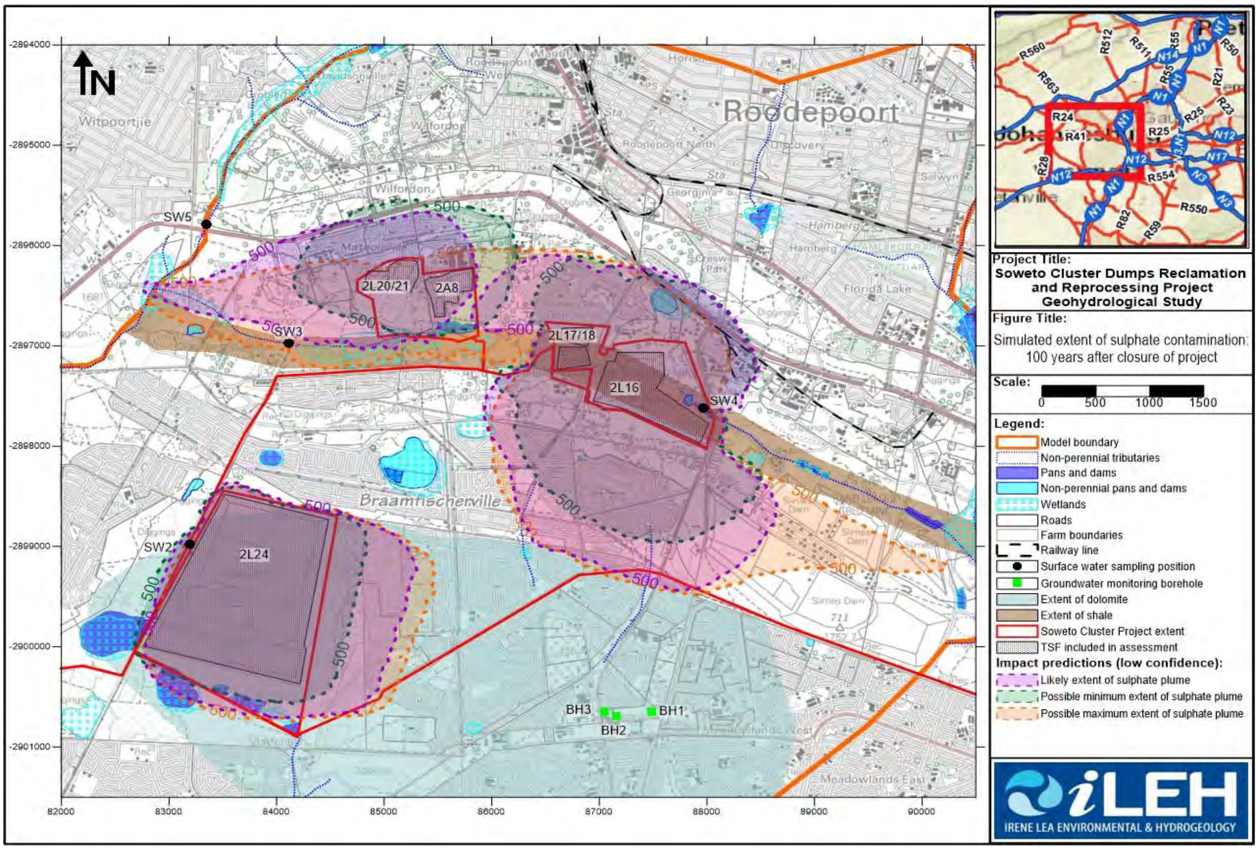

Figure 8-3: Simulated extent of sulphate plumes 100 years after the project has been decommissioned

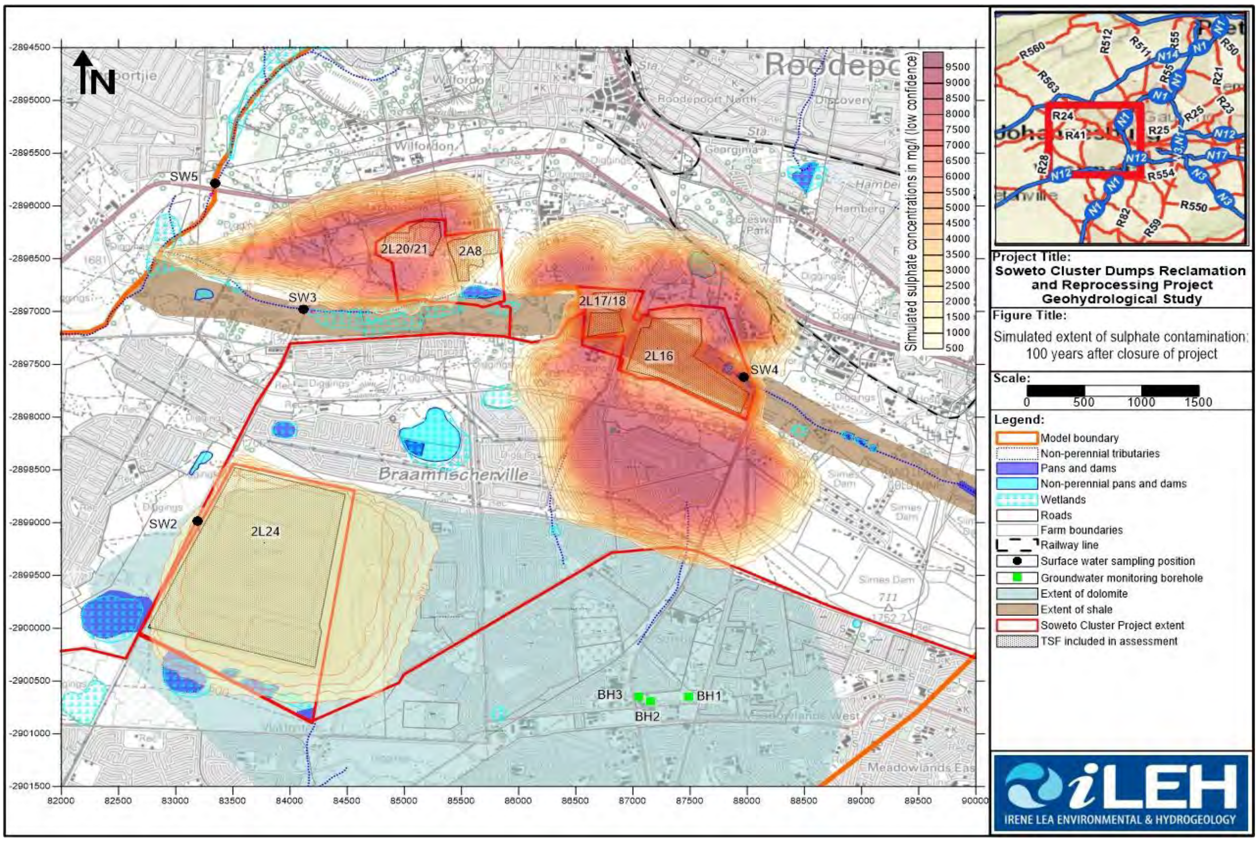

Figure 8-4: Long term sulphate concentrations likely under average permeability conditions.

8.3.3.3 The estimated long-term extent of pollution if the project DOES NOT GO AHEAD

The following is concluded from the information presented:

- The extent of sulphate contamination is expected to increase in future if the tailings removal and rehabilitation of the footprints are not implemented as part of the project. The anticipated contamination will continue to spread in the aquifers, as indicated on the Groundwater specialist report. Also indicated for the likely permeability scenario in Figure 8-5 is the extent of the sulphate plume, if the project is implemented. The aerial extent of the plumes is not expected to significantly reduce with the implementation of the project, mainly due to the continued impact of historical tailings deposition on groundwater quality.
- The most significant impact of tailings removal and rehabilitation of footprints is expected within the immediate area of the footprints. This is best illustrated with the sulphate concentrations presented in Figure 8-6 are compared to those in Figure 8-4. It is not possible to estimate this reduction with confidence with the available dataset. A reduction of 800 to 4,000 mg/L could be expected in this area.
- If the project will not go ahead, increased salt loads to the aquifers, wetlands and streams can be expected.

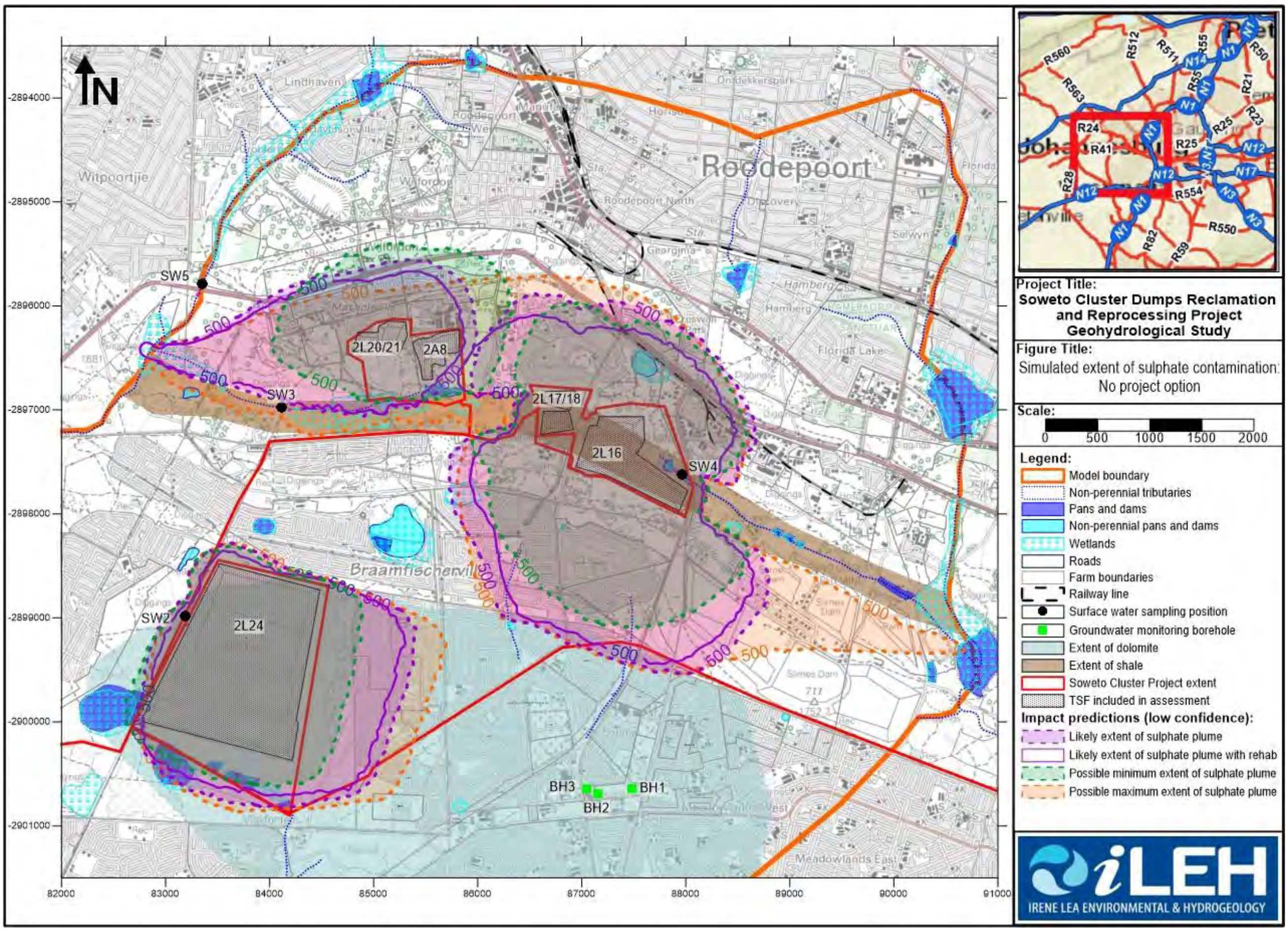

Figure 8-5: Simulated extent of sulphate plumes within 100 years if the project does not go ahead

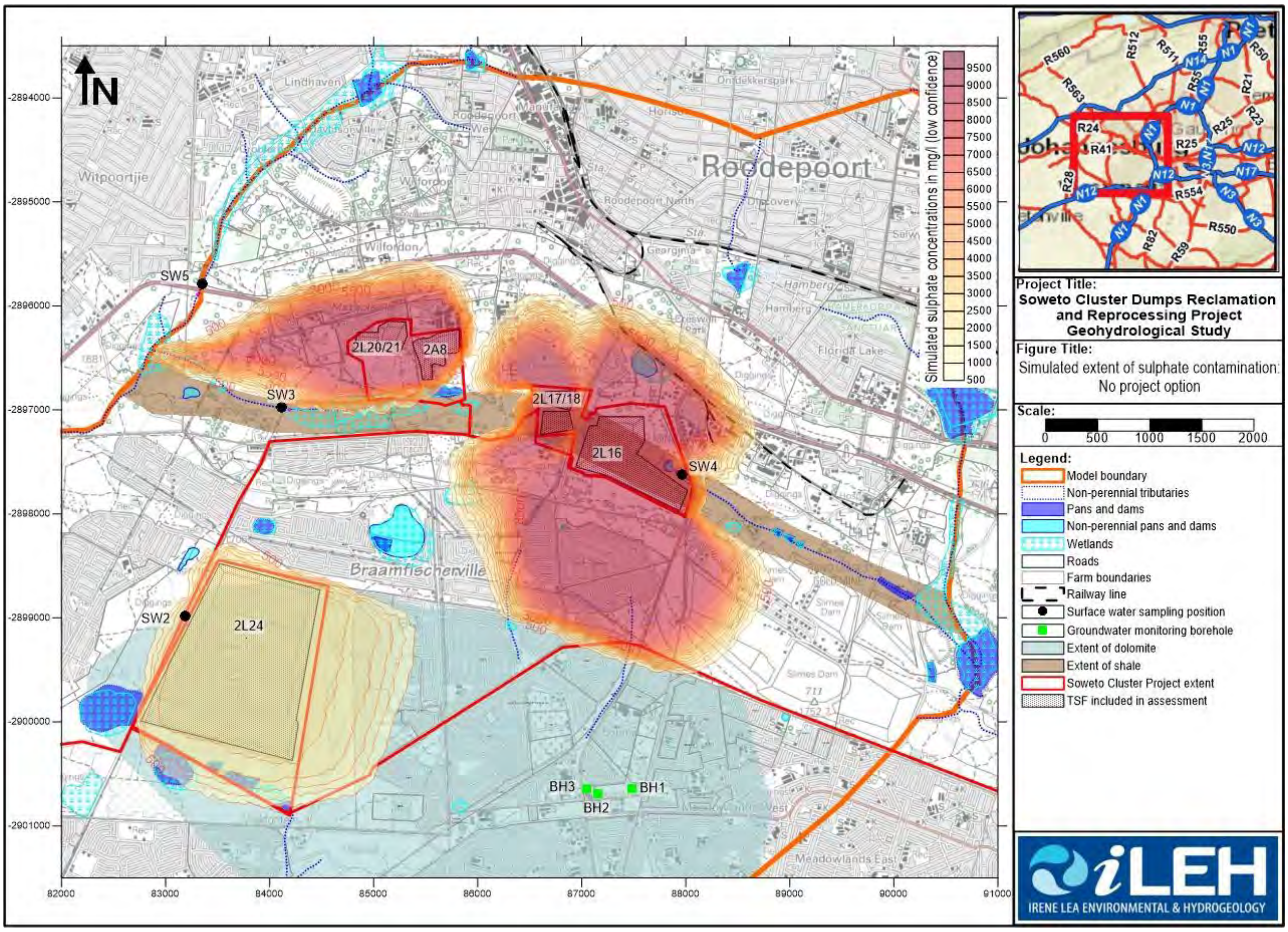

Figure 8-6: Long-term sulphate concentrations likely under average permeability conditions if the project does not go ahead

Drilling of dedicated groundwater monitoring boreholes is recommended to quantify the current groundwater quality and level depth status and define a better understanding of possible surface water – groundwater interactions. At each of the proposed monitoring borehole targets, a cluster of one shallow and one deep monitoring borehole must be drilled to assess impacts on the shallow weathered and deeper fractured aquifers, and downstream from the various dump sites. The depth of the deeper boreholes must be at least 50 m. The depth of the paired shallow borehole at each monitoring target must be drilled to the depth of weathering, approximately 20 m below surface.

Soil and groundwater assessments of the dump footprint area are recommended after removal of the tailings material to define the status of these environments and determine mitigation, management and monitoring requirements, post-removal. Crown Gold must ensure that an effective surface water collection and retention system is in place to ensure that all flow and collected water is directed towards the paddocks and not allowed to freely drain away from the dump areas. Pooling of water must not be allowed on open surfaces, except if lined.

The reclaimed slurry and any water must be removed from the exposed surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper fractured and karst aquifers.

Crown Gold must ensure that paddocks are desilted and designed to contain all dirty water generated during the reclamation process to prevent overflows and spillages.

Overall, the reclamation of the tailings and sand dumps will have a positive impact on the groundwater environment as the negative pollution impacts will be removed and with time the pollution concentrations will reduce. It is the opinion of GWA that the reclamation of the Soweto Cluster can proceed, if good surface water / storm water management is in place and maintained. In the short term there could be water quality impacts (sulphate and metals) if water on the surface is not managed effectively. Overall, the project will deliver a positive impact if the TSF is removed and subsequently a source of contamination.

8.3.4 Air Quality

The following conclusions can be made from the modelling results:

- Emissions from the TSFs and sand dumps in the current, undisturbed state are expected to be causing elevated ambient concentrations of both PM_{10} and $PM_{2.5}$ in downwind areas on windy days. Exceedances of the NAAQS may be expected up to 450 m from the northern cluster. This particularly affects the residents of Matholesville who reside within this area of impact. The size and lack of vegetation on 2L24 means that the area of impact surrounding this TSF is larger, with modelled exceedances of the NAAQS occurring over greater distances than for the northern cluster. The communities of Bram Fischerville to the north, Braamfischerville Township 14 to the west, Braamfischerville Phase 2 to the east and Thulani to the south are potentially affected if they are on the downwind side of the TSF on particularly windy days.
- The modelling indicates that the reclamation of the sand dumps may be expected to cause increased PM emissions with exceedances of the NAAQS extending over approximately 250 m from the work face and the reclamation stations on windy days. However, the areas of impact do not extend over any residential areas.
- The modelling of the TSFs indicates that, if reclamation of the TSFs is conducted conservatively, with the band stripped of vegetation not exceeding a width of 15 m and a length of 200 m, the area of impact is unlikely to increase significantly from the status quo emission situation.
- As reclamation progresses, if all mitigation methods are adhered to, the area of impact is expected to progressively decrease from the status quo emission situation.
- The modelling indicates that the removal of the Soweto Cluster as a permanent pollution source will, in the long term, improve the air quality of the surrounding areas, and reduce the health risk of fine particulate matter inhalation for the surrounding communities.

The Soweto Cluster lies in close proximity to several residential areas. It also lies partially within and partially to the north of the VTAPA which is a priority area for air quality. Therefore, all possible mitigation measures must be strictly adhered to. Furthermore, emissions must be monitored and if the increase in emissions from the reclamation activities cause the pre-operational phase dustfall levels to rise above the limits set by the National Dustfall Regulations, the mitigation programme will have to be increased until compliance is achieved.

The evaluation of the air quality impacts from mine tailings is based on a series of assumptions. Whilst care has been taken to assess the potential air pollution impact from the mine tailings, further research on tailings emission rates or actual on-site monitoring may result in different conclusions

8.3.5 Noise

Potential noise rating levels were calculated using a sound propagation model. Conceptual scenarios were developed for the construction and operational phase with the output of the modelling exercise indicating:

- a low risk of a noise impact for construction activities that are further than 200m from NSD;
- a medium risk of a noise impact for construction activities that are closer than 200m from NSD;
- a low risk for day-time operational activities (subject to the implementation of mitigation measures recommended for construction phase); and
- a potential medium risk for night-time operational activities.

Though Crown Gold indicated that activities will only take place during the day, the noise assessment also considered potential night-time reclamation activities (potential worse-case scenario). Mitigation is recommended for potential night-time activities. Mitigation options included both management as well as technical measures. Options to reduce the noise impact during the construction phase include:

- All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to realize the potential noise risks that activities (especially night-time activities) pose to the surrounding environment;
- Ensure a good working relationship between Crown Gold and all potentially noise-sensitive receptors. Communication channels should be established to ensure prior notice to the sensitive receptor if work is to take place close to them (especially if work is to take place within 200 m from them at night);
- Crown Gold should consider a relocation of potential noise sensitive receptors living closer than 200m from the construction and operational activities at dump 2L24. This should be read with what is required by the Social Impact Assessment
- Ensure that construction equipment is well maintained and fitted with the correct and appropriate noise abatement measures. Engine bay covers over heavy equipment could be pre-fitted with sound absorbing material. Heavy equipment that fully encloses the engine bay should be considered, ensuring that the seam gap between the hood and vehicle body is minimised.

Should night-time reclamation activities take place, the following measures are recommended by the noise specialist:

- Ensure that equipment is well maintained and fitted with the correct and appropriate noise abatement measures;
- All employees and contractors should receive induction that includes an environmental awareness component (noise). This is to allow employees and contractors to become aware of the potential noise risks that activities (especially night-time activities) pose to the surrounding environment;

- The company should plan to operate further than 200m from the closest potential noise sensitive receptors at night;
- Compliance with the Noise conditions of the Environmental Management Plan that covers:
  - Potential mitigation measures as defined in this report;
  - Formal register where receptors can lodge any noise complaints;
  - Noise measurement protocol to investigate any noise complaints; and
  - The commitment from Crown Gold to consider reasonable mitigation if the noise complaint investigation indicates the validity of a noise complaint. These measures could include steps ranging from process changes, development of barriers or enclosure of the noise source and even relocation (if no other feasible alternatives exist).

It is concluded that, if Crown Gold considers the recommendations in the noise impact assessment report (incorporated in the EMP of the EIA), that the increases in noise levels do not constitute a fatal flaw. It is, therefore, the recommendation of the noise specialist that the reclamation of the Soweto Cluster be authorized (from a noise impact perspective).

8.3.6 Heritage

8.3.6.1 Heritage Sites

The fieldwork for the HIA identified fourteen heritage sites with different heritage significance ratings. Eleven of these sites are historical structures or the remains of such structures, of which only two sites (**SC004** and **SC007**) are considered to have medium heritage significance and would require mitigation measures. The remaining historical structure sites (**SC001-003, SC006, SC008-011, SC013)** are considered to be of low to no heritage significance, and several of them have been recorded by previous heritage studies in the general area (du Pisanie 2014; Birkholtz 2018). Two of the sites identified are a burial ground (**SC005**) and possible graves (**SC014**), which are considered to have very high significance and would require mitigation measures. One of the sites is an informal church area (**SC012**) that is considered to be of Medium significance and would also require mitigation measures.

8.3.6.2 Historical structures

The impact significance before mitigation on two of the historical structure sites will be Medium negative before mitigation (**SC004 and SC007**). Implementation of the recommended mitigation measures will modify this impact rating to an acceptable LOW negative. The impact on the remainder of the historical structure sites (**SC001-003, SC006, SC008-011, SC013)** will be Medium to Low negative before mitigation but Low after mitigation.

However, sites **SC002, SC004, SC006, SC007, SC009**, and **SC011** all contain structures or remains that are 60 years or older and will require a permit to be obtained if they are required to be demolished.

8.3.6.3 Burial Grounds and graves

The impact significance before mitigation on the two burial ground and graves sites will be High negative before mitigation (SC005 and SC014). Implementation of the recommended mitigation measures will modify this impact rating to an acceptable Medium to Low negative.

8.3.6.4 Living Heritage/ Sacred sites

One informal church area (SC012). was identified immediately adjacent to the footprint area of historic slimes dam 2L24. Such religious sites could have significant heritage value to the relevant church group. Although this site has been given a Medium heritage significance, it is expected that destruction and relocation of the site could be undertaken with stakeholder engagement and consent (e.g. local community/ church group).

The impact of the proposed project on this living site is rated as having a MEDIUM negative significance rating before mitigation with a LOW significance rating after mitigation.

8.3.6.5 The historic slimes dams and sand dumps

Although several of the slimes dams/ sand dumps are older than 65 years and could technically be described as “man-made structures”, it is the considered opinion of this author that there is no heritage significance attached to the actual slimes dams/sand dumps. However, legally, the historic dumps 2L20, 2L21 and 2A8 and 2L16 and 2A6 and 2L17 and 2L18 will require a permit for their reclamation as they are 65 years or older. There is also a medium to high probability of the presence of historic graves under or adjacent to the historic dumps.

8.3.6.6 Palaeontology

The proposed project area is underlain by the Turffontein and Johannesburg Subgroups, which is rated as Low to Zero Palaeontological Sensitivity on the SAHRIS palaeosensitivity map. However, the area covered by the footprint of the dump 2L24 is located over an area marked red (Very High Significance). Since it is anticipated that there should be no excavation into the underlying geology and the area surrounding the dumps has been disturbed extensively in the past, it is recommended that an application for exemption from the standard requirement for a Palaeontological Impact Assessment be made to SAHRA.

8.3.6.7 General

It is the author’s considered opinion that overall impact on heritage resources is Medium to Low. Provided that the recommended mitigation measures are implemented, the impact would be acceptably low or could be totally mitigated to the degree that the project could be approved from a heritage perspective. The management and mitigation measures as described in this report have been developed to minimise the project impact on heritage resources.

8.3.7 Social Impacts

The following aspects were considered as part of the assessment of social impacts:

- People's way of life - How they live and work;
- Culture - The affected community's shared beliefs and languages;
- Community - Its cohesion, stability, character, services and facilities;
- Political systems - The extent to which people are able to participate in decisions that affect their lives, the level of democratisation that is taking place and the resources provided for this purpose;
- Environment - The quality of the air and water the community uses, the level of hazard or risk, dust and noise they are exposed, the adequacy of sanitation, their physical safety and their access to and control over resources;
- Their fears and aspirations - This relates to the community's perceptions about their safety, their fears about the future of their community and their aspirations for their future and the future of their children.

There are significant positive impacts associated with the proposed project, notably job security, skills training, stimulation of economic growth and the main positive impact is the removal of the pollution source, the dumps. There are however several potential negative socio-economic impacts of the proposed project that may affect surrounding businesses and residential areas. The SIA has proposed monitoring and mitigation measures to avoid or minimise negative impacts and enhance positive impacts.

From a social point of view, **Alternative 2 to the CPP** is the preferred option. Alternative 2 is the preferred route based on the following factors:

- Socio-economic impacts;
- Land use planning and future spatial development considerations
- Existing Approvals;
- New design standards and guidelines; and
- Logistical feasibility – raw material supply, market proximity and utilities;

In light of the SIA findings the following recommendations should be considered:

- It is recommended that the mitigation and management measures as contained in this SIA report be actively pursued and incorporated in the EMP where applicable;
- Regular internal and external monitoring should be undertaken to ensure compliance with the Environmental Management Plan.

In conclusion, the social specialist approves the project based on the assurance that potential negative impacts on the receiving socio-economic environment will be mitigated and managed as far as possible, and that potential positive impacts are enhanced to ensure the greatest value.

8.3.8 Community Health Impact Assessment

The removal of mine dumps will, in the long run, have a beneficial effect. Adequate mitigation measures are expected to reduce the significance of negative impacts, while positive health effects can be created through the implementation of associated enhancement measures. The recommended mitigation measures must be implemented to manage the impacts and ensuring compliance with current legislative requirements.

From a community health perspective, the Project will result in long term positive environmental and sustainability benefits to the larger West Rand.

To conclude, it is imperative to note that the natural radiological situation cannot be restored and that reclamation is an attempt to control the damage. It is, therefore, recommended that the Project is allowed to proceed on the assumption that the environmental, social and health management commitments are adhered to.

8.3.9 Traffic Statement

The following conclusions were made based on the Traffic Statement for the proposed project:

- Zoning Rights are already in place for the planned activities.
- The sites are located within the area of Soweto, Johannesburg, Gauteng. The Locality is shown on Figure 1 in the Traffic Impact Assessment specialist report.
- A total of 12 trips will be generated in the AM Peak hour and 10 trips during the PM Peak hour at each of the 3 sites.
- The proposed accesses are situated on Dobsonville Road (M77) (SITE1), West End Street/ Hail Street (SITE 2) and 56th Street (SITE 3). The access and geometric details are shown on Drawing 19050/AL/01, Drawing 19050/AL/02 and Drawing 19050/AL/03.
- Access safety measures are as follows:
    - Speed Limit Signs (60km/h) at least 200m from the proposed accesses in both directions on Dobsonville Road and 56th Street.
    - Heavy Vehicles Turning signs at least 100m from the proposed access in both directions on Dobsonville Road and 56th Street.
    - Sight distances of at least 180m in both directions are available on all roads. This is more than the minimum sight distances required by COTO TMH16.
    - A Flag Man is proposed in the event of slow-moving vehicles exiting the proposed accesses, a Flag Man will need to regulate traffic and ensure a safe traffic environment with enough space to allow the vehicle to exit.
    - An internal U-Turn space needs to be provided to avoid dangerous movements within the traffic on Dobsonville Road, West End Street/ Hail Street and 56th Street. See Drawing 19050/AL/01, Drawing 19050/AL/02, Drawing 19050/AL/03.
    - A minimum stacking distance of 24m are required before any gate or boom at the proposed accesses.

- On-site traffic circulation was analysed as a swept path analysis for both heavy vehicles and passenger vehicles. Details are shown on Drawing 19050/AL/01, Drawing 19050/AL/02, Drawing 19050/AL/03.
- 10 Parking bays are proposed, as well as 2 delivery zones for heavy vehicles are proposed at all 3 sites.
- A pick-up and Drop-off facility needs to be provided with space for at least one minibus-Taxi at all 3 sites.

The planned activities are supported from a traffic flow and traffic safety viewpoint, provided that the recommendations made in this report are implemented.

8.4 Summarised Environmental Risk Matrix

A detailed description of the methodology utilised to determining the environmental impacts and their respective probability, magnitude and severity is provided in Section 8.1 as well as in the specialist reports contained in Appendix D.

During the risk assessment process, it was found that the negative impacts of the proposed project with mitigation would be mostly medium to low in nature, and the positive impacts medium to high.

The EAP and environmental consultants responsible for the compilation of this document, and PPP feel that the Soweto Cluster project should be approved, on condition that the Crown Gold implements all identified management measures and implements the monitoring plan.

Table 8-66: Key Findings.

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
Positive (+)	**Major (high)**					**Major (high)**	❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Job security ❖ Skills development ❖ Economic growth ❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Groundwater quantity ❖ Alternative Land use ❖ Aquifer yield ❖ Economic Growth ❖ Health – Drinking water, Groundwater ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation	❖ Water quality ❖ Groundwater quality ❖ Health – minimising radioactive dust ❖ Minimising Particulate Matter inhalation ❖ Alternative Land-use ❖ Removal of pollution source ❖ Improved aquifer yield ❖ Opportunity for watercourses to reinstate.
Positive (+)	**Moderate (medium)**	❖ Job security ❖ Skills Development ❖ Economic growth	❖ Job security ❖ Skills development ❖ Stimulation of economic growth	❖ Groundwater quality ❖ Groundwater quantity ❖ Economic growth ❖ Alternative Land use ❖ Water Quality improvement ❖ Aquifer yield	❖ Water quality ❖ Groundwater quality	**Moderate (medium)**	❖ Job security ❖ Economic growth ❖ Respiratory Effects ❖ Health	❖ AMD removal ❖ Water Quality ❖ Groundwater quantity ❖	❖ Groundwater quality ❖ Economic growth	
Positive (+)	**Minor (low)**		❖ Economic growth			**Minor (low)**				
No Impact	**No Impact**					**No Impact**				
Negative (-)	**Minor (low)**	❖ Groundwater quantity ❖ Noise ❖ Heritage ❖ Safety ❖ Sense of place ❖ Influx of Job seekers	❖ Noise ❖ Heritage ❖ Influx of Job seekers	❖ Noise ❖ Safety ❖ Influx of Job seekers	❖ Air quality	**Minor (low)**	❖ Water Quality ❖ Groundwater Quality ❖ Air quality ❖ Heritage ❖ Health ❖ Sense of place ❖ Future land use ❖ Attitude formation ❖ Noise ❖ Biodiversity ❖ Fauna ❖ Flora ❖ Wetlands, wetland soil and wetland Vegetation	❖ Wetlands ❖ Water Quality ❖ Heritage ❖ Health ❖ Sense of place ❖ Impact on future land use ❖ Noise at night ❖ Nuisance factors ❖ Attitude formation and expectations ❖ Biodiversity ❖ Fauna ❖ Flora	❖ Water quality ❖ Air quality ❖ Noise ❖ Safety ❖ Dust nuisance on health ❖ Impacts on the Viva Settlement ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora ❖ Inappropriate closure leading to loss of wetlands	❖ Air quality ❖ Surface water quality
Negative (-)	**Moderate (medium)**	❖ Biodiversity ❖ Fauna ❖ Flora ❖ Water quality	❖ Water quality ❖ Surface Water ❖ Air quality ❖ Health	❖ Water quality ❖ Air quality ❖ Job security ❖ Skills development	❖ Surface water quality	**Moderate (medium)**	❖ Informal settlements ❖ Safety Impacts ❖ Viva Settlement	❖ Air quality ❖ Safety ❖ Heritage (burial ground)	❖ Job security ❖ Informal settlements ❖ Safety Impacts	

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
		❖ Air Quality ❖ Heritage (dam wall) ❖ Health ❖ Noise ❖ Informal settlements ❖ Sense of place ❖ Respiratory Effects ❖ Wetlands, wetland soil and wetland Vegetation	❖ Sense of place ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora	❖ Impacts on the Viva Settlement ❖ Nuisance factors ❖ Biodiversity ❖ Fauna ❖ Flora				❖ Informal settlements ❖ Dust nuisance on health ❖ Viva Settlements ❖ Direct loss of wetlands ❖ Contamination of wetland ❖ Wetlands, wetland soil and wetland Vegetation		
Negative (-)	Major (high)	❖ Heritage (burial ground) ❖ Safety Impacts ❖ Heritage (Graves) ❖ Health – Existing contaminated surface and groundwater ❖ Future land use ❖ Viva Settlement ❖ Attitude formation ❖ Water quality ❖ Noise at Night ❖ Health – status quo radioactive dust	❖ Informal settlements ❖ Safety ❖ Health – Existing contaminated surface and groundwater ❖ Viva Settlements ❖ Impact on future land use ❖ Attitude formation and expectations ❖ Direct loss of wetlands ❖ Contamination of wetland ❖ Wetlands, wetland soil and wetland Vegetation ❖ Health – status quo radioactive dust	❖ Informal settlements ❖ Safety Impacts ❖ Health – Existing contaminated surface and groundwater ❖ Inappropriate closure leading to loss of wetlands ❖ Health – status quo radioactive dust		Major (high)			❖ Skills development	

CHAPTER 9: INFORMATION FOR CONSIDERATION

9.1 Assumptions, Uncertainties and Gaps in Knowledge

The following assumptions and limitations are applicable to this EIA report:

9.1.1 Biodiversity and Wetlands

The following limitations are relevant for this project:

- As per the scope of work, the fieldwork component of the assessment comprised of one assessment only, which was conducted during the early wet season;
- A single season survey was conducted in spring. Although faunal activity is lower during this time, based on TBC's experience and knowledge of biodiversity in the region, the timing of the survey was unlikely to preclude the detection of any potentially occurring species of conservation concern.
- The use of two of the main wetland indicators namely hydromorphic soils and hydrophytic vegetation was limited in many of the project areas due to clearing and infilling;
- Infield wetland sampling was focussed within a 50 corridor along the pipeline route and within the Soweto Cluster and Cooke TSF and Processing Plant areas. As such, wetland delineations beyond these areas into the 500 m regulated area should be considered field- validated desktop delineations;
- The GPS used for wetland delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side; and
- Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

9.1.2 Surface Water

The following are key assumptions and limitations for the conceptual SWMP:

- The SWMP and associated calculations are based on the project description provided. Should the project description or infrastructure layout change, then the SWMP will need to be revised; and
- The channels were sized to take the maximum flow calculated at the downstream end of the contributing catchment, and it is assumed that the channel sizing will be uniform along the entire length.

9.1.3 Groundwater

The groundwater model presented in this report is based on the aquifer conceptualisation discussed earlier in this report. There are however a number of assumptions and limitations that affect the confidence level of the simulations results. These include:

- Site-specific aquifer parameters are not available at the project sites. In order to complete an assessment of the impacts of tailings reprocessing on groundwater quality, literature-based aquifer parameters were considered. It is shown that a wide range of values are reported for the affected geological formations. This is expected in fractured and karst-type aquifers, where groundwater flow is complex and changes with time. However, for the purpose of simulations, simplifications are required. For this reason, likely, minimum and maximum flow conditions will be evaluated at the hand of adjusting the permeabilities of the formations to understand groundwater flow under these hypothetical conditions.
- Due to the fact that no on-site groundwater levels are available, model calibration and sensitivity analysis could not be performed to a satisfactory level. Limited calibration was completed with groundwater levels measured in three boreholes situated approximately 3 km east of 2L24, in the dolomitic aquifer. The outcome of this process is discussed below. It is noted that the inadequate level of model calibration limits the level of confidence in the output.

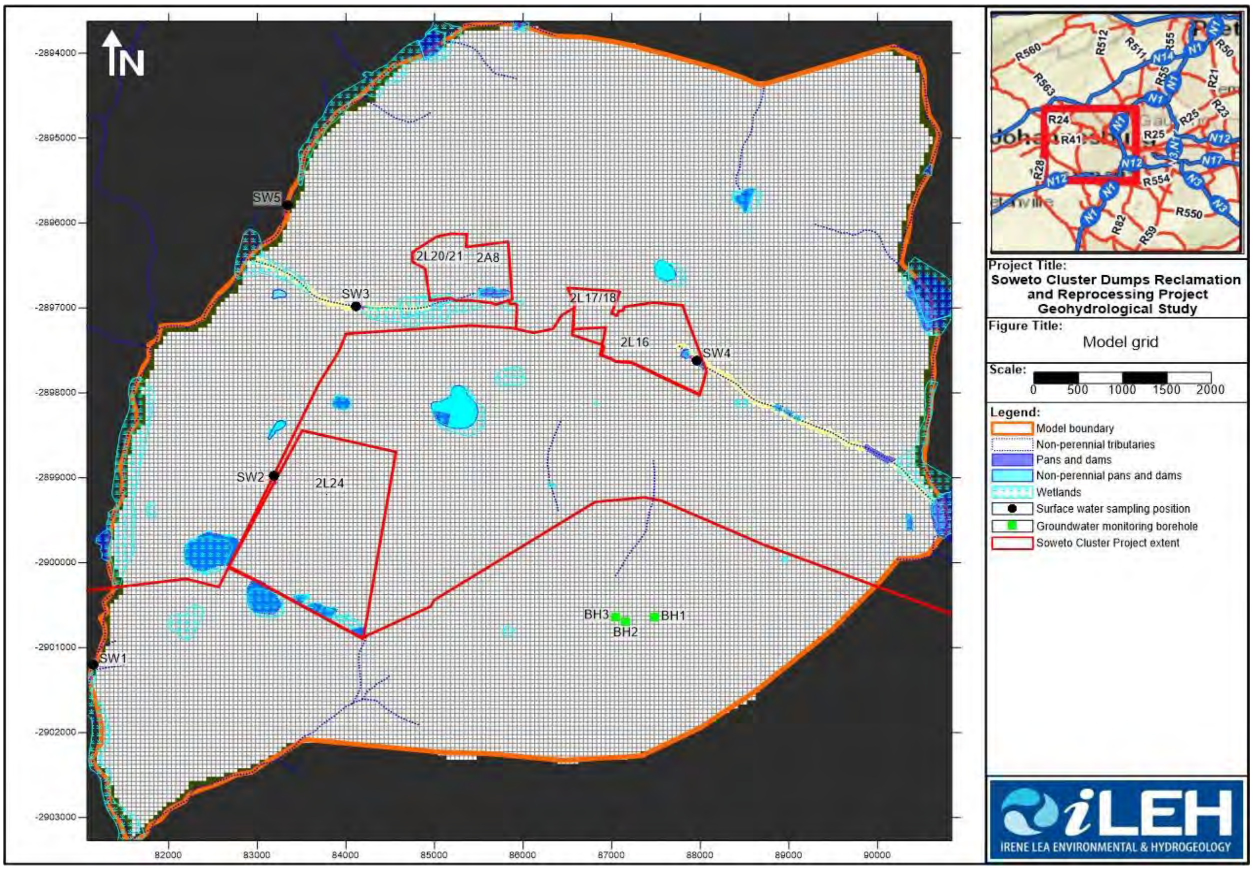

Figure 9-1: The project model grid

Table 9-1: Literature-based aquifer parameters considered

FORMATION	PERMEABILITY (M/D)			SPECIFIC STORAGE (M^{-1})		POROSITY (%)	
	Irene Lea (2016)	Freeze & Cherry (1979)	Domenico & Schwartz (1990)	Irene Lea (2016)	Anderson & Woessner (1992)	Irene Lea (2016)	Freeze & Cherry (1979)
Dolomite (minimum)	5,00E-01	8,64E-05		1,00E-03		10	
Dolomite (maximum)	1,00E+00	8,64E-02		1,00E-01		20	
Karst limestone (minimum)		8,64E+00	1,73E-05				5
Karst limestone (maximum)		8,64E+04	8,64E-02				50
Shale (minimum)		8,64E-09	8,64E-09		1,50E-06	1	0
Shale (maximum)		8,64E-05	1,73E-04		6,90E-05	5	10
Fractured crystalline rock (minimum)		8,64E-04	6,91E-04		6,90E-05		0
Fractured crystalline rock (maximum)		8,64E+02	2,59E+01		3,30E-06		10

- To test the model's sensitivity to possible variations in aquifer permeabilities, likely, minimum and maximum flow conditions were evaluated, as mentioned above. The sensitivity to other aquifer parameters were not tested as it is thought that aquifer permeability would play the most significant role in plume movement.
- Despite the current low confidence in the model, the water balance error for the flow components considered during simulations is less than 1%, as indicated in the groundwater impact assessment. This means that the difference between inflows and outflows simulated are within generally acceptable bounds.

Table 9 1: Model water balance

FLOW TERM	INFLOW (M^3/D)	OUTFLOW (M^3/D)	BALANCE (M^3/D)
Storage	5,94E+01	3,80E+02	-3,21E+02
Constant Head	0,00E+00	2,34E+02	-2,34E+02
Drains	0,00E+00	5,11E-02	-5,11E-02
Recharge	5,52E+02	0,00E+00	5,52E+02
River Leakance	1,09E-02	1,43E-01	-1,32E-01
Head Dependent Boundaries	2,46E-01	8,33E-01	-5,87E-01
Total	6,12E+02	6,15E+02	-3,45E+00
		Water Balance Error (%)	-0,56

- The source term used during simulations is based on surface water sampling and the water balance prepared for the site by Hydrospatial (2019). Generalised assumptions are made to characterise all the slimes dams and sand dumps that are considered as part of this project. These are discussed in more detail below. It is strongly recommended that a better understanding of the volume of seepage available for infiltration from the TSFs to the underlying aquifers, as well as the quality of leachate is obtained. Once this information is available, the predictive modelling should be updated.

- The historical impact of tailings deposition is not well understood. Some information is available to define the period over which groundwater quality has been affected in the past, but this is not sufficient to assess historical impacts with confidence. The available information was however incorporated and included during simulations. It is noted that the historical impact on groundwater quality plays a significant role in the current and future extent of plume movement.
- Only advective transport of contaminants was simulated. While it is acknowledged that attenuation will take place, there is currently no information available to characterise this aspect. Due to the fact that it is assumed that contamination will flow at the same rate as groundwater would in the aquifers, the scenarios represent a worst-case scenario, in line with taking a precautionary approach.

9.1.4 Air Quality

- Construction of buildings and roads is a source of dust emissions that may have a substantial temporary impact on local air quality. However, there will be minimal construction activities associated with the Soweto Cluster reclamation process. Access roads will be routed from existing entry points, and much of the basic infrastructure will be of a temporary nature e.g. construction contractors' yards, mobile change houses and mobile offices. Furthermore, pump stations and water infrastructure are already established. The pipelines which will need to be constructed will join into existing pipelines to and from the Cooke Plant. Emissions to the air from the laying of the pipelines are likely to be of relatively short duration and are deemed to be of low significance.
- Vehicles travelling across parts of the tailings could cause significant instantaneous emissions from exposed areas of tailings material. However, it was assumed that (other than haul vehicles on the sand dumps) the total amount of traffic and hence the total emissions from this source would be insignificant. Furthermore, it is recommended that a strict speed restriction of 40 km/hr be implemented for all vehicles travelling on site. This will substantially reduce possible instantaneous emissions.
- The location of the conveyors used to remove oversize material while water is sprayed to turn the sand into a slurry had not yet been defined at the time of writing this report. For the purpose of the modelling, it was assumed that the conveyors with the screens will be located near the reclamation stations at the lowest point of each area.
- The NPi emission factor for TSFs does not account for differences in vegetation cover, moisture content, salt concentration, surface structure (structural & textural cracks & inhomogeneity), nor weathering of the tailings (NPi, 2006). For this reason, it was assumed that in the 15-metre-wide bands where all vegetation is removed for the mining process, the emission rates predicted by the NPi will increase by a factor of 10.
- The Marticorena and Bergametti equations (1995) indicate that once the threshold velocity of a particle size is exceeded, the emission rate and therefore ambient concentrations increase very rapidly. This means that large amounts of PM_{10} and $PM_{2.5}$ may be emitted from the TSF on gusty days. However, the absence of meteorological data at the level of instantaneous wind gusts means that the frequency and duration of this occurring could not be assessed.

- The Marticorena and Bergametti equations (1995) also indicate that below 6.7 m/s the emission rate and therefore ambient concentrations decrease very rapidly. In the period 2015 to 2017 at O.R. Tambo International Airport, all except two days recorded a maximum gust speed of 6.7 m/s or more, indicating that there will be some emissions of PM_{10} from the tailings on almost every day of the year. However, the average wind speed of 255 days was less than 5.9 m/s. Lower wind speeds may cause the distance of dispersion to decrease. This may result in the modelling indicating more exceedances close to the TSFs, as lower wind speeds will reduce the distance of dispersion while the model is unable to reduce emission rates on those days.
- It was assumed that the face being mined by the jets of high-pressure water will be wet on a regular basis, therefore emissions will not be increased from this area, even though the tailings material is 'disturbed'.
- In line with the mandate for regulatory modelling, 'worst-case' scenarios were modelled i.e. modelling was undertaken for areas where the tailings are closest to most sensitive receptors.
- It was assumed that reclamation would start in the areas closest to the lowest points and reclamation stations. In the northern area of the cluster, it was, therefore, assumed that the two sand dumps would be reclaimed first. Based on this assumption, for each of these modelling runs it was also assumed that the areas 'uphill' from the mining cut would still be emitting particulates as if they hadn't been disturbed and the areas 'downhill' would have been stripped leaving bare 'red earth'.
- The size of 2L24 and the lack of vegetation cover on the southern areas means that the emissions from this TSF are substantial. However, this also amplifies the inadequacies of modelling emissions from TSFs where it is impossible to account for increases and decreases in emissions based on the presence or absence of instantaneous wind gusts. For this reason, the south cut was modelled independently of status quo emissions to the north of this area to illustrate the importance and efficacy of mitigating by clearing no more than an area of 15 m by 200 m at a time.
- Areas over which the slurry runs can be expected to have no emissions while they are wet. Furthermore, these areas tend to form a crust as they dry out. However, the position and extent of these areas was not known, and therefore the decrease in emissions from these areas could not be included in the models.
- For the 'denuded land' scenario, it was assumed that all tailings material will have been removed. If any of this fine tailings-material is left behind, the predicted emissions from these areas could be substantially different.
- It should be noted that isopleth plots reflecting the 24-hour averaging periods contain only the fifth-highest predicted ground level concentrations for that averaging period, over the entire three-year period for which simulations were undertaken. This is in line with the NAAQS which allows for four exceedances per year. It is therefore possible that, even though a high average daily concentration is predicted to occur at certain locations, this may only be true for five days a year.
- The scope of the work only covers ambient concentration impacts beyond the site's boundaries.
- Occupational health issues were not addressed.

9.1.5 Noise

9.1.5.1 Calculating Noise Emissions – Adequacy of Predictive Methods

The noise emissions into the environment from the various sources as defined were calculated for the operational phase in detail, using the sound propagation model described in ISO 9613-2.

The following was considered:

- The octave band sound pressure emission levels of processes and equipment;
- The distance of the receiver from the noise sources;
- The impact of atmospheric absorption;
- The operational details of the proposed project, such as projected areas where activities will be taking place;
- Topographical layout; and
- Acoustical characteristics of the ground. 50% soft ground conditions were modelled, as the area where the reclamation activity would be taking place is well vegetated and sufficiently uneven to allow the consideration of relatively soft ground conditions. This is because the use of hard ground conditions could represent a too precautionary situation.

The noise emission into the environment due to additional traffic was calculated using the sound propagation model described in RLS-90 used in Germany.

Corrections such as the following were considered:

- Distance of receptor from the road;
- Road construction material;
- Average speeds of travel;
- Types of vehicles used; and
- Ground acoustical conditions.

In this project, it illustrates the potential extent of the calculated noises of the complete project and not noise levels at a specific moment in time. It is used to define potential issues of concern and not to predict a noise level at a potential noise-sensitive receptor. For this, the selected model is internationally recognised and considered adequate. Noise contours are illustrated from 35 and 45 dBA upwards (night- and day-time rural rating levels). This may represent the potential audibility of the project activities.

9.1.5.2 Adequacy of Underlying Assumptions

Noise experienced at a certain location is the cumulative result of innumerable sounds emitted and generated both far and close, each in a different time domain, each having a different spectral character at a different sound level. Each of these sounds is also impacted differently by surrounding vegetation, structures and meteorological conditions that result in a total cumulative noise level represented by a few numbers on a sound level meter.

As previously mentioned, it is not the purpose of noise modelling to determine accurately a likely noise level at a certain receptor but to calculate a noise rating level that is used to identify potential issues of concern.

9.1.5.3 Uncertainties Associated with Mitigation Measures

Any noise impact can be mitigated to have a low significance. However, the cost of mitigating this impact may be prohibitive, or the measure may not be socially acceptable (such as the relocation of an NSD). These mitigation measures may be engineered, technological or due to management commitment.

For the purpose of the determination of the significance of the noise impact mitigation measures were selected that is feasible, mainly focussing on management of noise impacts using rules, policy and require a management commitment. This, however, does not mean that noise levels cannot be reduced further, only that to reduce the noise levels further may require significant additional costs (whether engineered, technological or management).

It was assumed the mitigation measures proposed for the construction phase will be implemented and continued during the operational phase.

9.1.5.4 Uncertainties of Information Provided

While it is difficult to define the character of a measured noise in terms of numbers (third octave sound power levels), it is difficult to accurately model noise levels at a receptor from any operation. The projected noise levels are the output of a numerical model with the accuracy depending on the assumptions made during the setup of the model. The assumptions include the following:

- That octave sound power levels selected for processes and equipment accurately represent the sound character and power levels of these processes and equipment. The determination of octave sound power levels in itself is subject to errors, limitations and assumptions with any potential errors carried over to any model making use of these results;
- Sound power emission levels from processes and equipment changes depending on the load the process and equipment are subject to. While the octave sound power level is the average (equivalent) result of a number of measurements, this measurement relates to a period that the process or equipment was subject to a certain load (work required from the engine or motor to perform action). Normally these measurements are collected when the process or equipment is under high load. The result is that measurements generally represent a worst-case scenario;
- As it is unknown which processes and equipment will be operational (when and for how long), modelling considers a scenario where processes and equipment are under full load for a set time period. Modelling assumptions comply with the precautionary principle and operational time periods are frequently overestimated. The result is that projected noise levels would likely be over-estimated;
- Modelling cannot capture the potential impulsive character of a noise that can increase the potential nuisance factor;

- The XYZ topographical information is derived from the Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) Global DEM data, a product of Japan's Ministry of Economy, Trade and Industry (METI) and the National Aeronautical and Space Administration (NASA). There are known inaccuracies and artefacts in the data set, yet this is still one of the most accurate data sets to obtain 3D-topographical information;
- The impact of atmospheric absorption is simplified and very uniform meteorological conditions are considered. This is an over-simplification and the effect of this in terms of sound propagation modelling is difficult to quantify, and
- Acoustical characteristics of the ground are over-simplified with ground conditions accepted as uniform. Fifty percent (50%) soft ground conditions will be modelled as the area where the construction activities are proposed is well vegetated and sufficiently uneven to allow the consideration of soft ground conditions.

9.1.6 Heritage and Palaeontology

Not detracting in any way from the comprehensiveness of the research undertaken, it is necessary to realise that the heritage resources located during the desktop research do not necessarily represent all the possible heritage resources present within the area.

Such observed or located heritage features and/or objects may not be disturbed or removed in any way until such time that the heritage specialist has been able to make an assessment as to the significance of the site (or material) in question. This applies to graves and cemeteries as well.

Field survey for this project was constrained by security issues related to illegal mining activity in the footprint areas, as well as restricted access to some areas due to informal settlements and areas of extensively disturbed ground, as well as formal mining activity. In addition, heritage visibility was obscured in some areas due to dense vegetation and extensive dumping

9.1.7 Social

- The social study is based on data obtained from the community survey, 2016, which may not reflect accurate information;
- Not every individual in the community could be interviewed therefore only key people in the community were approached for discussion;
- It should be noted that the social environment is a dynamic, constantly changing entity. It is therefore not always possible to predict all social impacts to a very high level of accuracy. Care has been taken to identify the most likely and significant impacts in the most appropriate way for the current local context;
- Social impacts can be experienced by affected communities on an actual or a perceptual level. It is therefore not always possible to quantify social impacts properly;
- It should be noted that predictions concerning the characteristics of the receiving socio-economic environment at the time of decommissioning are subject to a large margin of error, thus significantly reducing the accuracy of impact assessment- the specialist has attempted to assess (where possible) the impact during the decommissioning phase;

- Interviews were conducted at a time when xenophobic attacks were rife in the country, as such some interviews with participants from outside South Africa did not materialise -participants felt unsafe taking part in in the interviews;
- The proposed project is not regulated by the MPRDA, therefore a Mining Right Application and supporting documents such as the Social and Labour Plan do not form part of the proposed project.

9.1.8 Community Health

- The cHIA assessed the health impact related directly to the communities in the vicinity of the Soweto Cluster site.
- Where reference has been made to other specialist reports, it is assumed that the information sourced from these reports is current, and at the time has remained unchanged.
- This HIA assumes that the current impacts resulting from the Soweto Cluster are a health risk to the surrounding community.
- This study has taken comments gathered during project phase environmental process to understand the community concerns.

9.2 Aspects for Inclusions as Considerations of the Environmental Authorisation

Should the DMRE grant EA for this project, it should be subject to the following conditions:

- The project may not commence prior to the EA being issued;
- The project should remain in full compliance with the requirements of the EMPr and with all regulatory requirements;
- The EMPr should be implemented by qualified environmental personnel who have the competence and credibility to interpret the requirements of the EMPr. Such persons must be issued with a written mandate by Crown Gold management to provide guidance and instructions to employees and contractors;
- Crown Gold should conduct annual internal auditing of environmental performance and annual reporting to the DMRE;
- Crown Gold must undertake external auditing of the environmental performance as per the conditions of the Environmental Authorisation and provide the DMRE with a copy of the auditing report;
- Stakeholder engagement must be maintained during the construction, operational and decommissioning/rehabilitation phases of the project, with the emphasis on the continuing provision of information; and
- All necessary authorisation must be in place prior to commencement of the project activities.
- Crown Gold must adhere to the Rehabilitation Plan contained in the EMPr.
- The Applicant must maintain all financial responsibility throughout all phases of the project lifespan, including monitoring.
- The Applicant must ensure that there are sufficient funds set aside to complete the project fully. Partial reclamation and partial rehabilitation should not be accepted.
- The Applicant should report on the project progress monthly to the Department and must give reason where requirements of the EA have not been met.

- A spill containment plan is required to be in place prior to construction.
- Implementation of a Water Management Plan aimed at reducing and/or eliminating adverse impacts on the receptors identified. These include existing private groundwater users, wetlands, rivers and streams.
- Water Quality Monitoring should be implemented before construction to assess the impact on the surrounding water bodies.
- A Chance Find procedure for heritage resources and artefacts needs to be in place.
- Should the economic gold price diminish and not be seen as favourable to continue reclamation activities, Crown Gold must continue to implement monitoring and rehabilitation requirements as set out in this EMPr.

9.3 Proposed Management Objectives and Outcomes for Inclusion in the EMPr

The EMPr is compiled with the aim of achieving a required end state that, as far as possible, ensures that environmental quality is maintained. The impact management objectives and outcomes for the Soweto Cluster Project are as follows:

- To minimise the negative environmental impacts as far as feasible;
- To maximise the positive and minimise the negative socio-economic impacts;
- To capture, contain, treat and recycle all contaminated water arising from the mining operations on site and to prevent the discharge of contaminated water to the environment; and
- To maintain cordial relationships with local residents, authorities and other stakeholders via sustained open communication.

The EMPr describes how activities that have, or could have, an adverse impact on the environment will be mitigated, controlled and monitored. Moreover, the EMPr will address the environmental impacts during the construction, operational, decommissioning (where applicable post-closure) phases of the Project. Due regard must be given to environmental protection during the entire Soweto Cluster Project, and a number of environmental recommendations are made in this regard. 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 Soweto Cluster Project;
- Maintain a state of Environmental Quality following completion of the Soweto Cluster Project;
- Ensure appropriate restoration of areas affected by the Soweto Cluster Project; and
- Prevent long term environmental degradation.

9.4 Rehabilitation Requirements

Final rehabilitation will be carried out once the Soweto Cluster Project goes into its decommissioning phase.

The principles for proper rehabilitation, which should be followed, are:

- Preparing a comprehensive rehabilitation plan prior to the commencement of any activities on site;
- Stormwater management must be in place at the site prior to commencing with any activities;

- Landform design (levelling, re-grassing);
- Maintenance management and eradication of invader species;
- A plan which negates how waste will be managed on site; and
- An Emergency Preparedness/Response plan .

The objective of the site rehabilitation (in accordance with the NEMA EIA Regulations of 2014) must be measurable, practical and is feasible to implement through:

- Providing the vision, objectives, targets and criteria for final rehabilitation of the project;
- Outlining the principles for rehabilitation;
- Explaining the risk assessment approach and outcomes and link decommissioning activities to risk rehabilitation;
- Detailing the decommissioning and rehabilitation actions that clearly indicate the measures that will be taken to mitigate and/ or manage identified risks and describes the nature of residual risks that will need to be monitored and managed post closure;
- Identifying knowledge gaps and how these will be addressed and filled;
- Detailing the full closure costs for the life of project at increasing levels of accuracy as the project develops and approaches closure in line with the final land use proposed; and
- Outlining monitoring, auditing and reporting requirements.

9.5 A Reasoned Opinion: Should the Soweto Cluster Reclamation and Reprocessing Project be Approved?

Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Soweto Cluster Project can be mitigated to within acceptable limits and that the project should be authorised. This opinion holds provided all the recommendations proposed in the specialist studies and the EIA and EMP as well as legislative requirements are implemented and adhered to.

An impact assessment has been undertaken using qualified specialists, which has incorporated extensive consultation with and participation of interested and affected parties. Applying the hierarchical approach to impact management, alternatives were firstly considered to avoid negative impacts, but where avoidance was not possible, to better mitigate and manage negative impacts. Where impacts were found to be potentially significant, various mitigation measures to manage and monitor the impacts of the project have been proposed. As a final option, offset strategies should be investigated, if feasible.

The findings of the impact assessment have shown that the Soweto Cluster Project would conclusively result in certain negative impacts during the operational phase to the environment, however, none of the specialist studies objected to the project. Moreover, the scientific specialist mitigations measures have been included into this EIA and EMP Report to reduce the significance of all the identified negative impacts. Most of the negative impacts from the proposed project can be reduced through the implementation of mitigation measures.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of the mine dumps is extremely important and a positive benefit. It is envisioned that the removal of these dumps could significantly reduce a source of water, land and dust pollution, as well as costs associated with the dumps' maintenance. The land would be cleared to ground level and thereafter be available for future use. The proposed project would also directly and indirectly contribute to the Country's Gross Domestic Product (GDP), as well as enhance and further support workers and contractors employed or contracted to Crown Gold.

The Option of the project not proceeding would mean that the environmental and social status would remain the same as current. This implies that both negative and positive impacts would not take place. As such, the short-term negative impacts on the environment would not transpire; equally so, the long-term positive impacts such as environmental pollution source removal, economic development, skills development, and the availability of land for re-development would not occur. The only alternative land use is to leave the dumps as they stand; there is no other potential use of the space as the project area is a cluster of polluting historic mine dumps that impact upon the surrounding biophysical and social environment.

The "No-Go" Option also assumes the continuation of the current land use, implying the absence of any reclamation activities and associated infrastructures. The means that the attraction of the gold reserves located within the dumps could potentially enhance illegal mining, and if left as is, population settlement on or around the dumps could occur.

The 'No Project' alternative is not preferred due to the anticipated benefits of the proposed reclamation project. The expected indirect benefits resulting from the reclamation of the Soweto Cluster include:

- Removal and remediation of existing tailings deposits currently located on sensitive dolomitic aquifers, reducing future environmental liability and risk.
- Removal of tailings facilities, reducing health risks for surrounding communities from possible exposure to dust.
- Re-use of currently impacted mine water in the hydraulic mining process.
- Removal of a source of pollution and radiation in the area.
- The potential to unlock land for redevelopment, as read in the Metropolitan Spatial Development Vision.
- Continued supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), as well as the GDARD, the City of Johannesburg Strategic Development Framework and the Mining Belt West Framework. The reclamation and rehabilitation of the Soweto Cluster dumps will mitigate the current environmental, health and social impacts, as well as unlock land for potential future development.

9.6 Oath Undertaking

The EAP hereby confirms:

- The correctness, to the best of his knowledge, of the information provided in the specialist reports and on information provided by Crown Gold. The information was accepted as being as reliable as information generated during an EIA and a feasibility study, and provided in good faith, can be;
- The inclusion of comments and inputs from stakeholders and I&APs;
- The inclusion of inputs and recommendations from the specialist reports where relevant; and
- The acceptability of the project in relation to the finding of the assessment and level of mitigation proposed.

KONGIWE ENVIRONMENTAL (PTY) LTD

Company Name

Ashleigh Blackwell

Name of the Environmental Assessment Practitioner **Signature**

6 December 2019

Date

CHAPTER 10: REFERENCING

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