KONGIWE

ERGO MINING (PTY) LTD: THE VALLEY SILTS PROJECT, RIVERLEA AND BOOYSENS RESERVE, JOHANNESBURG.

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

9 December 2019

DMRE Reference Number: GP 184 MR

mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT REPORT

FOR LISTED ACTIVITIES ASSOCIATED WITH THE VALLEY SILTS PROJECT 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).

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Document Date: 09 December 2019
DMRE Reference Number: GP 184 MR

DRAFT ENVIRONMENTAL IMPACT ASSESSMENT

PROJECT:	VALLEY SILTS PROJECT
Report Title:	Draft Impact Assessment Report: Valley Silts Project in Johannesburg, Gauteng Province.
Applicant:	Ergo Mining (Pty) Limited
Project No:	DRDG#008
Compilation Date:	09 December 2019
Status of Report:	**Draft EIA and EMP reports for Public and Authority review**

Verification	Capacity	Name	Signature	Date
By Author	The EAP	Ashleigh Blackwell		09 December 2019
Reviewed by	Technical Director	Gerlinde Wilreker		09 December 2019
Reviewed by:	Legal Director	Michael Hennessy		09 December 2019
Authorised by	Chief Executive	Bradly Thornton		09 December 2019

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 is made available for public review and comment from **Monday, 09 December 2019 to Friday, 31 January 2020.**

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		
Riverlea Public Library	Cnr Avon & Colorado Dr, Riverlea, Johannesburg	Mr John Keith, Librarian (011) 474 2968 or (071) 390 6549
Greater Johannesburg City Library	Albertina Sisulu Rd & Pixley Ka Isaka Seme Street	Ms Prudence Chauke (011) 407 7703
Electronic copies		
Kongiwe Environmental website	www.kongiwe.co.za/ 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		

Comments received from the public throughout the Scoping and 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 Environmental (Pty) Ltd ('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 **Valley Silts Project** (hereafter the Proposed Project).

The Application for Environmental Authorisation was submitted to the Department of Mineral Resources and Energy (DMRE), the Competent Authority (CA), on **Monday**, **22 July 2019**. The Draft Scoping Report (DSR) was made available for public review from **26 July 2019 – 26 August 2019.** The Final Scoping Report (FSR) was submitted to the DMRE for their consideration and comment on the **4 September 2019.**

Project Introduction and Background

The Proposed Project activities include removing gold bearing silts from the Russell Stream (otherwise referred to as the Klipspruit), situated north of Nasrec near Booysens Reserve. This is an area referred to as the Valley Silts and the project is held under the Mining Right GP184MR.

Currently, the Russell Stream is highly polluted and heavily silted. Ergo will aim to remove the silt from the valley in specific target areas, thereby potentially improving the water flow dynamics, which could assist in ameliorating current flooding issues experienced in the area of Riverlea. After removal of the silt from the target areas, Ergo aims to rehabilitate the target areas within the Valley area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil. The extent and viability of the proposed project area, as well as rehabilitation, will need to be evaluated through specialist studies during the EIA phase, in consultation with the City of Johannesburg and Department of Human Settlements, Water and Sanitation (DHSWS).

The gold bearing silts will be mechanically excavated from the Proposed Project area. The removed silts will be stockpiled and dried on old tailings footprints (dumps 3L12, 3L11 and 3L10) directly north of the project site, before being hauled by truck to a tailings dam footprint known as the Ezekiel dump (dump 4A18). At the Ezekiel dump, the dried silt will move through a scrubber for pre-processing. The scrubber allows for de-agglomeration of the silt to expose gold residues. Water will then be added to create a slurry which will then be pumped to the Knights Plant for beneficiation.

At the Knights Plant the material will be reprocessed through the Knights Mining Right (GP187MR), and gold will be recovered. From the Knights Plant, the unwanted slurry (not containing gold) will move through existing pipelines to the Brakpan/Withok Tailings Storage Facility (TSF) for ultimate deposition.

Project Alternatives

The sediments of this Valley Silts Project originate from three dams labelled Dam A, Dam B and Dam C. These three dams expand a distance of about 2 km east - west and connected to one another, some 500 m south and southwest of the present Crown Gold Recovery plant. Dam A has been reclaimed completely, however dams B and C have not yet been reprocessed for their gold content (Ndazi, 2007)

Although the entire Mining Right (MR) area for the Valley Silts Project was investigated during the Scoping phases as well as within the Specialist studies, this impact assessment phase will focus on the area where silts are located at Dam B with the potential to reclaim Dam C as well, as seen in Figure 1-1. The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations.

Dam B is an area of approximately **37 Ha of the 122 Ha** Mining Right area and is situated between Nasrec and Crownwood roads, adjacent to the Crown Golf Course dumps and the Soweto Highway. A recent radiation site walkover, for which 50 readings were taken, indicated that Uranium (U) (at 0.349 Bq/g) and Thorium (Th) (at 0,281 Bq/) measured highest. Therefore, this material is below the 0.5 Bq/g limit and currently not regarded as radioactive.

The removal of silts from Dam C and other target areas in the Mining Right Boundary will be investigated for feasibility following the successful removal of silts from the initial development area.

Environmental Impacts of the Valley Silts 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 and closure.

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)**				❖ Monitoring	**Major (high)**	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Improved aquifer yield ❖ Job Security ❖ Skills Development ❖ Economic growth ❖ Amelioration of flooding potentially	❖ Improved aquifer yield ❖ Job Security ❖ Skills Development ❖ Economic growth ❖ Amelioration of flooding potentially
Positive (+)	**Moderate (medium)**	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth			**Moderate (medium)**	❖ Improved water quality and drinking water	❖ Improved water quality and drinking water	❖ Improved surface water quality ❖ Improved groundwater quality ❖	❖ Improved surface water quality ❖ Improved groundwater quality
Positive (+)	**Minor (low)**					**Minor (low)**			❖ Improved ecosystem health and functioning	❖ Improved ecosystem health and functioning
No Impact	**No Impact**					**No Impact**				
Negative (-)	**Minor (low)**	❖ Groundwater quality impacts ❖ Traffic, congestion and impacts damage	❖ Groundwater quality impacts ❖ Traffic, congestion and impacts damage			**Minor (low)**	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Water Quality impacts ❖ Groundwater quality impacts ❖ Impact on cemetery ❖ Destruction of historical structures ❖ Disruption of daily movement patterns ❖ Traffic, congestion and impacts damage	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Water Quality impacts ❖ Groundwater quality impacts ❖ Impact on cemetery ❖ Destruction of historical structures ❖ Disruption of daily movement patterns ❖ Traffic, congestion and impacts damage	❖ Encroachment of alien species ❖ Faunal mortalities ❖ Safety impacts for community members and employees	
Negative (-)	**Moderate (medium)**	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Sedimentation ❖ Water Quality impacts ❖ Destruction of historical structures ❖ Disruption of daily movement	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Sedimentation ❖ Water Quality impacts ❖ Destruction of historical structures ❖ Disruption of daily movement	❖ Encroachment of alien species ❖ Faunal mortalities ❖ Safety impacts for community members and employees		**Moderate (medium)**	❖ Direct Loss of Wetlands ❖ Contamination of watercourse ❖ Sedimentation ❖ Air quality impacts ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic	❖ Direct Loss of Wetlands ❖ Contamination of watercourse ❖ Sedimentation ❖ Air quality impacts ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic		

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
		patterns	patterns							
Negative (-)	Major (high)	❖ Direct Loss of Wetlands ❖ Contamination of watercourse ❖ Air quality impacts ❖ Impact on cemetery ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic	❖ Direst Loss of Wetlands ❖ Contamination of watercourse ❖ Air quality impacts ❖ Impact on cemetery ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic			Major (high)				

Conclusions

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 Valley Silts 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. Impacts are largely Moderate (negative) in significance, being mitigated to Low (negative) Significance. During the decommissioning and post-decommissioning phases, the majority of the impact are expected to be Moderate – High (positive) in significance after mitigation.

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. Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Valley Silts 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 report as well as legislative requirements are implemented and adhered to.

There is a possibility that there may be temporary contamination of downstream watercourses during operation, and if authorised, Ergo will need to minimise such contamination by following the prescribed mitigation stipulated in this EIA / EMPr, the water use licence and all relevant best practice guidelines and legislation regarding the rehabilitation of contaminated land. It is anticipated that through carefully planned reclamation efforts **the system can be restored** to a state where it represents a viable and functioning wetland system. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the reclamation efforts but is likely to remain one of the most challenging issues.

Economic Benefits of Silt Removal

Ndasi (2007) found that dam sediments are trap sites for heavy metals originating from surrounding tailings dumps. In the Russell Stream deposits, the maximum thickness is defined by a region of greater than 12 m of sediment fill just below and behind the dam wall in Dam B. An axial zone following the original river course contains sediments in excess of 10 m over a distance of 250 m. Dam C downstream of Dam B shows a similar pattern with an axial zone of greater than 8 m thickness. In addition, high concentrations of gold in these sediments have been proven to be economically viable in the Russell Stream dams. Reserve calculations on the Russell Stream sediments (still unmined) gave a total estimated gold content of 3.8 million tons at an average grade of 1.0 g/t Au.

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 Valley Silts Project will retrieve gold from the gold bearing silts of the Russell Stream. 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.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of the silts is extremely important and a positive benefit. It is envisioned that the removal of these silts could significantly reduce a source of water, land and dust pollution, as well as costs associated with the Project maintenance. In addition, the project will assist in ameliorating flooding issues currently experienced by residents of Riverlea. 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 Ergo

Social Benefits of the Silt Removal

The Russell Stream forms part of a greater wetland system which stretches approximately 25 km from Soweto to southern Gauteng. Due to rapid urbanisation, erosion, siltation from mine tailings and illegal dumping in this stream, the Russel Stream and New Canada Dam are under threat and highly polluted.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of mine residue is extremely important as well as a major positive benefit. It is envisioned that the removal of these silts could significantly reduce a source of water and land pollution. Additionally, the removal of the silts will also aid in the flow of the stream and help with flooding that occurs sporadically, in the wet seasons in the Riverlea area.

The Silts contained within the Russell stream is also an allure for illegal elements, like *Zama-Zamas* (informal miners). As informal miners settle into the area, crime becomes a concern for the residents of Riverlea due to the level of uncontrollability and lawlessness of these individuals. The removal of these silts from the dams may help alleviate the levels of crime and lawlessness found within the area.

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 Ergo. The delivery of the mine residue material to the Knights plant will help keep the plant operational ensuring current and future employees with a form of employment.

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), which is to reclaim and/or rehabilitate areas that have been affected by the mine dumps to the point where they become safe for adjacent communities. This strategy also aims at making previously unavailable land, available for use.

Environmental Benefits of Silts Removal

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. It is anticipated that the removal of silts will have a positive impact on groundwater and surface water in terms of improved water quantity and quality.

Specialist reports found that through carefully planned rehabilitation efforts the system could potentially be reinstated to where it represents a valuable greenbelt and open space asset, that is actively utilised for land-based recreational purposes. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the rehabilitation efforts but is likely to remain one of the most challenging issues.

The impact of NOT proceeding with the project

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 removal, economic development, and the rehabilitation of the Russell Stream for both natures and human benefit – would not occur. The only alternative option to this project (the No-Go option) is to leave the polluting silts within the stream; there is no other potential use.

The "No-Go" Option also assumes the continuation of the current land use, implying the absence of any rehabilitation activities and associated infrastructures. The means that the attraction of the gold reserves located within the stream could potentially enhance Illegal mining, and if left as is, population settlement on or around the stream could occur. In addition, without the removal of silts from the initial development area, the Russell Stream will continue to follow its current path – meaning that flooding risks to residents will remain.

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

- Removal of a source of pollution in the area;
- The rehabilitation of target areas in the Russell Stream;
- Enhanced ecosystem functioning, including attraction of fauna, flora and improved water quality;
- Continued supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy;
- Liberating land for future development;
- Continued employment for staff and contractors of Ergo; and
- Potential to ameliorate flooding of resident's houses.

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. Moreover, removing the silts is directly aligned to future development plans for the area.

In conclusion, the EAP is of the reasoned opinion that the **project should be authorised to proceed**. It is furthermore stressed that a collective effort needs to be made by relevant Government Departments to address the current municipal issues experienced in Riverlea, to ensure that the end result of this project is positive in the long-term and is aligned to future development plans for the site.

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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

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

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') 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 **Valley Silts Project** (hereafter the Proposed Project).

At the turn of the 20th century, dams were built on the Klipspruit, approximately 5.5 km east of New Canada and Fleurhof Dams: the Russell Stream dam (also known as the No. 12 Shaft dam) and the Got Heer Lake. Over time tailings materials have accumulated in these dams due to erosion from the Rand Leases, Crown Mines, Bantjies and other old tailings dumps in the area. This has formed a thick layer of sediment, averaging 2 m thick, but up to 12 m in some areas. As a result of the silt build-up in the valley, the Russell Stream has a reduced stream velocity and has become displaced northward toward the areas of Riverlea and Crown Industrial.

For this Valley Silts Project, Ergo Mining (Pty) Ltd (Ergo) intend to reclaim the areas where these silts have been deposited. With the upturn of the gold price, and the ease of which silts can be accessed, Ergo will aim to remove the silt from the valley in specific target areas, thereby potentially improving the water flow dynamics, which could assist in ameliorating current flooding issues experienced in the area of Riverlea. After removal of the silt from the target areas, Ergo aims to rehabilitate the target areas within the Valley area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil.

1.1 Valley Silts Project Location Description

The Russell Stream flows in an east – west direction to the south of Crown treatment plant and north of Gold Reef City on Crown Mines. The mean annual precipitation of the Gauteng Highveld is about 700 mm, falling mainly during the summer months in the form of heavy thunderstorms. A windy season from August to October precedes the summer rains and is responsible for considerable erosion from exposed tailings dumps and serious air pollution (Ndasi, 2007).

The sediments of this Valley Silts Project originate from three dams labelled Dam A, Dam B and Dam C. These three dams extend for a distance of about 2 km east - west and connect to one another, some 500 m south and southwest of the present Crown Gold Recovery plant. Dam A has been reclaimed completely, however dams B and C have not yet been reprocessed for their gold content. Although the entire Mining Right (MR) area for the Valley Silts Project was investigated during the Scoping phases as well as within the Specialist studies, this impact assessment phase will focus on the area where silts are located at Dam B with the potential to reclaim Dam C as well, as seen in Figure 1-1 and Figure 1-2

The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations

Sediments below the dam wall of Dam B came from a leakage of the golf course dumps (Figure 1-1) situated directly west of Dam B, adjacent to the Soweto Highway (Ndasi, 2007). Due to the sediment infill, the original river channel has diverted at the river mouth around the dam wall. Since there are not many distributaries seen here, it is assumed that gold bearing sediments were then washed down into Dam C.

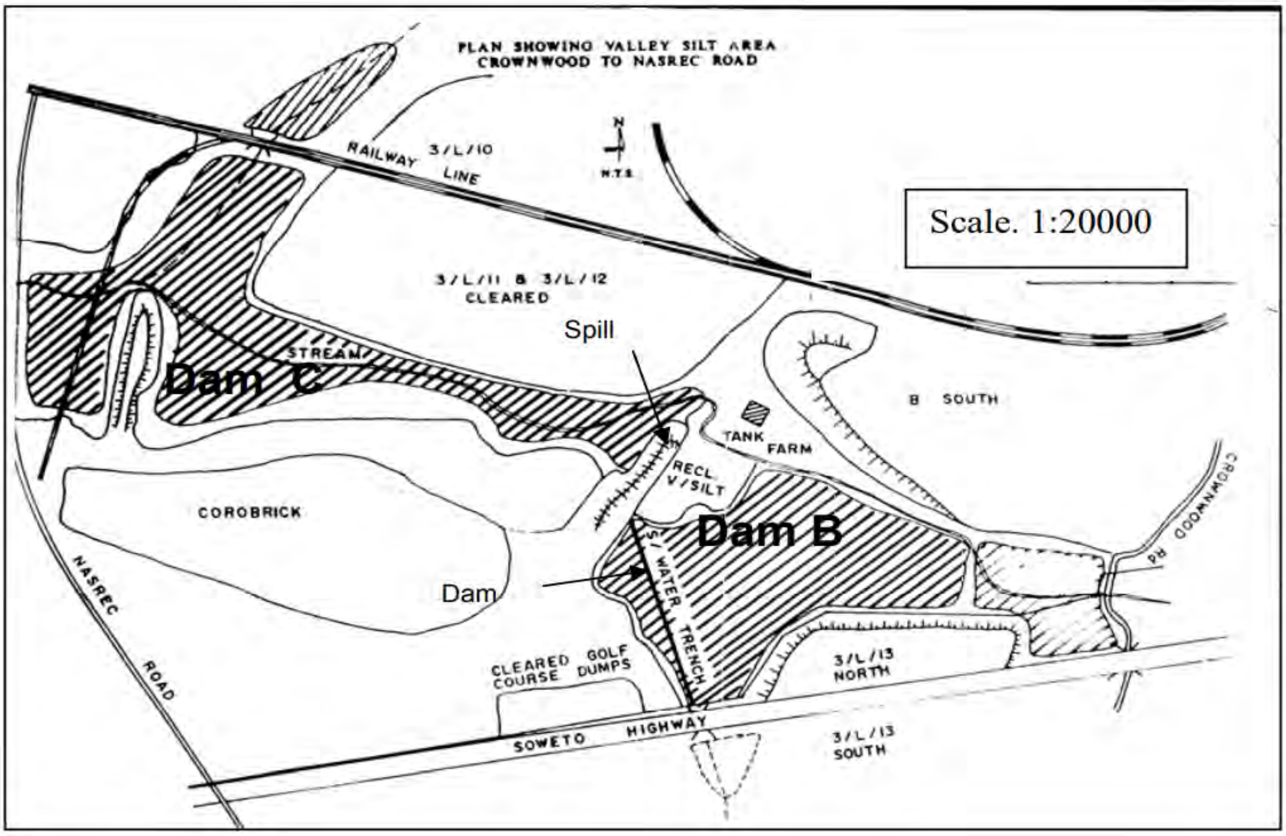


Figure 1-1: Diagram indicating the Valley Silts deposits in Dam A, Dam B and Dam C on the Russell Stream.

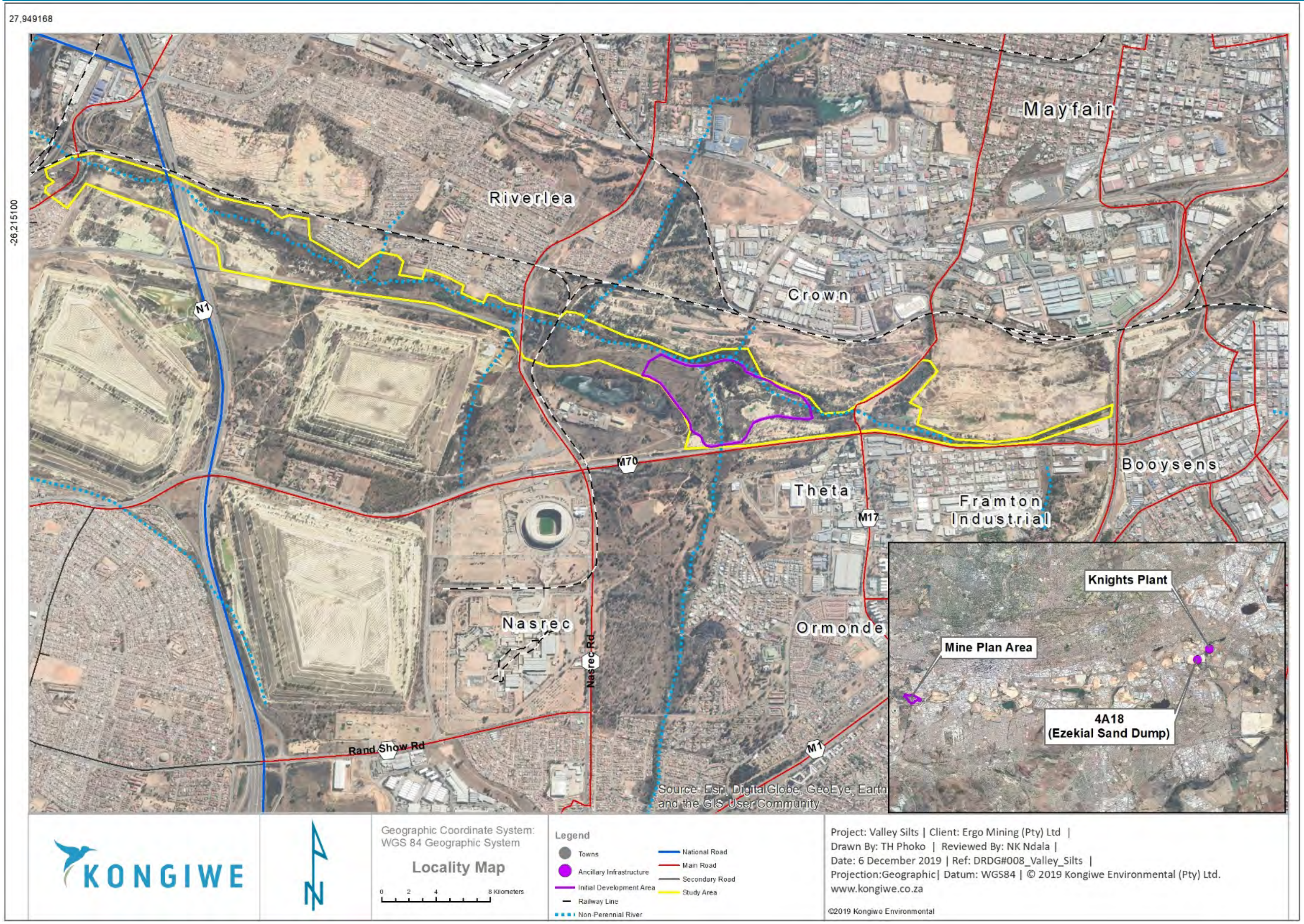


Figure 1-2: Diagram indicating the location of the initial development area (purples) within the study area (yellow)

Ndasi (2007) found that dam sediments are trap sites for heavy metals entrained from surrounding tailings dumps. High concentrations of gold in these sediments have been proven to be economically viable in the Russell Stream dams. Reserve calculations on the Russell Stream sediments (still unmined) gave a total estimated gold content of 6.4 tons (206,452 ounces) at an average grade of 0.8 g/t Au.

In terms of locality, the Proposed Project is located within the Russell Stream valley, near Booysens Reserve. The project area stretches from New Canada Road, following the valley south east, past the Nasrec Road bridge and past Crownwood Road until the stream meets the M1. This area is known as Valley Silts. The Proposed Project is situated within Ward 68 and Ward 124 of the City of Johannesburg Metropolitan Municipality (CoJMM). The Russell Stream (also referred to as the Klipspruit) is surrounded by industrial, commercial, residential and undeveloped land. The closest residential area to the project is Riverlea, the outskirts of the suburb is situated approximately 120 m from the Valley silts project area.

The following infrastructure is encountered in the area (Figure 1-3 and Figure 1-4):

- National and provincial roads (M70, M17, N17, N1);
- Residential and commercial properties:
- Industrial properties;
- FNB Soccer City Sports Centre;
- Power lines;
- Sewer lines;
- Railway line;
- Water reticulation systems; and
- Historic Mine Dumps.

Figure 1-3 FNB Stadium (Soccer City)

Figure 1-4: Infrastructure found in the project area including pipelines and powerlines.

Figure 1-5: A portion of the Russell Stream which will be excavated. This image was taken at the following location: 26°13'46.58"S; 27°59'43.03"E

Figure 1-6: The cleared This image was taken at the following location: 26°13'47.87"S; 27°59'32.28"E

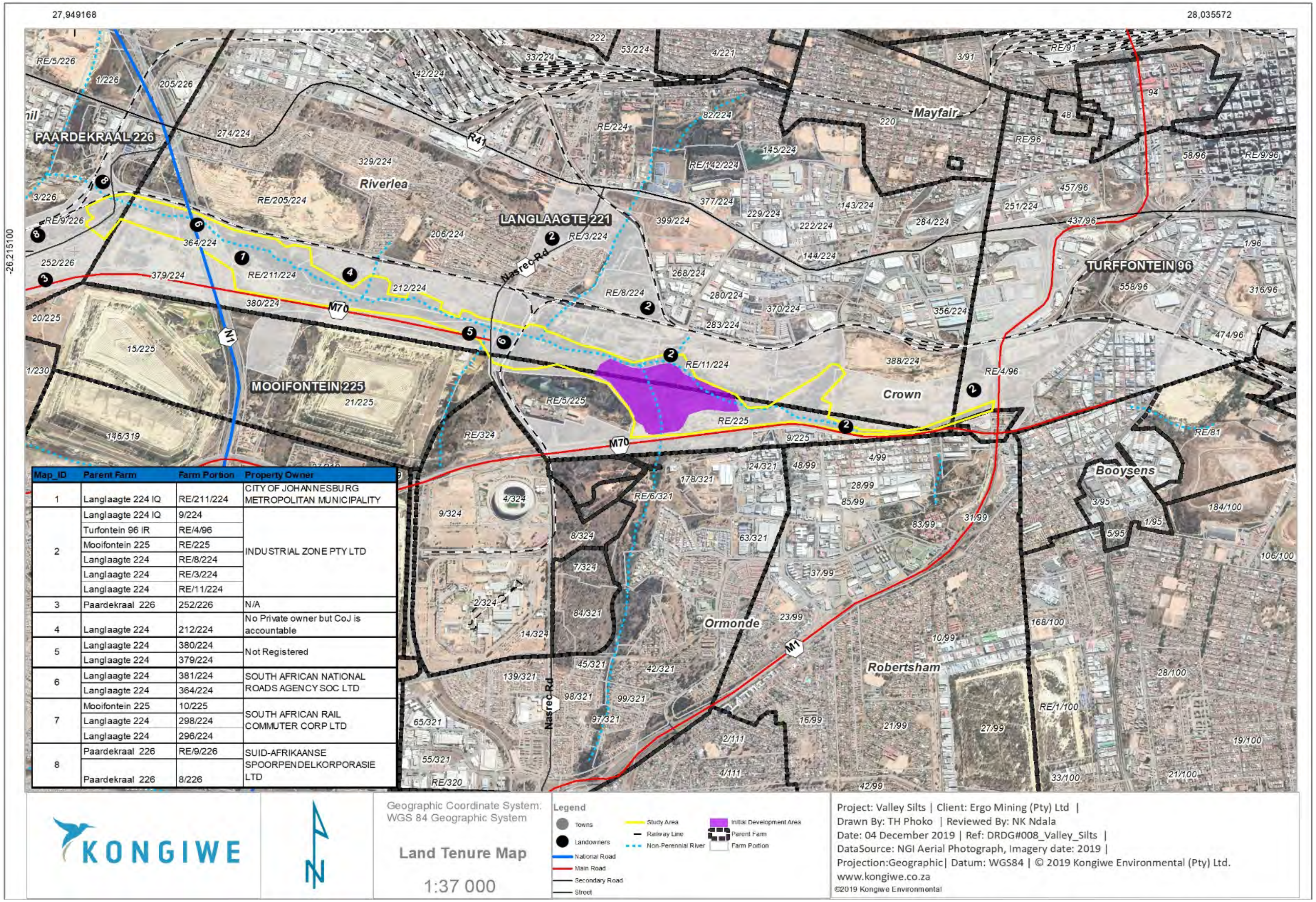
The properties of interest for the Valley Silts Project is illustrated by Figure 1-7 below.

Table 1-1: Property Details of the Valley Silts Project

FARM NAMES	FARM NAME:	FARM ID	PORTION	LANDOWNER[1]
	Paardekraal	226 IQ	8	South African Rail Commuter Corporation
	Paardekraal	226 IQ	9 (RE)	South African Rail Commuter Corporation
	Paardekraal	226 IQ	252	Undetermined
	Langlaagte	224 IQ	211 (RE)	City of Johannesburg Metropolitan Municipality
	Langlaagte	224 IQ	379	Undetermined
	Langlaagte	224 IQ	364	South African National Roads Agency SOC Ltd
	Langlaagte	224 IQ	380	Undetermined
	Langlaagte	224 IQ	212	This property is under the responsibility of the City of Johannesburg.
	Langlaagte	224 IQ	3 (RE)	Industrial Zone (Pty) Ltd
	Langlaagte	224 IQ	381	South African National Roads Agency SOC Ltd
	Langlaagte	224 IQ	296	South African Rail Commuter Corporation Ltd
	Langlaagte	224 IQ	298	South African Rail Commuter Corporation Ltd
	Langlaagte	224 IQ	8 (RE)	Industrial Zone (Pty) Ltd
	Langlaagte	224 IQ	11 (RE)	Industrial Zone (Pty) Ltd
	Langlaagte	224 IQ	9	Industrial Zone (Pty) Ltd
	Mooifontein	225 IQ	10	South African Rail Commuter Corporation Ltd
	Mooifontein	225 IQ	(RE)	Industrial Zone (Pty) Ltd
	Turffontein	96 IR	4 (RE)	Industrial Zone (Pty) Ltd
APPLICATION AREA (HA)	The Valley Silts approved Mining Right covers an approximate area of 122 Hectares (ha).			
MAGISTERIAL DISTRICT	The project site is located in Ward 68 and 124 within the City of Johannesburg Metropolitan Municipality (CoJ).			
DISTANCE AND DIRECTION FROM NEAREST TOWN	The site is within the City of Johannesburg. Riverlea, Nasrec, Booysens Reserve, Theta and Amalgam are located in close proximity to the Russell stream and the Valley Silts area.			

[1] [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.

21-DIGIT SURVEYOR GENERAL CODE FOR EACH FARM PORTION	FARM NAME:	FARM ID	PORTION	21 DIGIT SG-CODE
	Paardekraal	226 IQ	8	T0IQ00000000022600008
	Paardekraal	226 IQ	9 (RE)	T0IQ00000000022600009
	Paardekraal	226 IQ	252	T0IQ00000000022600252
	Langlaagte	224 IQ	211 (RE)	T0IQ00000000022400211
	Langlaagte	224 IQ	379	T0IQ00000000022400379
	Langlaagte	224 IQ	364	T0IQ00000000022400364
	Langlaagte	224 IQ	380	T0IQ00000000022400380
	Langlaagte	224 IQ	212	T0IQ00000000022400212
	Langlaagte	224 IQ	3 (RE)	T0IQ00000000022400003
	Langlaagte	224 IQ	381	T0IQ00000000022400381
	Langlaagte	224 IQ	296	T0IQ00000000022400296
	Langlaagte	224 IQ	298	T0IQ00000000022400298
	Langlaagte	224 IQ	8 (RE)	T0IQ00000000022400008
	Langlaagte	224 IQ	11 (RE)	T0IQ00000000022400011
	Langlaagte	224 IQ	9	T0IQ00000000022400009
	Mooifontein	225 IQ	10	T0IQ00000000022500010
	Mooifontein	225 IQ	(RE)	T0IQ00000000022500000
	Turffontein	96 IR	4 (RE)	T0IR00000000009600004



Map_ID	Parent Farm	Farm Portion	Property Owner
1	Langlaagte 224 IQ	RE/211/224	CITY OF JOHANNESBURG METROPOLITAN MUNICIPALITY
2	Langlaagte 224 IQ	9/224	INDUSTRIAL ZONE PTY LTD
	Turfontein 96 IR	RE/4/96	
	Mooifontein 225	RE/225	
	Langlaagte 224	RE/8/224	
	Langlaagte 224	RE/3/224	
	Langlaagte 224	RE/11/224	
3	Paardekraal 226	252/226	N/A
4	Langlaagte 224	212/224	No Private owner but CoJ is accountable
5	Langlaagte 224	380/224	Not Registered
	Langlaagte 224	379/224	
6	Langlaagte 224	381/224	SOUTH AFRICAN NATIONAL ROADS AGENCY SOC LTD
	Langlaagte 224	364/224	
7	Mooifontein 225	10/225	SOUTH AFRICAN RAIL COMMUTER CORP LTD
	Langlaagte 224	298/224	
	Langlaagte 224	296/224	
8	Paardekraal 226	RE/9/226	SUID-AFRIKAANSE SPOORPENDELKORPORASIE LTD
	Paardekraal 226	8/226	

Figure 1-7: Land Tenure Map for the Valley Silts Project

1.2 Water use exemption

The project falls within the 1:50 year floodline. Exemption from Government Notice No. 704 of the National Water Act, 1998 (Act 36 of 1998) (NWA) will need to be applied for. Ergo will apply for water use licences in terms of Sections 21 (c) and (i) of the same Act.

Generally, the natural bed and flow of the stream will be used to prevent potentially diverse impacts that could result from a fifty year storm event, therefore during the silt removal activities, minimal disruption of the stream will take place.

1.3 Description of the current Land Uses Applicable

The Valley Silts is situated in an urban and industrial area of Johannesburg. The communities directly adjacent to the Valley Silts Mining Right area are:

- Riverlea;
- Crown;
- Crown City;
- Booysens Reserve; and
- Theta.

The Valley Silts project area is classified in the Gauteng Provincial Environmental Management Framework (GPEMF) (2014) as Zone 1 (Urban Development Zone), Zone 2 (High Control Zone within the urban development zone) and Zone 5 (Industrial and large commercial development zone).

A site visit was undertaken by Kongiwe on the 18th of September 2019 and photographs were taken by the project team to illustrate the current site conditions. Refer to Appendix B 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;
- Schools;
- Grocery Stores, Supermarkets, Butcheries and Spaza Shops;
- Health facilities and Recreation facilities;
- ATMs and banking facilities;
- An oil and cake mill;
- Crown TSF's
- A soccer stadium;
- Gold Reef City; and
- The Industrial centre of Crown and Business Park of Booysens Reserve

An old dam wall and sluice gate system which is no longer functional is in the centre of the property of Dam B for which the initial development plan is proposed. A pipeline which is no longer in use can be found to the south of the site belonging to IProperty (Pty) Ltd (iProp).

1.3.1 Future Land use proposals

To the knowledge of the EAP, and through consultations with various stakeholders, the following future development plans were put forward:

1. Flooding of a 16 Ha area between Crownwood Road and the M1 Highway to create a wetland that can be used as an evapotranspiration pond capable of removing contaminants from the soil and water.
2. Reinstate the old dam at the area earmarked Dam B in this report. The existing dam wall will be assessed in terms of structural liability.
3. A Bamboo Plantation between Crownwood Road and the M1 Highway for the rapid removal of contaminants. The bamboo would then be refurbished for future uses.

With both 1 and 2 above, there is an opportunity for a waterfront type development, with new housing stands and a functional wetland habitat. Ergo will remove the silts from Dam B initially. After removal of the silts, Ergo aims to rehabilitate the target areas by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil. The following rehabilitation plan above will, as far as possible, remove contaminated 'yellow sand' from the future proposed development areas.

1.4 Known Mining Rights held in the Area

There are several unrelated mine dumps scattered around the Proposed Project site, bearing testament to the historical mining that took place in Johannesburg. The Valley Silts project area is north east of the Crown Tailings Dams.

In terms of active mining in the area, both Ergo Mining (Pty) Ltd and Crown Gold Recoveries (Pty) Ltd have resources that are being processed and removed. In addition to this, other activities vary in ownership and are primarily associated with quarries for sand and silica mining, as well as surface and underground gold mining.

There is an abandoned open cast gold mine belonging to Central Rand Gold, east of the project area (Dam B). This mine was opened in 2010 and went bankrupt in February 2019. The mine now lies unregulated and unrehabilitated within the community.

Other inactive mines and mining structures in the project area are indicted in Table 1-2:

Table 1-2 Inactive mines and structures in the project area. Source: Witwatersrand Mining Survey Contents. Accessed at: http://joburgheritage.org.za/docs/Witwatersrand%20Mining%20Survey%20Listing.pdf

COMPANY	LOCATION	HISTORICAL INFRASTRUCTURE	CURRENT SERVICE
3 Langlaagte Estate & G M Co Limited *Historic Mining Activity*	Corner Main Reef Road and Avon Street. Off Aalwyn Road to east of Riverlea Ext 2	Historical gold mining village and shafts	Residential hall, Workshops and remnant structures

COMPANY	LOCATION	HISTORICAL INFRASTRUCTURE	CURRENT SERVICE
Crown Mines *Historic Mining Activity*	Corner of Main Reef Road and Nasrec Road	Church and Manse and inclined shaft headgear to South of George Harrison Park	Services a church, residential use, some mining activity remaining
	Nasrec Road south of George Harrison Park, Crown Mines.	Mining Houses south of George Harrison Park	Residential Housing
	Old Crown Mines Golf Course off Booysens Reserve Road.	Cemetery at Crown Mines Golf Course	Cemetery
	George Harrison Park, Main Reef Road, Crown Mines.	George Harrison Park where the Main reef was discovered.	Museum plaque, and Museum.
Central Rand Gold *Liquidated*	Behind the T.C. Esterhuysen Primary School	None	Not operational due to liquidation

1.5 Flooding Concerns Facing Riverlea

As stated above, the Russell Stream has become displaced and has since changed its original course northward toward the areas of Riverlea and Crown Industrial.

As the population of Riverlea expanded over time, areas on which to live and build houses were reduced. As a consequence, houses were built wherever land was free and available, and this meant that some houses were built in the 1:50 year flood line.

Houses have been built adjacent to the Russell Stream and along the floodplains. During heavy rainfall events, the river overflows and houses along Sand, Seekoei, Mogol and Selati Street begin to flood causing irreversible damage to resident's houses (Figure 1-8).

In addition to pipeline spills from surrounding economic activities, municipal services and maintenance in the area is poor (Figure 1-9). There are often sewage overflows and burst sewage pipes, burst water pipes and poor waste handling which have added to the cumulative risks facing residents of Riverlea.

Figure 1-8: Flooding of Sand Street (Beckett, 2018) Accessed at: https://westside-eldos.co.za/42870/storm-turns-sand-street-dangerous-river/

Figure 1-9: Lack or / poor maintenance of municipal services in the area of Riverlea which includes overflowing manholes and sewage pipes and poor waste collection services.

Ergo will aim to remove the silt from the valley in specific target areas, thereby potentially improving the water flow dynamics, which could assist in ameliorating current flooding issues experienced in the area of Riverlea. After removal of the silt from the target areas, Ergo aims to rehabilitate the target areas within the Valley area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil.

Although the entire Mining Right (MR) area for the Valley Silts Project was investigated during the Scoping phases as well as within the Specialist studies, this impact assessment phase will focus on the area where silts are located at Dam B with the potential to reclaim Dam C as well, as seen in Figure 1-1. The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations.

1.6 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.

1.6.1 Contact Person and Corresponding Address

Details of the Environmental Assessment Practitioner (EAP) who prepared the report are presented below

Table 1-3: Details of the EAP

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

1.6.2 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.

1.6.3 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.

1.6.4 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 below

Table 1-4: Details of the Kongiwe Project Team

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.

1.6.5 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. The specialist consultants have provided input into this EIAr as well as EMPr (Refer to Appendix D).

Table 1-5: Details of the Specialist Team

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)

SPECIALIST STUDY	SPECIALIST COMPANY	SPECIALIST NAME	PEER REVIEWER
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)
Traffic	EDL Consulting Engineers	John v Rooyen	Eben D. Kotze (Pr.Tech.Eng)
Health	Kongiwe Environmental	Natasha Taylor-Meyer	Gerlinde Wilreker (Pr.Sci.Nat)

1.7 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 1-6 cross-references the various sections in this report with these requirements.

Table 1-6: Structure of the Final EIA Report in line with the Appendix 2 of the EIA 2014 Regulations

NEMA REGULATION REQUIREMENT		REPORT SECTION
(a)	**Details of -**	
(iii)	The EAP who prepared the report and;	Chapter 1.6
(iv)	The expertise of the EAP, including a CV	Appendix A
(b)	**The location of the development footprint of the activity on the approved site as contemplated in the accepted scoping report, including:**	
(i)	The 21-digit Surveyor General code of each cadastral land parcel	Chapter 1.1
(ii)	Where available, the physical address and farm name	Chapter 2
(iii)	Where the required information in terms of (i) and (ii) is not available, the coordinates of the boundary of the property or properties	
(c)	**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 –**	
(i)	A linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken	Appendix B
(ii)	On land where the property has not been defined, the coordinates within which the activity is to be undertaken	
(d)	**A description of the scope of the proposed activity, including –**	
(i)	All listed and specified activities triggered and being applied for	Chapter 2.1
(ii)	A description of the associated structures and infrastructure related to the development	Chapter 2.3 to 2.5
(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
(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**	Chapter 5

NEMA REGULATION REQUIREMENT		REPORT SECTION
	footprint within the approved site as contemplated in the accepted scoping report	
(g)	**A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report**	Chapter 3
(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
(i)	Details of the development footprint alternatives considered	Chapter 3
(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 2.2.4 Appendix C
(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.	Chapter 3 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
(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
(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
(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
(viii)	The possible mitigation measures that could be applied and level of residual risk	Chapter 8.3
(ix)	If no alternative development footprints for the activity were investigated, the motivation for not considering such	Chapter 3
(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
(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
(i)	a description of all environmental issues and risks that were identified during the environmental impact assessment process	Chapter 8.2
(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
(j)	**An assessment of each identified potentially significant impact and risk, including-**	Chapter 8.3
(i)	cumulative impacts;	
(ii)	the nature, significance and consequences of the impact and risk;	
(iii)	the extent and duration of the impact and risk;	
(iv)	the probability of the impact and risk occurring;	

NEMA REGULATION REQUIREMENT		REPORT SECTION
(v) (vi) (vii)	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;	
(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
(l)	**an environmental impact statement which contains-**	
(i)	a summary of the key findings of the environmental impact assessment:	Chapter 8.4
(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 Appendix B
(iii)	a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	Chapter 8.4
(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
(n)	**The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;**	Chapter 3
(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
(p)	**A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed**	Chapter 9
(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
(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
(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
(t)	**Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;**	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

NEMA REGULATION REQUIREMENT		REPORT SECTION
(v)	**Any specific information that may be required by the competent authority**	Chapter 9.3
(w)	**Any other matters required in terms of section 24(4)(a) and (b) of the Act**	N/A

CHAPTER 2: PROJECT DESCRIPTION

This chapter of the EIA provides a description of the requirements for authorisation, the EIA process, project methodologies, infrastructure, life-cycle, layout selection Valley Silts Project.

2.1 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).

2.2 Overview of the Environmental Impact Assessment (EIA) Process

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

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 **10 years.** It must be noted that even though the EA applied for is a 10 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.

An 'initial development plan' has been provided for which silts will be removed from the Dam B area as indicated in Chapter 1 above. The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations.

The EIA findings, including specialist findings, are used by the EAP, Applicant and Authorities to obtain an objective view of the potential environmental and social impacts that could arise during the removal of silts from Valley Silts. Measures for the avoidance or mitigation of negative impacts will be proposed and positive impacts will be enhanced.

2.2.2 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.

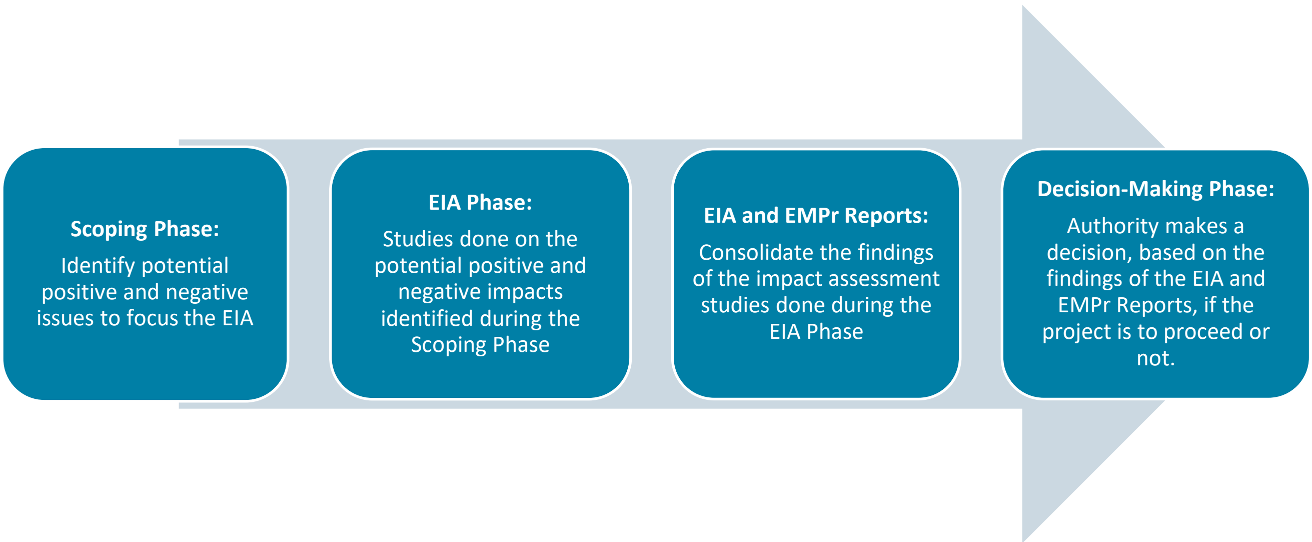


Figure 2-1: Methodology applied to conducting a S&EIA process

2.2.3 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.

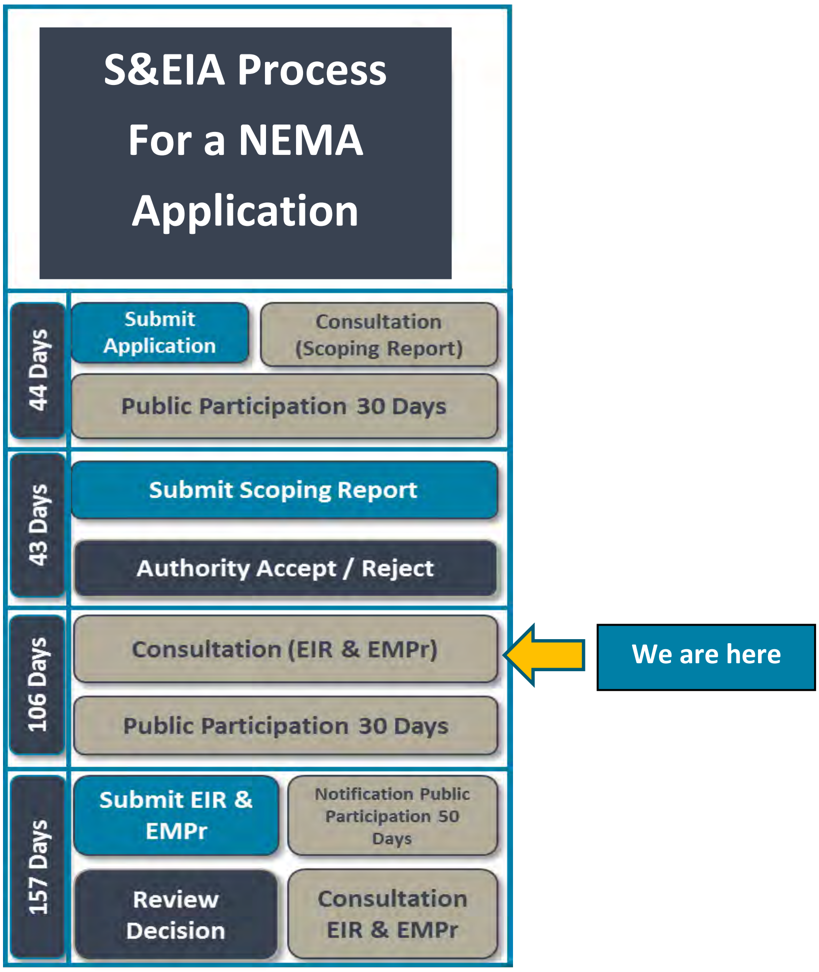


Figure 2-2: S&EIA Timeframes

2.2.4 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

2.2.5 Requirements for Environmental Authorisation

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 2-1 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 Valley Silts 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 2-1: Listed Activities Triggered by the Proposed Project.

Name of activity *Reclamation (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.	Unknown	X	**GNR 983 – 24 GNR 985 – 4**		
Site preparation and earthworks which may include the clearance of indigenous vegetation from the Russell Stream	> 20 Hectares	X	**GNR 984 – 15**		
Altering the bed, banks, course or characteristics of a watercourse		X	**GNR 984 - 6**		X
Mechanical excavation of gold bearing silts from the Russell Stream		X	**GNR 983 - 19** **GNR 984 - 17**		X
Scrubber operation and pre-processing of the gold bearing silts		X	**GNR 984 – 17**		
Stockpiling of gold bearing silts		X		**GNR 921 -B (2)**	

[3] The total area of the mining and associated areas is approximately 122 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

2.3 Description of Project Activities

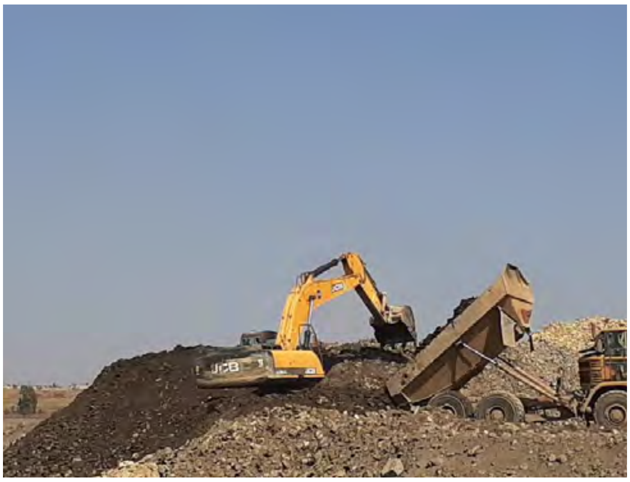
Ergo Mining (Pty) Ltd ('Ergo') intends to make use of its current infrastructure for the Valley Silts Project (hereon referred to as the 'Proposed Project'). The extent and viability of the proposed project area, and its rehabilitation have been evaluated through specialist studies during this EIA phase.

The gold bearing silts will be mechanically excavated from the Valley Silts project area. It is envisioned that 30-ton Articulated Dump Trucks (ADT) (Figure 2-3) will be used to excavate and stockpile the silts from the Russell Stream. The silts will be left to dry on existing Tailings Storage Facility (TSF) footprints known as 3L10, 3L11 and 3L12. These are considered as "dirty" footprints (Figure 2-4). Silts will have up to a 40% moisture content when hauled and are not expected to be fully dried out. These silts will be hauled by haul trucks (Figure 2-3) to a tailings dam footprint known as Ezekiel dump, or 4A18.


Example of excavators working to remove silt.


Example of silt being loaded from the watercourse onto a ADT

Example of new silts being transported for stockpiling


Example of newly removed silt being dumped by the ADT, and turned by a front-end loader

Example of silt which is stockpiled according to wetness. Course materials such as stones and rock are stockpiled and sold / donated to external parties.

Example of a typical hauing truck to be used for the Valley Sils Project.

Figure 2-3: Examples of typical operations which will be employed for the Valley Silts project

At Ezekiel dump, the dried silt will be pre-processed which allows for de-agglomeration of the silt to expose the gold residues. Water will then be added to create a slurry which will be pumped via existing pipelines to the Knights Plant for beneficiation. Beneficiation at the Knights plant includes reprocessing the slurry for gold extraction/recovery. The residue is then pumped through existing pipelines to the licenced Brakpan/Withok tailings storage facility (TSF) where the ultimate deposition will occur. A summary of the process is indicated in Figure 2-5 below.

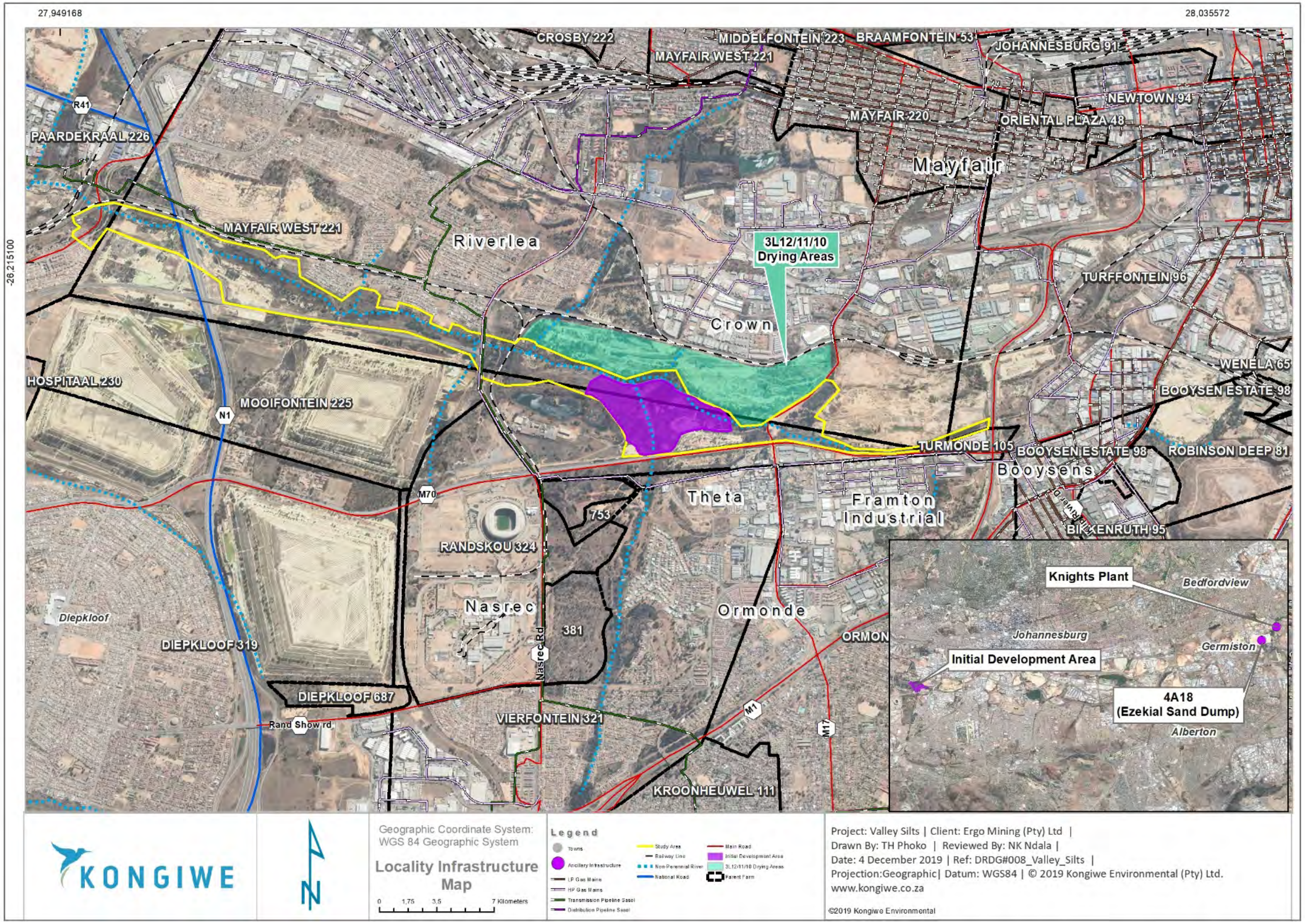


Figure 2-4: Overview of important project facilities

Figure 2-5: Summary of the flow of project logistics.

Considering the existing and future planned surrounding road network, as well as the fact that the surrounding area is already mostly developed, with large portions reserved for mining activities, traffic growth at the proposed access position to the site will be average (2.0% - 3.0%). There are no future roads planned near the access position, according to the Johannesburg Roads Agency (JRA) Road Master Planning and Gautrans Master Planning. It was stated in a meeting with iProperty (Pty) Ltd (Iprop) that there is a future realignment of the N17 planned to connect to Derado Road.

One (1) access to the site is proposed directly off Crownwood Street, as indicated in Figure 2-6 below. This access to the site is proposed approximately 440 m to the south of the intersection with Jupiter Road. The access must be 10 m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from Crownwood Road (M17) will have the right of way and a 'STOP' condition will be implemented for the proposed access.

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. 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.

Please refer to the Traffic impact assessment for a detailed design and routed access for the Valley Silts Project.

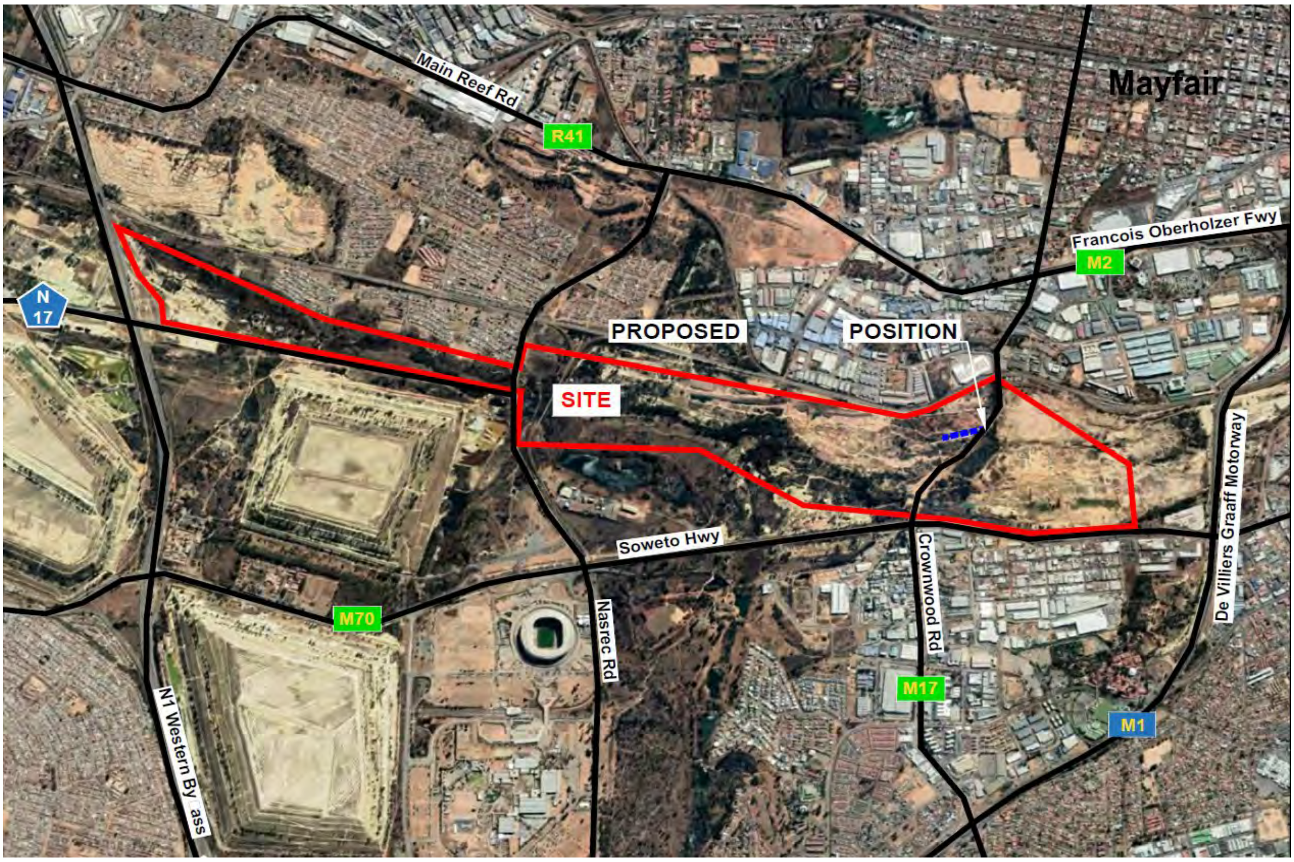


Figure 2-6: Proposed site access.

This project will not require any additional process water for the mechanical excavation of gold bearing silts from the Russell Stream. Retreated and recycled water (not suitable for consumption) will be used for wet suppression, as well as for any other mitigation measures requiring water. Potable drinking water will be sourced from the municipality and will be available to employees on site.

Dirty storm water will be contained in existing paddocks on the drying sites. The clean storm water runoff from the area to the south of the drying sites will be diverted using a storm water diversion drain around the area to the west. Storm water from the north will flow via properly constructed inlets into the Russell Stream. Temporary berms will be constructed along the banks of the channel - these banks will be raised - in sections in order to retain flood flow and prevent flooding of any of the reclamation area during excessive rainfall. The raised riverbanks and berms will be able to contain a 1:50 year storm event.

The processing capacity of the Knights plant is estimated to be 80 000 – 110 000 tons of material a month. In terms of the number of vehicles required to transport the dried silts to the Ezekiel dump footprint, it is estimated that a maximum of 25 dump trucks could be used per day. The silts will be transported to Ezikiel Dump via the Francois Olberholzer Freeway (M2) running east, and Main Reef Road (R41) running east. When constructed, the use of the potential extension of the N17 between Nasrec and Crownwood road may become an option as well.

No domestic or industrial disposal sites are required. The coarse screen oversize material will consist mostly of vegetation (i.e. reeds, grass and sticks) and soil, and will be removed from the site and dumped on a waste dump. There will be a skip on-site for any domestic waste generated.

Information that provides perspective on the scale of the Proposed Project is presented in the table below. It should however be noted that this information may be refined further during the EIA Phase.

Table 2-2: Project perspective and technical details.

GROUP	SPECIFIC	DETAILS
Silt Removal	Target Mineral	Gold Silver has been considered as a possible target mineral in addition to Gold.
	Mining Right Area	Mining Right area of 122 ha. DMRE Reference: GP184MR
	Initial Development Area	Initial development plan area. Also referred to as Dam B. Area is approximately 37 Ha.
	Drying Areas on an existing dirty footprint (covered in an existing MR)	1.5 ha. Areas have been reclaimed.
Vehicle Allocation	Articulated Dump Trucks	Maximum of 6 trucks working in the stream per day
	Hauling Trucks	Maximum of 25 trucks hauling silt per day.
	Trip calculations	A total of 22 trips will be generated in the Weekday AM Peak hour, and 22 trips during the Weekday PM Peak Hour
	Silt Transport	Francois Olberholzer Freeway (M2) running east, and Main Reef Road (R41) running east.
Employment Allocation	Staff allocation: construction (*Non-labour intensive project*)	Continual Development of contractors, vendors and staff currently employed by Ergo Mining. Minor allocation for local employment.
	Operating Times	7 days a week. Day time operation only for desilting activities. 24hrs a day for the Knights Plant.

Although the silts are mainly dry, they will be turned to allow for evaporation of water contained in the silts prior to hauling. Turning is done mechanically.

Regarding the safety of both the public and the employees, Ergo has completed a workers safety assessment as well as a public safety assessment. The public safety assessment for all of the proposed operations of Ergo are currently being updated. This is being done in relation to the requirements of the National Nuclear Regulator (NNR).

Rehabilitation will take place as and when excavation progresses to other target areas. This will entail the following:

- Step 1: Backfilling and shaping of the area;
- Step 2: Storm water control:
  - diversion channels;
  - paddocks;
  - berms;
- Step 3: Regressing with appropriate species; and
- Step 4: 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. Ergo aims to rehabilitate the Valley Silts area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil. Rehabilitation will, as far as possible, support the future development plans for the area.

2.4 Description of Project Infrastructure

The Valley Silts Project is well serviced by existing roads and infrastructure. <u>Existing</u> infrastructure to be utilised at stages during the project include:

- The Ezekiel Dump footprint;
- Drying sites 3L10/11/12 and associated infrastructure;
- Pre-processing infrastructure, scrubber and pump station at Ezekiel;
- Existing site access roads;
- The Knights Plant;
- Existing pipelines;
- The Brakpan/Withok TSF;
- Electricity and water reticulation; and
- Hauling road: access roads and main roads.

The following infrastructure and vehicles will be utilised on site:

- Backhoes and excavators
- 30 ton Articulated Dump Trucks (ADT's) and 30 ton Dump Trucks;
- Water Bowser Truck allocated to the drying sites;
- Temporary administration buildings, ablution facilities; and
- Additional site access roads if required.

The drying sites of 3L10, 3L11 and 12 already have the necessary stormwater management infrastructures in places (paddocks, trenches) and these would need to be cleared and desilted prior to commencing with the removal of silt and drying

2.5 Life-Cycle Phases of the Project

The mining method is divided into a number of stages, as shown in Figure 2-7 below.

Figure 2-7: Project Process

2.5.1 Estimated Project Timeframes

The anticipated life span of the project is approximately **10 years maximum.** The proposed project could start immediately (should Environmental Authorisation be granted) in 2020 and continue to 2030 following a 2 year period of post-closure environmental monitoring.

It must be noted that even though the EA applied for is a 10 year period, it may be the case that the project does not begin immediately until all environmental authorisations, surface right permissions, legal matters 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 Valley Silts Project

PHASE	TIMEFRAME	YEAR START DATE
Pre-Construction and Construction	1 year	2020 - 2021
Operations starting at the initial development area	2 years	2021 - 2023
Decommissioning, Closure, Rehabilitation and monitoring of the initial development area	Ongoing	2023 - 2030
Operations potentially continuing to other areas of the Russell Stream	4 years	2023 - 2027
Decommissioning at all sites	Half a year	2027 / 2028
Closure at all sites	1 year	2028
Post-Closure at all sites	Monitoring 2 years	2030

2.5.2 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 a further pre-construct baseline Radiation walk-over survey
2	Removal of vegetation and site clearance
3	Preparation of access roads should this be required
4	Initiation of a community forum for engagement throughout the project life cycle
Construction Phase	
5	Employment of workers (minimal)
6	Operation of construction machinery and vehicles
7	Temporary storage of construction materials and hazardous material such as contaminated soil
8	Instatement of waste management and dust control measures on site
9	Desilting of existing facilities
10	Instatement of traffic signage, access, parking bays
Operational Phase	
11	Excavation of Silts
12	Stockpiling and drying of silts
13	Hauling of silts to the Ezekiel Dump for Pre-Processing
Decommissioning	
14	Demolition of temporary infrastructure and Rehabilitation of the project area. Ergo aims to rehabilitate the Valley Silts area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil.
15	Closure forum to be established with key stakeholders.
Post-Closure	
16	Post- Closure Monitoring.

2.5.3 Pre-Construction Activities

Prior to the initiation of construction, a radiation survey will be undertaken to determine the radioactive baseline. 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.

2.5.4 Construction Phase Activities

The construction phase will be short as the majority of the site infrastructure already exists. Employment will be allocated for the project and communities will be engaged regarding the commencement of activities on site. Access roads will be prepared and Ergo are expected to erect traffic signage, construct turnings, as well as parking bays as read in the Traffic Impact Statement (TIS). In addition to this, Ergo will appoint security guards, and fence off sites that will be used for the Valley Silts project. During construction, any temporary facilities will be constructed.

2.5.5 Operational Phase Activities

Although the entire Mining Right (MR) area for the Valley Silts Project was investigated during the Scoping phases as well as within the Specialist studies, this impact assessment phase will focus on the area where silts are located at Dam B with the potential to reclaim Dam C as well, as seen in Figure 1-1 and Figure 1-2.. The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations. .

It is proposed that before the activity enters the decommissioning phase of the Project, the Applicant should establish a Closure Forum. This Closure forum will encompass the following:

- Discuss and develop joint action plans and strategies with key stakeholders to achieve sustainable closure;
- Identification and analysis of problems and challenges impacting the operations during the closure phase of the Project;
- Accountability for the implementation of action plans and strategies;
- Review of current economic trends and programmes within the province to ensure that the strategies in place are best suited;
- Generating awareness around the decommissioning and closure of the project; and
- Alignment with the Social and Labour Plan (SLP).

Post closure land use is determined in consultation with stakeholders so that the use meets the requirements of all the participants. As the specific forum proposed for the discussion and planning of the post closure land use is yet to be established, for purposes of current planning and liability costing, the assumption is made that the land use will be for development purposes.

During the operational phase, it is advised that continual monitoring of both surface and ground water is conducted. This information needs to be collected and used to update specific water models, and to monitor and evaluate the impact of the operation.

2.5.6 Decommissioning Phase Activities

Once the economically viable silts have been removed from the targeted areas, decommissioning will commence with the removal of all associated vehicles and infrastructure from the site as well as the removal of berms, paddocks, diversion trenches, infrastructure, and anything else installed during construction.

Regarding the safety of both the public and the employees, Ergo has completed a workers' safety assessment as well as a public safety assessment. The public safety assessment for all of the proposed operations of Ergo are currently being updated. This is being done in relation to the requirements of the National Nuclear Regulator (NNR).

Rehabilitation will take place as and when excavation progresses to other target areas as read in Section 2.3 above. Care will be taken to ensure that the material and excavated soil required for backfilling are free of contamination from hydrocarbons. Ergo aims to rehabilitate the Valley Silts area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil.

2.5.7 Post Decommissioning Activities

Post-decommissioning activities will entail the assessment of rehabilitation and will address any further rehabilitation requirements. M

onitoring must occur for at least five years after decommissioning and rehabilitation, or until satisfactory results are achieved.

2.5.7.1 Maintenance and Aftercare

Maintenance will specifically need to focus on the rehabilitated areas. Furthermore, groundwater and surface water monitoring will have to take place surrounding in the surrounding project area. 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.

2.6 Conclusions from the Scoping Phase

2.6.1 Evaluation of the Proposed Project

The Scoping study for the Valley Silts Project, which commenced in July 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 18th September 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.

2.6.2 Potential Impacts Identified in the Scoping Phase

Preliminary environmental impacts were determined and have been populated in Table 2-5. 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 2-5: 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	❖ Improved water quality following rehabilitation. ❖ Potential release of water containing polluted silts into the immediate environment. ❖ The mobilisation of trace metals. ❖ Rehabilitation of the Valley Silts area by shaping the target areas where silt is removed and make the area free draining, appropriate species to be planted to stabilise the soil. ❖ Disruption of stream banks and other drainage lines during excavation activities. ❖ Positive changes to water regime of drainage features and other affected streams in terms of increased flow due to the removal of silt. ❖ Soil contamination during excavation of silt. ❖ Removal of a source of increased heavy metal concentration and increased sulphate concentration from the watercourse.	Biodiversity Impact Assessment Surface Water Impact Assessment Traffic Impact Statement Groundwater Impact Assessment Wetland Impact Assessment
Biological Environment (living)	Ecology and Biodiversity (including fauna and flora)	❖ Disturbance due to excavation works in the watercourse identified as a CBA and ESA according to the Gauteng C-Plan. ❖ Temporary habitat disturbance. ❖ Rehabilitation of the Valley Silts area by shaping the areas where silt is removed and make the area free draining, appropriate species to be planted to stabilise the soil. ❖ Temporary displacement of fauna and avifauna. ❖ Migration of species into the project area following rehabilitation of the Russell Stream. ❖ Removal of a major polluting source from the stream environment. ❖ Long-term improvement of ecosystem health and functioning of the project area following rehabilitation.	Biodiversity Impact Assessment Surface Water Impact Assessment Traffic Impact Statement Groundwater Impact Assessment Wetland Impact Assessment
	Employment	❖ Continued employment and job security for vendors and contractors currently employed by Ergo Mining.	Social Impact Assessment

ENVIRONMENTAL COMPONENT	COMPONENT TYPE	POTENTIAL IMPACT	SPECIALIST STUDY PLANNED FOR EIA
Social and Economic Environment		❖ Continued investment in local economy through the reclamation of gold bearing silts. ❖ Potential for limited local employment.	
	Land-use	❖ Rehabilitation of the Valley Silts area by shaping the areas where silt is removed and make the area free draining, appropriate species to be planted to stabilise the soil.	Biodiversity Impact Assessment
	Health	❖ Possible increase in dust levels where the silts will be dried and loaded onto the trucks for hauling. ❖ Health impacts due to particulate emissions and gaseous emissions during hauling. ❖ Possible dust impact from trucks on dirt roads traveling on the dirt roads. ❖ Improvement of the overall quality of the water of the Russell Stream (this includes the smell of the water, the colour of the water, the removal of silt, free flowing water). ❖ The potential for ameliorating the current flooding issues experienced in the area.	Air Quality Impact Assessment Health Impact Assessment Social Impact Assessment Surface Water Assessment Groundwater Assessment

2.6.3 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 04 September 2019), which was submitted to the DMRE for their consideration.

Table 2-6: Potential identified environmental and social impact of the Proposed Project.

PROJECT STAKEHOLDER	MAIN ISSUE RAISED	REFERENCE IN THE EIA REPORT
Johannesburg Roads Agency	❖ Sand Street, Seekoei and Selati Street are flooding due to the silt build up	Chapter 1.5
City of Johannesburg	❖ Groundwater and Surface water pollution	Chapter 7 Chapter 8
Federation for a Sustainable Environment (FSE)	❖ The reclamation of the gold from the Russell Stream may liberate the other metals	Chapter 7 Chapter 8
	❖ The foreseeable impacts of dust fallout during the mechanical removal of the silts	Chapter 7 Chapter 8
Earthlife Africa	❖ Radioactivity impacts on workers and residents	Chapter 7.12
Johannesburg Heritage Foundation	❖ Disturbance or destruction of heritage features	Chapter 7.10
Riverlea Mining Forum	❖ Impact on communities should Ergo fail to abide by the EMPr and Rehabilitation objectives set thereout.	Chapter 8
	❖ Groundwater and Surface Water pollution	Chapter 8
Transnet	❖ Impact of excavation on two pipelines along the Russell Stream in Booysens Reserve, North of Nasrec.	N/A

Comments received outside of, or on the last day of the 30-day commenting period of the DSR were not included in the CRR of the FSR. However, Table 2-7 below highlights the main concerns stakeholders raised during this period until present. Furthermore, these comments have been included in the CRR of this EIA in Appendix C.

Table 2-7: Potential identified impact because of the Proposed Project.

PROJECT STAKEHOLDER	MAIN ISSUE RAISED	REFERENCE IN THE EIA REPORT
City of Johannesburg	❖ The mismanagement of surface water runoff	Chapter 8
	❖ Undertaking reclamation and removal of silts during the wet season	N/A
	❖ Impacts of dust fallout at the drying areas on days with strong winds	Chapter 7.8

PROJECT STAKEHOLDER	MAIN ISSUE RAISED	REFERENCE IN THE EIA REPORT
Riverlea mining Forum		Chapter 8
	❖ Excavations may impact pipelines which provide the region with water	Addressed directly
	❖ Impacts on groundwater and the mixing of silts and sewage.	Chapter 7.8
SANRAL	❖ Concerned about the number of trucks on the road at any given time and the impacts on traffic	Chapter 7.13

2.6.4 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 Valley Silts project area. At the moment, the area is unmanaged, and it is for this reason that the current environmental, health and safety risks exist. During heavy rainfall events, the siltation of the Russell Stream causes periodic flooding of the area, which in-turn results in damages to infrastructure and houses of the community of Riverlea and Booysens Reserve. The removal of the silt will attempt to assist with the alleviation of these impacts.

CHAPTER 3: CONSIDERATION OF ALTERNATIVES

In accordance with the requirements of Appendix 3 of the 2014 EIA Regulations (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

Please refer to Section 1.1 above.

The sediments of this Valley Silts Project originate from three dams labelled Dam A, Dam B and Dam C. These three dams expand a distance of about 2 km east-west and connected to one another, some 500 m south and southwest of the old Crown Gold Recovery plant. Dam A has been reclaimed completely, however dams B and C have not yet been reprocessed for their gold content (Figure 1-1).

Although the entire Mining Right (MR) area for the Valley Silts Project was investigated during the Scoping phases as well as within the Specialist studies, this impact assessment phase will focus on the area where silts are located at Dam Bwith the potential to reclaim Dam C as well, as seen in Figure 1-1. The feasibility of removing silts from other areas within the approved MR area will be assessed in terms of prevailing economics and may be subject to further Environmental Authorisations. .

Dam B is an area of approximately **37 Ha of the 122 Ha** Mining Right area and is situated between Nasrec and Crownwood roads, adjacent to the Crown Golf Course dumps and the Soweto Highway. A recent radiation site walkover, for which 50 readings were taken, indicated that Uranium (U) (at 0.349 Bq/g) and Thorium (Th) (at 0,281 Bq/) measured highest. Therefore, this material is below the 0.5 Bq/g limit and currently not regarded as radioactive.

Radioactive elements – uranium and thorium – have been compared to the proposed South African regulatory limit of 1Bq/g3 per radionuclide for solid materials. It should be noted that this limit is not an absolute limit, but rather a decision support tool, which screens out samples whose radioactivity is so low as to be regarded as being of no regulatory concern. The removal of silts from Dam C and other target areas in the Mining Right Boundary will be investigated for feasibility following the successful removal of silts from the initial development area.

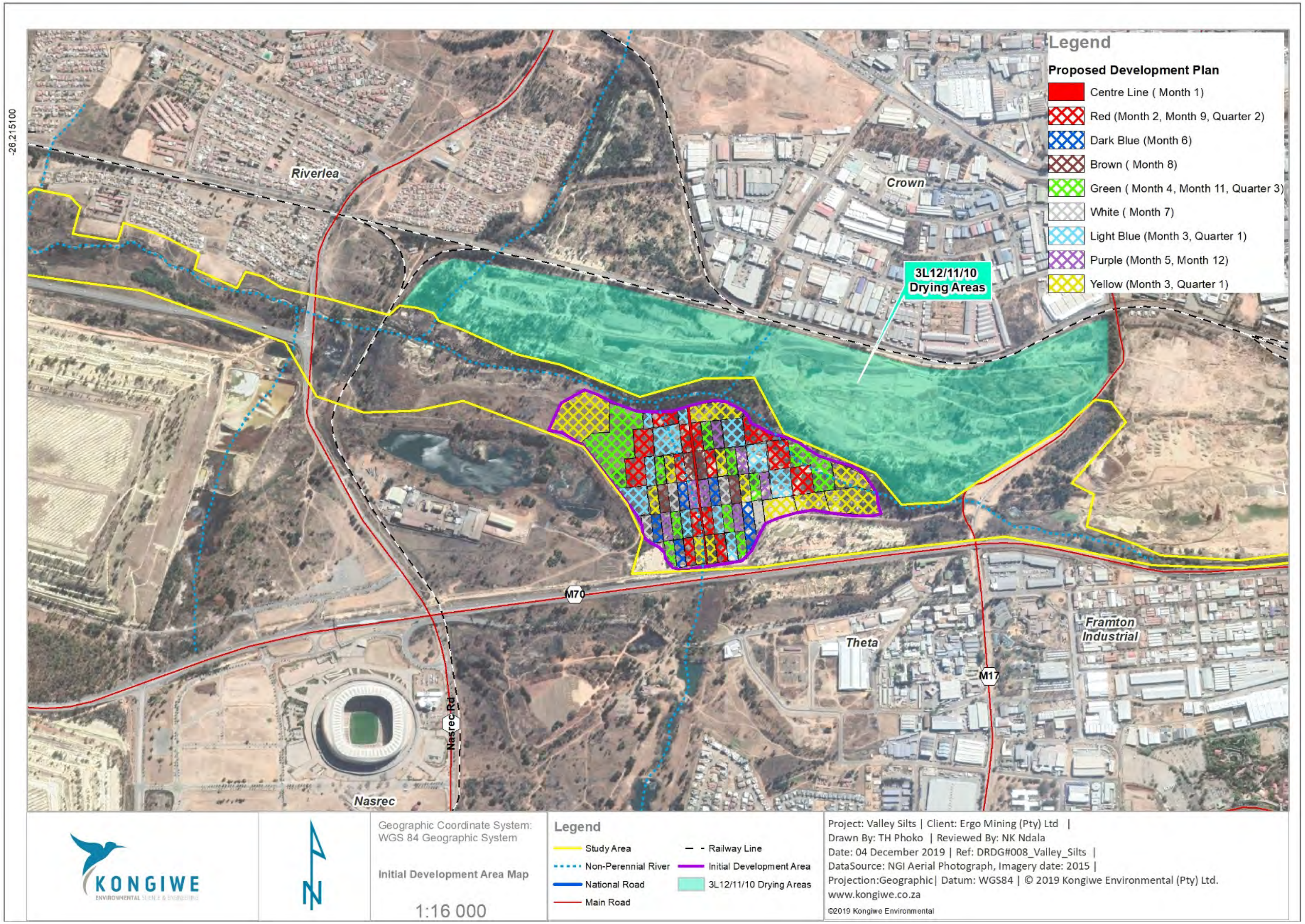


Figure 3-1: Initial development area – proposed plan of activities for the removal of silts

3.2 The property on which or location where it is proposed to undertake the activity

The Proposed Project is covered under Mining Right GP 184 MR. The right in which to remove silts from the Russell Stream, in the area/s proposed, falls within this Mining Right. Other than properties owned by the Applicant, no additional properties outside of the Mining Right Boundary will be considered.

The initial development area earmarked for silt removal will be undertaken on Farm Langlaagte 224-IQ, on the Remaining Extent of Portion 11. This land is owned by Industrial Properties (Pty) Ltd.

3.3 The type of activity to be undertaken

The only optional activity for Ergo is to excavate and reclaim gold bearing silts from the Russell Stream as per the approved MR.

Table 3-1: The advantages and disadvantages of removing silt from the Russell Stream

OPTION	ADVANTAGE	DISADVANTAGE
Excavation and reprocessing of the gold bearing silts within the Russell Stream (Preferred)	❖ Low Risk. ❖ Low capital requirement. ❖ Not labour intensive. ❖ Minimal safety issues. ❖ Economic benefits from the reclamation of gold. ❖ Removal of pollution source after rehabilitation and cessation of project. ❖ Improvement of the natural stream functioning. ❖ Rehabilitating land in line with future developments ❖ Reducing the lure for gold for informal and illegal mining	❖ Potential profits rely on substantial volumes of material required to be reclaimed and the fluctuating gold price. ❖ Potential negative environmental effects during construction and operational phase of the project. ❖ Not labour intensive, no opportunity for additional hiring of labour. ❖ Public interference during excavation and rehabilitation.

3.4 The Design and Layout of the Activity

The current layout plan for the Valley Silts project is indicated in Figure 2-4. The layout plan is dictated by the existing location of Valley Silts project area and existing infrastructure.

3.5 The Technology to be Used in the Activity

Mechanical excavation is preferred. Hydraulically removing the silts can cause irreversible water contamination and is not preferred. ADT's will be used to mechanically excavate the gold bearing silts from the Russell Stream. An independent contractor, with the relevant knowledge and expertise, will be responsible for the removal of silt and rehabilitation of the stream. This will be overseen and monitored by Ergo.

Dump trucks will haul the dried silts to the dirty TSF footprint known as Ezekiel Dump (4A18) for pre-processing. Ergo intends to make use of its existing infrastructure for this project with minimal impact.

3.5.1 Mechanical Removal:

Ergo 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 mechanical removal

OPTION	ADVANTAGE	DISADVANTAGE
Mechanical Removal	❖ Low rates for re-mining ❖ Suited to short-life projects. ❖ Does not carry high capital costs. ❖ Removal of silt. ❖ Improved water quality, specifically salt and metal loading. ❖ Removal of secondary waste from the Russell Stream. ❖ Best practical option for the removal of silts from the water course.	❖ Dust emissions when the silts are dried and when the loading onto the trucks for hauling occur. ❖ Increased traffic from hauling. ❖ Delayed operations due to economic factors. ❖ Removal of vegetation and disturbance of the current habitat. ❖ Nuisance factors for the surrounding community during the project activities. ❖ Stealing of project equipment and disruption of activities.

3.6 The Operational Aspects of the activity

The only operational option for the project is the **removal of silts as well as gold recovery.**

As mentioned, the secondary operations of this project (using existing infrastructure) include hauling the dried silts to the Ezekiel site. Once at the Ezekiel site the dried silts will move through a scrubber (known as pre-processing) and water will be added to create a slurry. From the Ezekiel site the slurry will be pumped via existing pipelines to the Knights Plant for beneficiation. At the Knights Plant the material will be reprocessed through the Knights Mining Right (GP 187 MR), and gold will be recovered. From the Knights Plant, the unwanted slurry (not containing gold) will move through existing pipelines to the Brakpan/Withok TSF for ultimate deposition.

Table 3-3: The advantages and disadvantages of the process option.

OPTION	ADVANTAGE	DISADVANTAGE
***Secondary Operations**:* *Hauled to the Ezekiel Site, processed and*	❖ No installation of pipelines needed at Valley Silts. ❖ Increasing load of material pumped to the Knights plant.	❖ Distance dried material has to be hauled. ❖ Dust from the hauling of the dried-out material.

OPTION	ADVANTAGE	DISADVANTAGE
pumped to the Knights plants for reprocessing and ultimately disposed on the Brakpan/Withok TSF	❖ The plant and deposition facility are existing. ❖ Welded, steel HDPE lined pipelines. ❖ The pipelines do not traverse a great distance.	❖ The cumulative impact of dust at the Ezekiel site.

3.6.1 Hauling route options

Considering the existing and future planned surrounding road network, as well as the fact that the surrounding area is already mostly developed, with large portions reserved for mining activities, traffic growth at the proposed access position to the site will be average (2.0% - 3.0%). There are no future roads planned near the access position, according to the Johannesburg Roads Agency (JRA) Road Master Planning and Gautrans Master Planning.

One (1) access to the site is proposed directly off Crownwood Street, as indicated in Figure 2-6. This access to the site is proposed approximately 440 m to the south of the intersection with Jupiter Road. The access must be 10 m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from Crownwood Road (M17) will have the right of way and a 'STOP' condition will be implemented for the proposed access.

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. 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.

Please refer to the Traffic impact assessment for a detailed design and routed access for the Valley Silts Project.

3.7 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 removal, economic development, and the rehabilitation of the Russell Stream for both natures and human benefit – would not occur. The only alternative option to this project (the No-Go option) is to leave the polluting silts within the stream; there is no other potential use.

The "No-Go" Option also assumes the continuation of the current land use, implying the absence of any rehabilitation activities and associated infrastructures. The means that the attraction of the gold reserves located within the stream could potentially enhance Illegal mining, and if left as is, population settlement on or around the stream could occur. In addition, without the removal of silts from the initial development area, the Russell Stream will continue to follow its current path – meaning that flooding risks to residents will remain.

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

- Removal of a source of pollution in the area;
- The rehabilitation of target areas in the Russell Stream;
- Enhanced ecosystem functioning, including attraction of fauna, flora and improved water quality;
- Continued supply of gold to the local and national markets, and therefore contribution to local, provincial and national economy;
- Liberating land for future development;
- Continued employment for staff and contractors of Ergo; and
- Potential to ameliorate flooding of resident's houses.

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.

Table 4-1: 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. This 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.
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.	Ergo proposes to reclaim the gold bearing silts from Valley Silts and submit the required documents within the prescribed timeframes.
Mineral and Petroleum Resources Development Act, 2002 (Act No. 28 of 2002) (MPRDA) The MPRDA contains provisions relating to the reclamation and processing of residue deposits and residue stockpiles. This must be read together with the EIA 2014 Regulations, as amended, and the assessment of impacts relating to pollution control, where appropriate, must form part of the EMPr. 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.	Ergo proposes to undertake the desired project activities under Mining Right GP 184 MR, in accordance with the provisions of the MPRDA.
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, Ergo operates in	MHSA regulations are included in Ergo's Code of Practice (COP) and Standard Operating Procedures (SOPs).

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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.	
National Environmental Management Act, 1998 (Act No. 107 of 1998) (NEMA) 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.	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 Chapter 2). The respective EA was lodged with the DMRE on the 22 of July 2019. The DSR was made available from the 26th of July until the 26th of August 2019.

5 Sections 24(5) and Section 44

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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 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.	
<u>**National Environmental Management: Waste Act, 2008 (Act No. 59 of 2008) (NEM: WA)**</u> 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]	Listed activities as per the NEM: WA regulations have been identified (refer to Chapter 2)

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
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)". In addition to the requirement for a WML for the mine discard dump (debris resulting from mining), the Project 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 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	The project falls within the 1:50 year floodline. Exemption from Government Notice No. 704 of the National Water Act, 1998 (Act 36 of 1998) (NWA) will be been applied for. Ergo will apply for water use licenses in terms of Sections 21 (c) and (i) of the same act. Generally, the natural bed and flow of the stream will be used to prevent potentially diverse impacts that could result from a fifty year storm event, therefore during the silt removal activities, minimal disruption of the stream will take place.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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." The water uses triggered, in terms of Section 21 for this project are: **(a) impeding or diverting the flow of water in a watercourse;** **(b) altering the bed, banks, course or characteristic of a watercourse;** It is not likely that sub-sections **(a), (b), (d), (e), (f), (g), (h), (j) or (k)** will apply to the Proposed Project. 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.	
National Environmental Management: Biodiversity Act, 2004 (Act No.10 of 2004) (NEM:BA) 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 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.	NEM:BA was used to inform the activities triggered by Listing Notice 3 (refer to Chapter 2)
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	SANBI website and GIS tools were utilised to determine if the project area overlaps with CBAs. The majority of the initial development plan falls

<table>
<tr><th>Applicable Legislation and Guidelines used to compile the report.</th><th>Reference where Applied</th></tr>
<tr><td>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);</td><td>within an Ecologically Sensitive Area (ESA) with a moderate to low biodiversity functioning.

The Regulations were utilised to determine the need for any additional listed scheduled activities under GNR 985.</td></tr>
<tr><td><u>Conservation of Agricultural Resources Act (No. 43 of 1983)</u>

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</td><td>The protection of land, soil, watercourses and vegetation and the control of weeds and invader plants will be contained within the EIA Report.</td></tr>
</table>

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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 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. 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. Ergo 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.	The impact of extra heavy vehicle traffic in the project area is expected to be low in significance.
Spatial Planning and Land Use Management Act, 2013 (Act No. 16 of 2013) (SPLUMA) 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	Should the project proceed, land will be liberated for future development in line with SPLUMA.

<table>
<tr><th>Applicable Legislation and Guidelines used to compile the report.</th><th>Reference where Applied</th></tr>
<tr><td>sustainable development into land use and planning regulatory tools and legislative instruments.</td><td></td></tr>
<tr><td><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.</td><td>No hazardous substances are expected to occur or be stored on site for this project.</td></tr>
<tr><td><u>The National Development Plan, 2030</u>

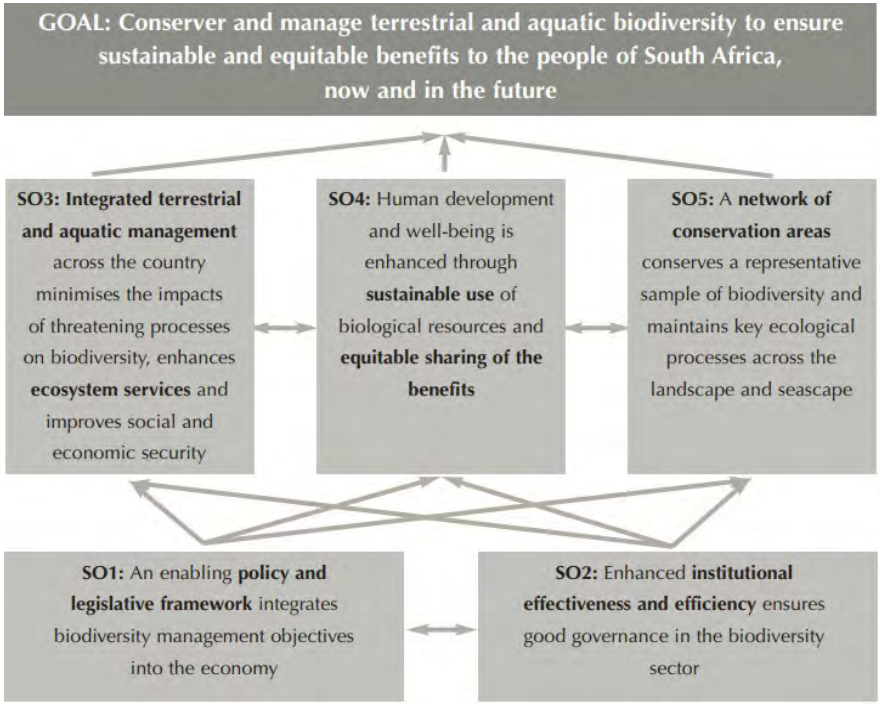
The NDP strives to ensure a tightening of the accountability chain, where, in relation to this EIP, environmental noncompliance in terms of Section 16(1)(b) of NEMA is addressed at all levels of government.

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.</td><td>The project – if approved – will assist in improving disaster preparedness for extreme climate events such as flooding.</td></tr>
<tr><td><u>Action Plan of the Environmental Initiative of the New Partnership of Africa’s Development, 2003.</u>

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,</td><td>The rehabilitation of the areas very silts have been removed, as well as the control of aliens species has been included in this report.</td></tr>
</table>

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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.	
Mining and Biodiversity Guideline, 2013. 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 projects life cycle.	This project will, as far as possible, make use of the fundamental principles outlined in the Mining and Biodiversity Guideline, 2013.
South Africa's National Biodiversity Strategy and Action Plan 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	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.

Applicable Legislation and Guidelines used to compile the report.	Reference where Applied
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:  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 Department of Water and Sanitation 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 rehabilitation projects 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 were 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 1-2: Applicable Provincial and Local Policies, Guidelines and By-Laws

Policies, Guidelines and By-Laws	
Gauteng Mine Residue Areas Strategy, 2012 The aim of the Gauteng Mine Residue Areas Strategy 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 strategy are as follows: ❖ To evaluate current pollution problems caused by mining activities and suggest how they should be addressed;	The Proposed Project is in line with the objectives of the Strategy. The guidelines of the Strategy has been considered throughout the S&EIA process and reporting.

Policies, Guidelines and By-Laws	
❖ 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.	
Gauteng Nature Conservation Bill, 2014 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 have been considered throughout the S&EIA process and have been included within the reporting documents.
Gauteng Conservation Plan Version 3.3 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 in ensuring	Aspects of this Plan are applicable to the Proposed Project. Where applicable, these have been considered throughout the S&EIA process and have been included within the reporting documents.

Policies, Guidelines and By-Laws	
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 have been 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 landscape: ❖ Increasing pressure on the natural environment and green infrastructure. ❖ Urban sprawl and fragmentation.	Where applicable, this document has been considered and consulted throughout the S&EIA process and will be included within the reporting documents.

<table>
<tr><th colspan="2">Policies, Guidelines and By-Laws</th></tr>
<tr><td>❖ 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.</td><td></td></tr>
<tr><td><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.</td><td>This DEIA 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.</td></tr>
<tr><td><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.</td><td>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.</td></tr>
</table>

Policies, Guidelines and By-Laws	
The Public Participation Guidelines in terms of the National Environmental Management Act, 1998 Environmental Impact Assessment Regulations, 2017 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 participation process.	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.
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 Ergo, hold the rights to several gold tailings dams.

As see in Figure 5-1 it is Ergo's intention to reclaim gold bearing silts in the Russell Stream as part of the Valley Silts Project, 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 Economic Benefits of Silt Removal

Ndasi (2007) found that dam sediments are trap sites for heavy metals originating from surrounding tailings dumps. In the Russell Stream deposits, the maximum thickness is defined by a region of greater than 12 m of sediment fill just below and behind the dam wall in Dam B. An axial zone following the original river course contains sediments in excess of 10 m over a distance of 250 m. Dam C downstream of Dam B shows a similar pattern with an axial zone of greater than 8 m thickness. In addition, high concentrations of gold in these sediments have been proven to be economically viable in the Russell Stream dams. Reserve calculations on the Russell Stream sediments (still unmined) gave a total estimated gold content of 3.8 million tons at an average grade of 1.0 g/t Au.

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 Valley Silts Project will retrieve gold from the gold bearing silts of the Russell Stream. 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.

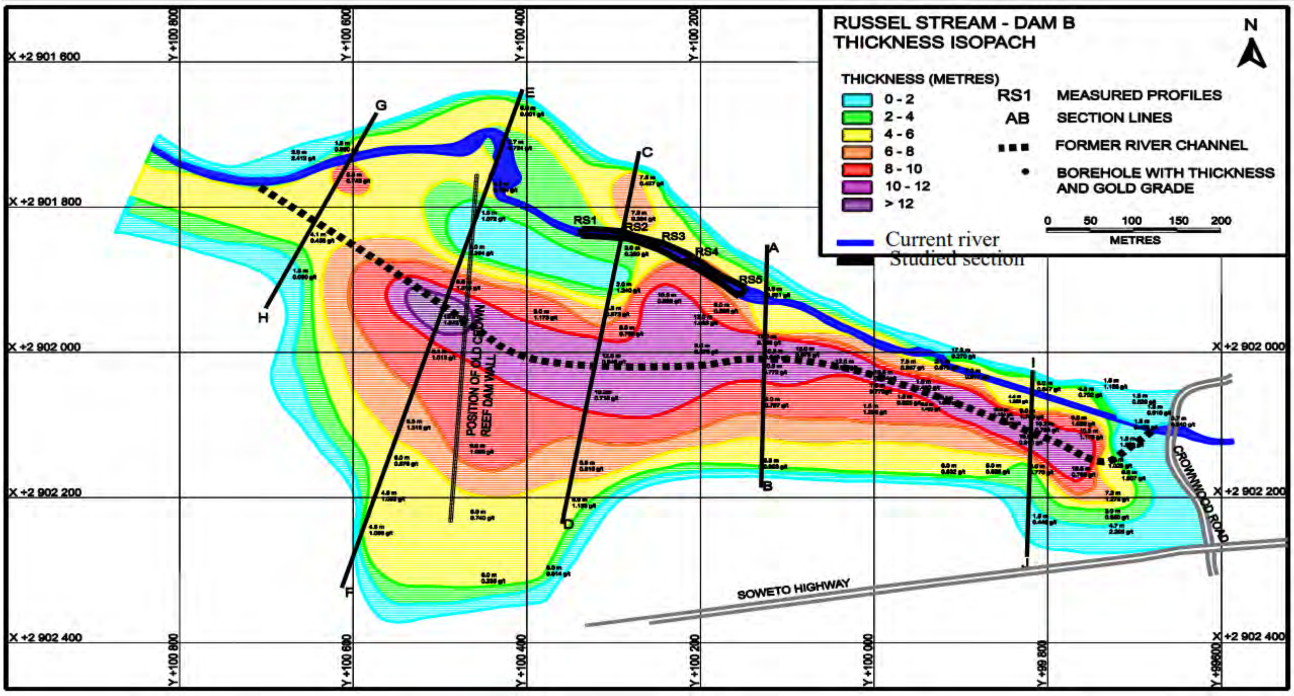


Figure 5-2: Isopach of sediment thickness (m) in the Russell Stream Dam B (Ndazi, 2007).

5.2 Social Benefits of the Silt Removal

The Russell Stream forms part of a greater wetland system which stretches approximately 25 km from Soweto to southern Gauteng. Due to rapid urbanisation, erosion, siltation from mine tailings and illegal dumping in this stream, the Russel Stream and New Canada Dam are under threat and highly polluted.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of mine residue is extremely important as well as a major positive benefit. It is envisioned that the removal of these silts could significantly reduce a source of water and land pollution. Additionally, the removal of the silts will also aid in the flow of the stream and help with flooding that occurs sporadically, in the wet seasons in the Riverlea area.

The Silts contained within the Russell stream is also an allure for illegal elements, like *Zama-Zamas* (informal miners). As informal miners settle into the area, crime becomes a concern for the residents of Riverlea due to the level of uncontrollability and lawlessness of these individuals. The removal of these silts from the dams may help alleviate the levels of crime and lawlessness found within the area.

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 Ergo. The delivery of the mine residue material to the Knights plant will help keep the plant operational ensuring current and future employees with a form of employment.

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), which is to reclaim and/or rehabilitate areas that have been affected by the mine dumps to the point where they become safe for adjacent communities. This strategy also aims at making previously unavailable land, available for use. See Figure 5-3 below for the GDARD Mine Residue Area decision making tree.

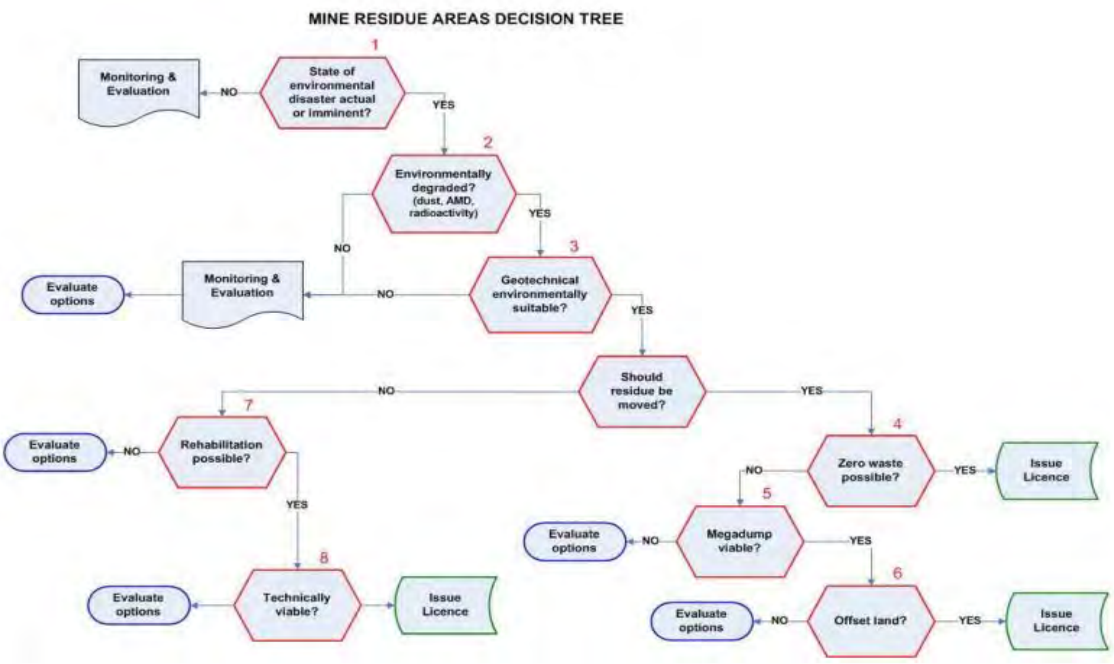


Figure 5-3: GDARD's Mine Residue Area decision making tree as illustrated in the Gauteng Mine Areas Strategy (Source: GDARD, 2012).

5.3 Environmental Benefits of Silts Removal

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. It is anticipated that the removal of silts will have a positive impact on groundwater and surface water in terms of improved water quantity and quality.

Specialist reports found that through carefully planned rehabilitation efforts the system could potentially be reinstated to where it represents a valuable greenbelt and open space asset, that is actively utilised for land-based recreational purposes. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the rehabilitation efforts but is likely to remain one of the most challenging issues.

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 Valley Silts Project 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 a DMRE Reference of GP 184 MR.

6.1 Relevant Legislative Permitting Requirements

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

Table 2-1 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 project falls within the 1:50 year floodline. Exemption from Government Notice No. 704 of the National Water Act, 1998 (Act 36 of 1998) (NWA) will be applied for. Ergo will apply for water use licences in terms of Sections 21 (c) and (i) of the same act.

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 Valley Silts 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; ❖ 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

PROJECT PHASE	DESCRIPTION OF ACTIVITIES
	❖ 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 2.6.3 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 Valley Silts Project was submitted to the Department of Mineral Resources on 22 July 2019. To date there has been no acknowledgement letter from the DMRE regarding the proposed project. The project is assigned the DMRE Mining Right reference number of GP 184 MR.

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
  - o A site visit was undertaken to identify I&APs for which no contact details could be obtained;
  - o 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 properties for the project, was submitted to the Land Claims Commission, Gauteng Department of Agriculture, Land Reform and Rural Development (DALRRD) on **Monday, 8 July 2019 (refer to Appendix C2)**. The office of the Land Claims Commission has confirmed on **Tuesday, 30 July 2019** that there is a land claim lodged on the property Ormonde 99 IR portion 4 - please see attached correspondence **(Appendix C2)**.

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 Valley Silts Project;
- 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 **Friday, 26 July 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.

A second advertisement (Appendix C4) will be placed in the ***The Star,*** on **Wednesday, 04 December 2019** to inform stakeholders of the following:

- Availability of the Draft Environmental Impact Assessment Report (DEIR) / Environmental Management Programme (EMPr);
- The venues where the Draft Reports can be accessed;
- The details of the Open Day to be held on Saturday, 18 January 2020; and
- The contact details of the public participation office.

Site notice: Similar to the advertisement, the site notice provides an overview of the project, and highlights the applicable legislation for the EIA process. It also stipulates the PPP to be followed and where relevant information could be obtained from. A locality map of the project site was included in the site notice. Details of the public meeting and how stakeholders can register as Interested and Affected Parties were included in the Site Notice. Pictures and co-ordinates of where the site notices were placed were recorded in the site notice report. **(Please refer to Appendix C5 for a copy of the site notice map and the site notice report).**

Notification Letter with a Comment and Registration Form: An email was sent to stakeholders 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 to the full stakeholder database, to remind stakeholders of the availability of the Daft Scoping Report for public review and about the public meeting.

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 meeting. Furthermore, meetings were also held with directly affected landowners on a one-on-one basis.

All comments raised by stakeholders during these meetings will also be captured into the Comment and Response Report (CRR). Responses to comments will be provided in line with the overall project scope and available information.

Authority Meetings: Authority meetings were held with various Organs of State, the purpose of the meetings was to discuss the proposed project and 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 meeting.

Landowner Consultation Meetings: Consultation meetings were held with directly affected landowners on a one-on-one basis. An overview of the proposed project, land tenure and locality plans were presented. Landowners were provided with an opportunity to raise issues of concern and comments/suggestions regarding the proposed project.

Public Meeting: A public meeting was scheduled for **Thursday, 22 August 2019 at the Riverlea Recreation Centre at 10H00.** An invitation to attend the public meeting was communicated to stakeholders on 24 July 2019 by means of email, telephonic discussions and during stakeholder engagement meetings.

Cancellation of the Public Meeting: The above-mentioned public meeting was cancelled, the project team received requests from various stakeholders to reconsider the date and time for the public meeting. As such, Kongiwe took a decision to cancel the public meeting. Further appropriate consultation is planned to ensure compliance with the regulatory requirements.

A notification letter **(Appendix C6)** informing stakeholders about the cancellation of the public meeting was sent on **Wednesday, 21 August 2019**, by means of email and telephonic communication. The letter was also displayed on the notice board at the Riverlea Recreation Centre (Figure 6-2) **(See Appendix C6)**.

All comments raised by stakeholders during these meetings have been captured into the Comment and Response Report (CRR) **(Appendix C9)**. The CRR will continue to be updated throughout the EIA/EMPr phase.

Figure 6-2: Riverlea Recreational Centre. The venue which was proposed for the Public Meeting (The public meeting was cancelled).

Availability of the Draft Scoping Report for public review and comment: The DSR was made available to stakeholders for a 30-day comment period from **Friday, 26 July 2019 to Monday, 26 August 2019** (please refer to Table 6-2 for a list of places where the report can be accessed). Notification of the availability of the documentation for review was distributed on **Thursday 25th July 2019.**

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

LOCATION	PHYSICAL ADDRESS	CONTACT PERSON
Hard copies		
Riverlea Public Library	Cnr Avon & Colorado Dr, Riverlea, Johannesburg	Mr John Keith, Librarian (011) 474 2968 or (071) 390 6549
Greater Johannesburg City Library	Albertina Sisulu Rd & Pixley Ka Isaka Seme Street	Mr Johannes Masenya Manager, Cell: (061) 438 0153 or (011) 492 7071
Electronic copies		
Kongiwe Environmental website	www.kongiwe.co.za/ 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		

The DSR was distributed to the Competent Authority, the Department of Mineral Resources and Energy (DMRE) and key Commenting Authorities.

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

- Department of Human Settlements, Water and Sanitation (DHWS) (previously known as the Department of Water and Sanitation);
- National Nuclear Regulator (NNR);
- City of Johannesburg Metropolitan Municipality;
- Gauteng Department of Agriculture and Rural Development (GDARD);
- National Department of Health (DoH);
- South African Heritage Resources Agency (SAHRA);
- Department of Public Works and Infrastructure (DPW) and
- Department of Environment, Forestry and Fisheries (DEFF).

The table 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 Draft Scoping Report
Pre-scoping Phase		
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 of Agriculture, Land Reform and Rural Development (DALRRD) was (DRDLR**), Monday, 8 July 2019**. Still awaiting feedback.	Appendix C2 Land claims letters
Development of the Background Information Document	The BID was developed and emailed to the full stakeholder database on **Thursday, 24 July 2019.** The BID was also distributed at stakeholder meetings, libraries and it is available on Kongiwe's website.	Appendix C3 BID
Placement of media advertisements	An advertisement was placed in *The Star* (Regional Newspaper) on **Friday 26 July, 2019.**	Appendix C4 Advertisements
Placement of site notices	Site notices were placed in publicly accessible places within the project area on **Thursday, 1 August 2019**. Site Notices were placed at the following places: ❖ Riverlea Public Library; ❖ Riverlea Recreation Centre; ❖ Greater Johannesburg Public Library; ❖ Riverlea Empowerment Centre; ❖ Riverlea Clinic; ❖ Booysens South African Police Services Station; ❖ Booysens food vendor stalls. A site notice placement report and map have 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 Draft Scoping Report
Pre-scoping Phase		
Announcement of the project and Draft Scoping Report	The announcement letter was emailed to the full database on **Wednesday, 24 July 2019** to: ❖ Announce availability of the Draft Scoping Report; ❖ Share details of the public meeting; ❖ Indicate where the Scoping Report will be available for public review and comment; and ❖ Communicate the public review and comment period. The Draft Scoping Report was available for public review and comment from **Friday, 26 July 2019 to Monday, 26 August 2019.** The Draft Scoping Report and the BID are available on Kongiwe's website http://www.kongiwe.co.za/publications-view/public-documents	Appendix C6 Announcement Letter Appendix C3 BID
Stakeholder meetings	Consultation meetings were held with Authorities and directly affected landowners throughout the scoping phase. An overview of the proposed project was discussed, and stakeholder comments are captured and responded to in the CRR.	Appendix C8 List of meetings Appendix C9 Comment and Response Report
Public Meeting	The scheduled public meeting was cancelled, the project team received requests from various stakeholders to reconsider the date and time for the public meeting. As such, Kongiwe took a decision to cancel the public meeting. A notification letter **(Appendix C6)** informing stakeholders about the cancellation of the public meeting was sent on **Wednesday, 21 August 2019**, by means of email and telephonic communication. The letter was also displayed on the notice board of the Riverlea Recreation Centre for stakeholder's information **(See appendix C6).** A Open Day meeting date has been finalised for 18 January 2020, 10H00 till 15H00 at the Riverlea Recreation Centre.	Appendix C6 Notification Letter

6.3 Consultation Undertaken as part of the Final Scoping Phase

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.

Notification of the availability of the documentation for review has been distributed on **Thursday, 5 September 2019 (Appendix C6).** In the submission of the Final Scoping Report, stakeholders will have the opportunity to verify that their comments which were captured during the draft Scoping phase, and to review responses provided by the project team. All comments received on the Final Scoping Report were incorporated into the CRR that will accompany the Draft EIA Report.

Table 6-4: Summary of PPP activities to be undertaken during the Final Scoping Phase

Activity	Details
Update stakeholder database	The stakeholder database has been updated with new stakeholders who formally registered or submitted comments.
Placement of the Final Scoping Report	The Final Scoping Report was available on the Kongiwe Environmental website http://www.kongiwe.co.za/publications-view/public-documents/. Copies of the Final Scoping Report were submitted to the Competent Authority and relevant Commenting Authorities for their review and comment.
Announcement of the Final Scoping Report	Announcement letter of availability of the Final Scoping Report for public review was emailed to the full stakeholder database on **Thursday, 5 September 2019.**

6.4 Consultation with stakeholders during the impact assessment phase

Consultation with stakeholders during the EIA Phase will provide stakeholders with an opportunity to provide comments on specialist study findings, recommendations and mitigation measures proposed. These studies and recommendations will be included as part of the Environmental Impact Assessment Report and the Environmental Management Programme EIA/EMPr. Stakeholders will be provided with opportunities to raise their concerns/ comments and engage with the project team.

6.4.1 Availability of the Draft Environmental Impact Assessment Report / Draft Environmental Management Programme (DEIR/EMPr) for public review and comment

The DEIR/EMPr will be available for a 30-day public review period from **Monday, 9 December 2019 to Friday, 31 January 2020**.

Notification of the availability of the documentation for public review and comment has been distributed on **Friday, 29 November 2019** to all stakeholders on the database to notify them of the availability of the DEIR/EMPr and the Open Day. The reports will be made available at the locations indicated in

Table 8-6-5 below:

Table 8-6-5: Public places where the Draft EIA/EMPr and IWULA reports can be accessed

LOCATION	PHYSICAL ADDRESS	CONTACT PERSON
Hard copies		
Riverlea Public Library	Cnr Avon & Colorado Dr, Riverlea, Johannesburg	Mr John Keith, Librarian (011) 474 2968 or (071) 390 6549
Greater Johannesburg City Library	Albertina Sisulu Rd & Pixley Ka Isaka Seme Street	Ms Prudence Chauke (011) 407 7703
Electronic copies		
Kongiwe Environmental website	www.kongiwe.co.za/ 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: (012) 003 6627, Email: stakeholders@kongiwe.co.za		

6.4.2 The Public Open Day

An Open Day will be held on **Saturday, 18 January 2020** for all stakeholders who are affected by or interested in the project, details of the Open Day are indicated below. The intention of this open day is to provide feedback to stakeholders on specialist studies undertaken and to obtain further comments. The Open day will allow stakeholders to engage with the project team members/specialists on technical information for example surface and ground water, air quality, wetlands and traffic. Posters with information regarding the proposed project description, findings from the specialist studies, impacts and proposed mitigation measures and locality maps will be displayed. All comments raised will be captured into the Comment and Response Report and will be responded to.

Table 6-2: Details of the Open Day

Date	Venue	Time
Saturday, 18 January 2020	Riverlea Recreation Centre, Riverlea	10:00 to 14:00

6.5 Public Participation Materials: EIA phase

Notification Letter: a letter **(Appendix C6)** which provides details about the availability of the DEIR/EMPr Reports for public comment and an invitation to the Open Day will be sent by email to the full stakeholder database. A Short Message Service (SMS) will be sent to stakeholders who do not have email access.

Newspaper advertisements: A newspaper advert **(Appendix C4)** will be placed in **The Star on Wednesday, 04 December 2019**. The advertisement will provide details about the public review period for the DEIR/EMPr and how the public can access the draft reports for their review and comment. The advert will also provide information about the Open Day details.

Telephonic Discussions: Stakeholders will be invited to the Open Day by means of telephonic discussions and SMSs will be sent to key stakeholders to remind them of the Open Day.

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

Posters: Posters will be developed and used at the Open Day. The following aspects will be covered in the poster 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 6-6: 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 Reports	A Notification letter announcing the availability of the DEIR/EMPr for public review and comment was emailed to the full stakeholder database on **Friday, 29 November 2019 December 2019.** (Public comment period for DEIR/EMPr (30 days): **Monday, 9 December 2019 to Friday, 31 January 2020**.	Appendix C6 Announcement Letter
Placement of Draft EIA/EMP Reports for public review and comment	The DEIR/EMPr will be made available to stakeholders at the following public places: ❖ Riverlea Public Library ❖ Greater Johannesburg City Library An electronic copy of the DEIR/EMPr will be made available on Kongiwe's website http://www.kongiwe.co.za/publications-view/public-documents/ A copy of the DEIR/EMPr will also be made available at the Open Day. Copies of the DEIR/EMPr will be sent to the DMRE and various Commenting Authorities for review and comment.	-
Open Day	An Open Day will be held with all stakeholders on **Saturday, 18 January 2020** between 10h00 and 14h00 at the **Riverlea Recreation Centre, Riverlea**. All comments provided at this Open Day will be captured into the Comment and Response Report. Minutes from the meeting will be compiled and distributed to stakeholders who attended the Open Day.	Appendix C9 Comment and Response Report
Placement of media advertisement for the EIA	An advertisement will be placed in ***The Star*** **(Regional Newspaper)** on **Wednesday, 04 December 2020.**	Appendix C4 Advertisements

Table 6-7: Summary of the PPP activities-Final EIA phase

Activity	Details
Announcement of the FEIR/EMPr	A notification letter announcing the availability of the FEIR/EMPr will be emailed to the full database. The FEIR/EMPr will be made available on Kongiwe's website.
Submission to the Authorities	The FEIR/EMPr will be submitted to the DMRE and the DHWS and key Commenting Authorities.

6.6 Consultation during the decision-making phase

Once the competent authority has taken 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

CHAPTER 7: THE BASELINE ENVIRONMENT AND SPECIALIST FINDINGS

This Chapter provides a description of the environment that may be affected by the Valley Silts Project. 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.

Monthly patched rainfall data for weather station 0476040 W, located 7 km north-east of the Project, was adopted to represent the rainfall of the Project area. Monthly rainfall data was available for the period of October 1915 to September 2010 and was downloaded from the WR2012 website.

7.1.1 Rainfall

The mean monthly rainfall is indicated in Figure 7-1. The area has a Mean Annual Precipitation (MAP) of 799 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.

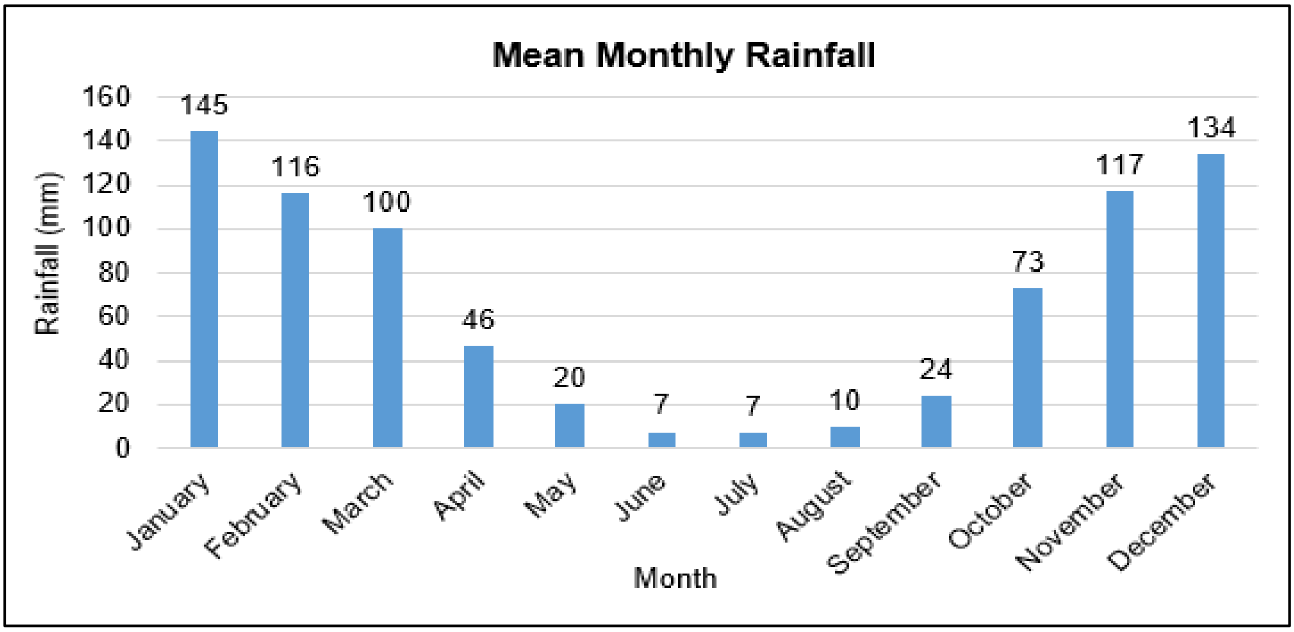


Figure 7-1: Average monthly rainfall totals for the project area.

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 7-1.

Table 7-1: 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	12	15	17	21	25	28
10 min	13	18	21	25	31	36	41
15 min	16	22	26	31	38	44	50
30 min	20	28	34	40	49	56	65
45 min	23	32	39	46	56	65	75
1 hr	26	36	43	51	63	72	83
1.5 hr	30	41	50	59	72	84	96
2 hr	33	46	55	65	80	93	106
4 hr	40	55	66	78	96	111	127
6 hr	44	61	74	87	107	124	142
8 hr	48	66	80	94	115	133	153
10 hr	51	70	84	100	122	141	162
12 hr	53	73	88	105	128	148	170
16 hr	57	79	95	113	138	160	183

STORM DURATION	RETURN PERIOD / STORM RAINFALL DEPTH (MM)						
20 hr	61	84	101	120	147	169	194
24 hr	64	88	106	125	154	178	204
1 day	55	76	92	109	133	154	177
2 day	68	94	113	134	164	190	218
3 day	77	106	128	151	185	214	246
4 day	83	115	139	165	202	233	268
5 day	89	123	149	176	216	249	286
6 day	94	130	157	186	228	263	302
7 day	99	136	164	195	239	276	316

7.1.2 Evaporation

Evaporation data was obtained from the DWS weather station C2E007, located 18 km south-west of the Project area. 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. 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 7-2. Evaporation is highest over the months of September to March, and lowest over the cooler months of April to August.

Table 7-2: 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 Valley Silts Project area (as given by the WRF data for the period from 2016 to 2018) are from the north-north-westerly direction for approximately 11% of the time, followed by the east-south-easterly and south-easterly directions (Figure 7-2). The highest number of winds with speeds greater than 6.5 m/s are expected from the north to west quadrant. The average hourly wind speed predicted by the WRF model is approximately 2.5 m/s. Calm conditions (wind speeds below 0.5 m/s) are predicted for approximately 1.2 % of the time.

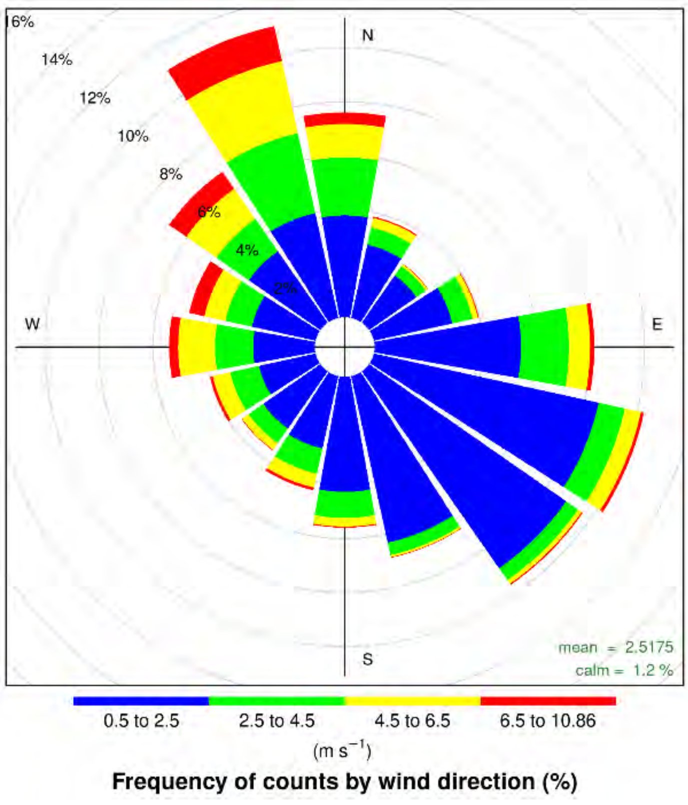


Figure 7-2: Wind rose of the average winds produced by the WRF model for the Valley Silts Project site for the years 2016-2018.

The seasonal variations in wind direction for the Valley Silts 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 late Autumn to Winter.

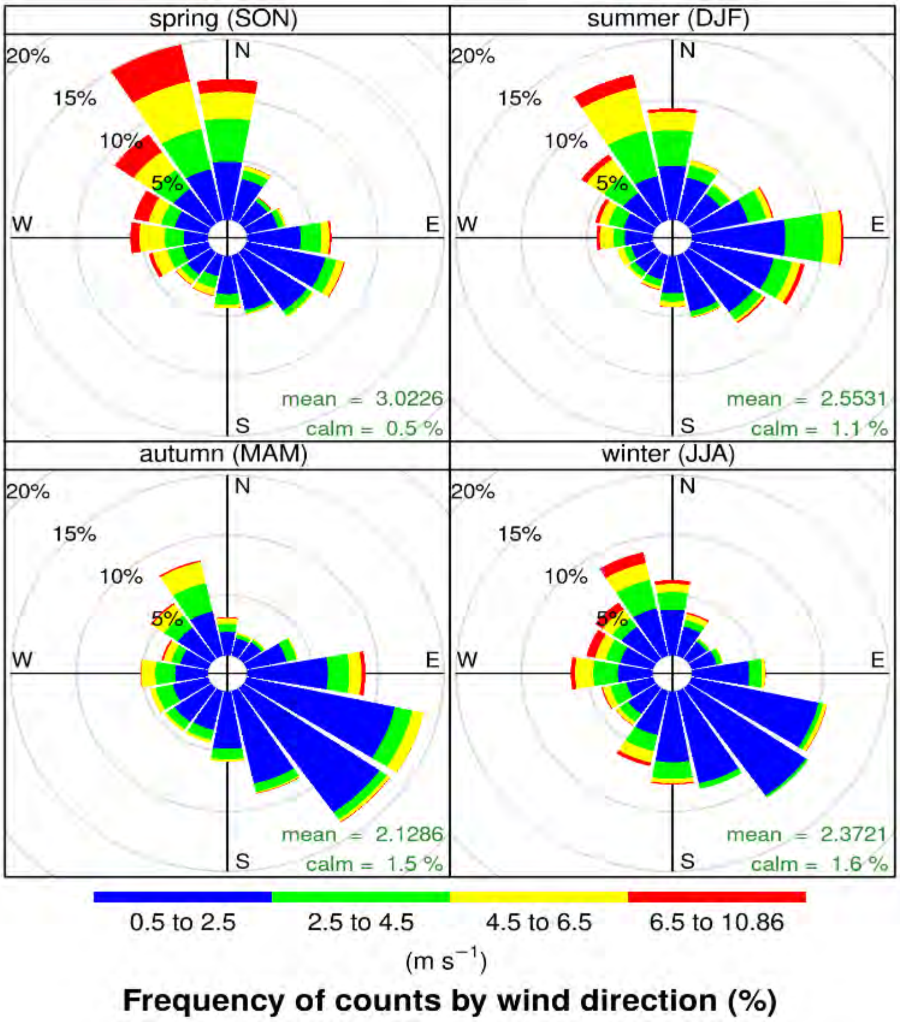


Figure 7-3: Seasonal wind roses of winds predicted by the WRF model for the Valley Silts Project site for the years 2016-2018.

There is a clear diurnal variation in both wind speed and wind direction at the Valley Silts Project site. Wind speeds are generally higher during the day and tend to blow from the north-westerly quadrant as opposed to the generally slower wind speeds at night from the south-easterly quadrant. During the warmer hours of the day, calm conditions are expected for approximately 2.2 % of the time, and average wind speeds are approximately 3 m/s. The most frequent winds are from the north-north-westerly direction. During the night, calm conditions are expected for approximately 0.2 % of the time, and average wind speeds are approximately 1.9 m/s (Figure 7-4)

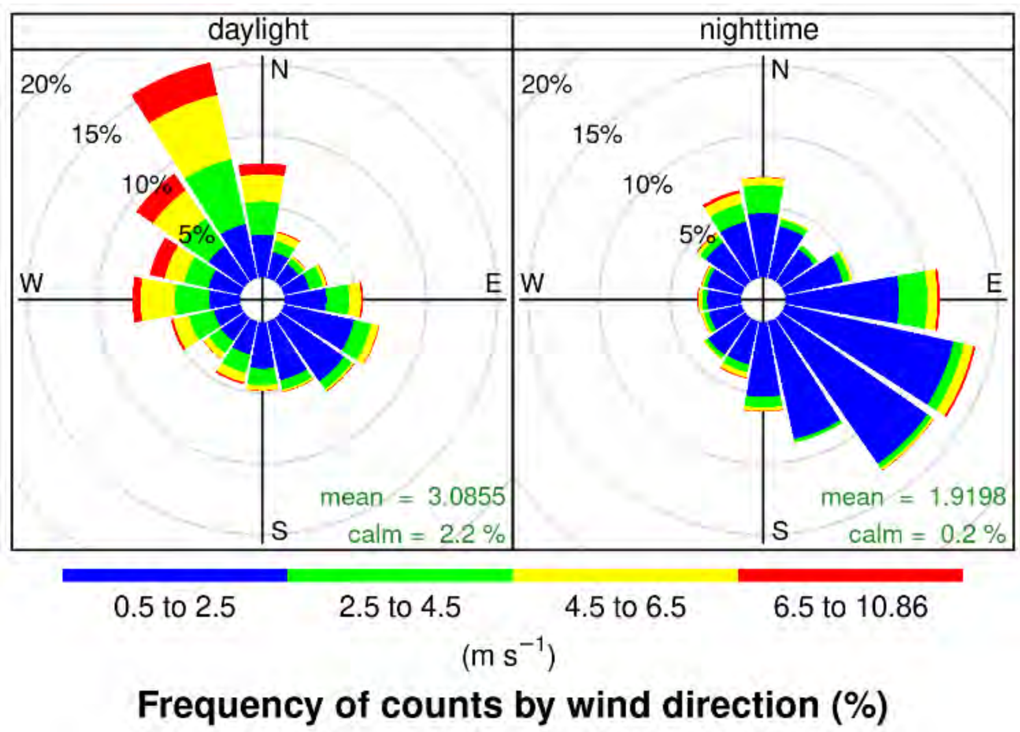


Figure 7-4: Diurnal wind roses predicted by the WRF model for the Valley Silts Project site for the years 2016-2018.

7.2 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 (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 contributed to the silt in the Russell Stream. Several of these dumps are currently being reclaimed by Ergo.
The Valley Silts Project is located on the Central Rand Group, of the Witwatersrand Supergroup. The Witwatersrand Supergroup is a sequence of conglomerate, shale and quartzite, ranging in age from 2.7 Ga for the Hospital Hill Subgroup to 2.4 Ga for the Turffontein Subgroup. 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.

The Russell Stream is underlain predominantly by the Booysens Subgroup (shale) of the Witwatersrand Supergroup. To the south is the younger Turffontein Subgroup (quartzite, conglomerate and shale) and to the north, conglomerate and quartzite of the older Johannesburg Subgroup (Figure 7-5 and
Figure 7-6).

A characteristic of the Witwatersrand mining area is a series of cross-cutting faults and diabase dykes. The dykes are not 100% impermeable. Fault appearance varies from small localised fractured zones to large breccia filled zones. Faults are commonly filled with intrusive material. The composition ranges from diabase (or quartz diabase) to norite (Biccard Jeppe, 1946).

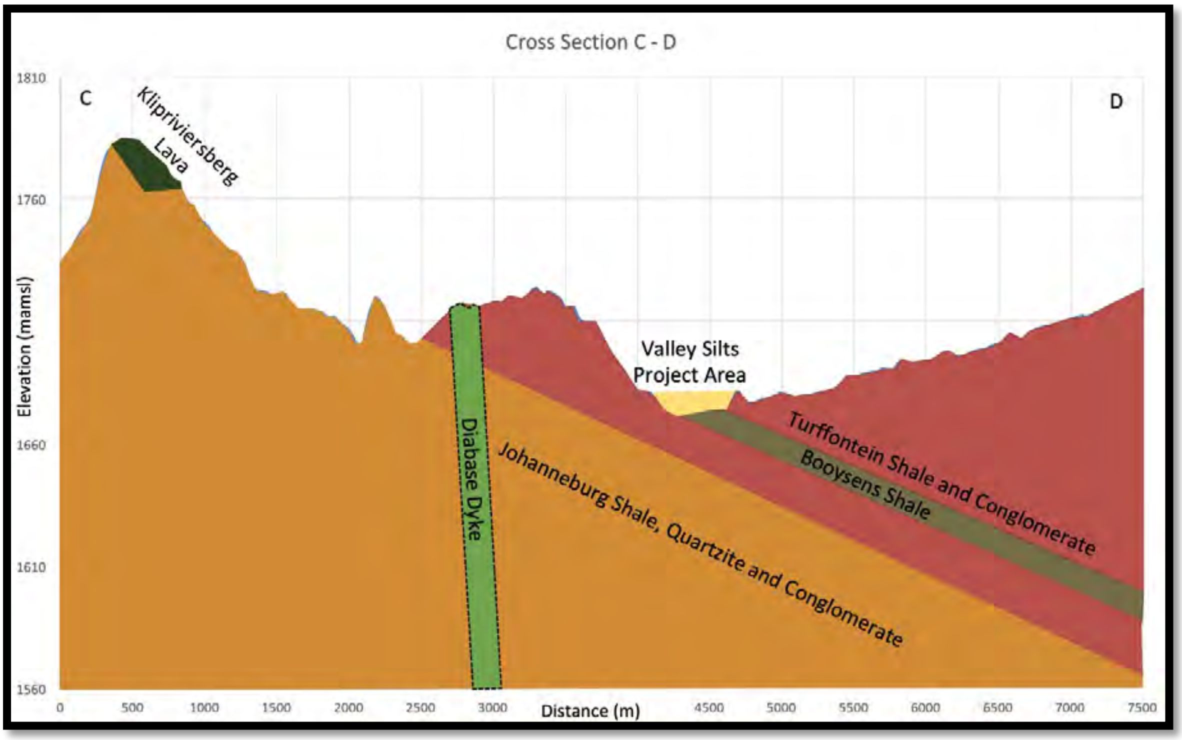


Figure 7-5: Geology cross section

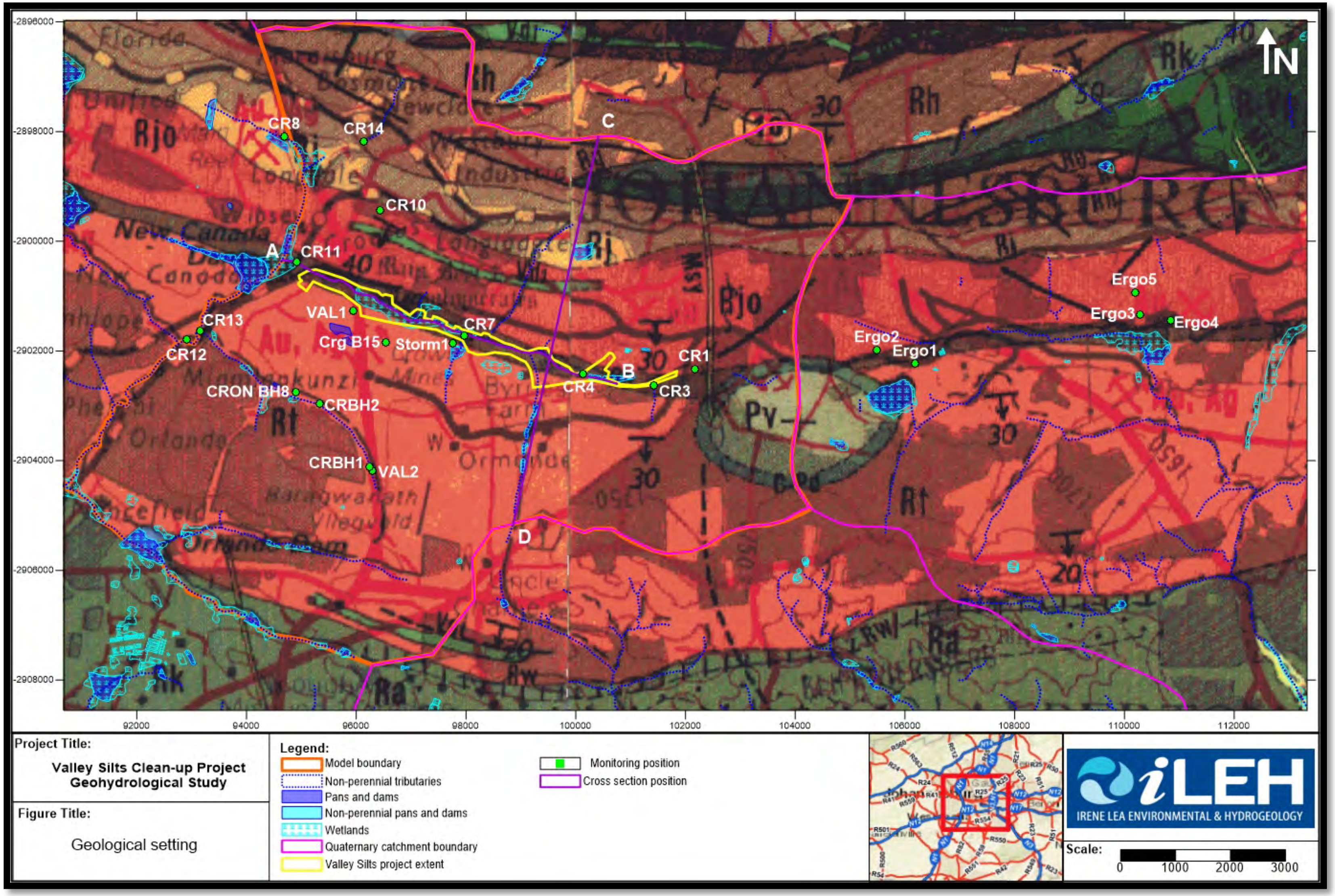


Figure 7-6: Valley Silts geology

7.3 Biodiversity

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

Environmental features relevant to the project area are listed in Table 7-3.

Table 7-3: 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 intersect with CBA: Important and ESA areas.
Rocky Ridges	A Class 4 ridge occurs in the project area
Ecosystem Threat Status	Falls within ecosystems which are listed as CR and VU
Ecosystem Protection Level	The ecosystem of the project area is rated as not 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 wetlands.
Protected Areas	The project area is found 5.6 km south of the Melville Koppies Nature Reserve
Mining and Biodiversity Guidelines	According to these guidelines, the project area falls within areas which is considered to be 'highest risk for mining' and 'moderate risk for mining'
Important Bird and Biodiversity Areas	Irrelevant: Closest IBA (Magaliesburg IBA) is 20.5 km North-west 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.

7.3.1 The Habitat Assessment

Habitats identified during the field visit can be seen in Figure 7-7 to Figure 7-9. Three primary habitats that were identified included degraded grassland, transformed habitat and wetlands. In the 'initial development area' two habitats were identified namely degraded and wetlands. The field assessment was conducted the 5th of September 2019. Based on their current conditions these areas **do not uphold their CBA and ESA statuses**.

The degraded grassland habitats were fragmented and disturbed by historic mining practises and development. Current impacts included encroachment by informal settlements and littering. Due to the extent of historic and current anthropogenic disturbance the area is in a degraded state, and regarded as of low/moderate ecological significance

The transformed areas have little to no natural vegetation left due to historic and current anthropogenic disturbance (i.e. mining activities, urbanisation, invasion of alien and invasive plant species) and regarded as of low ecological significance. This habitat contributed to the high amount of alien vegetation recorded.

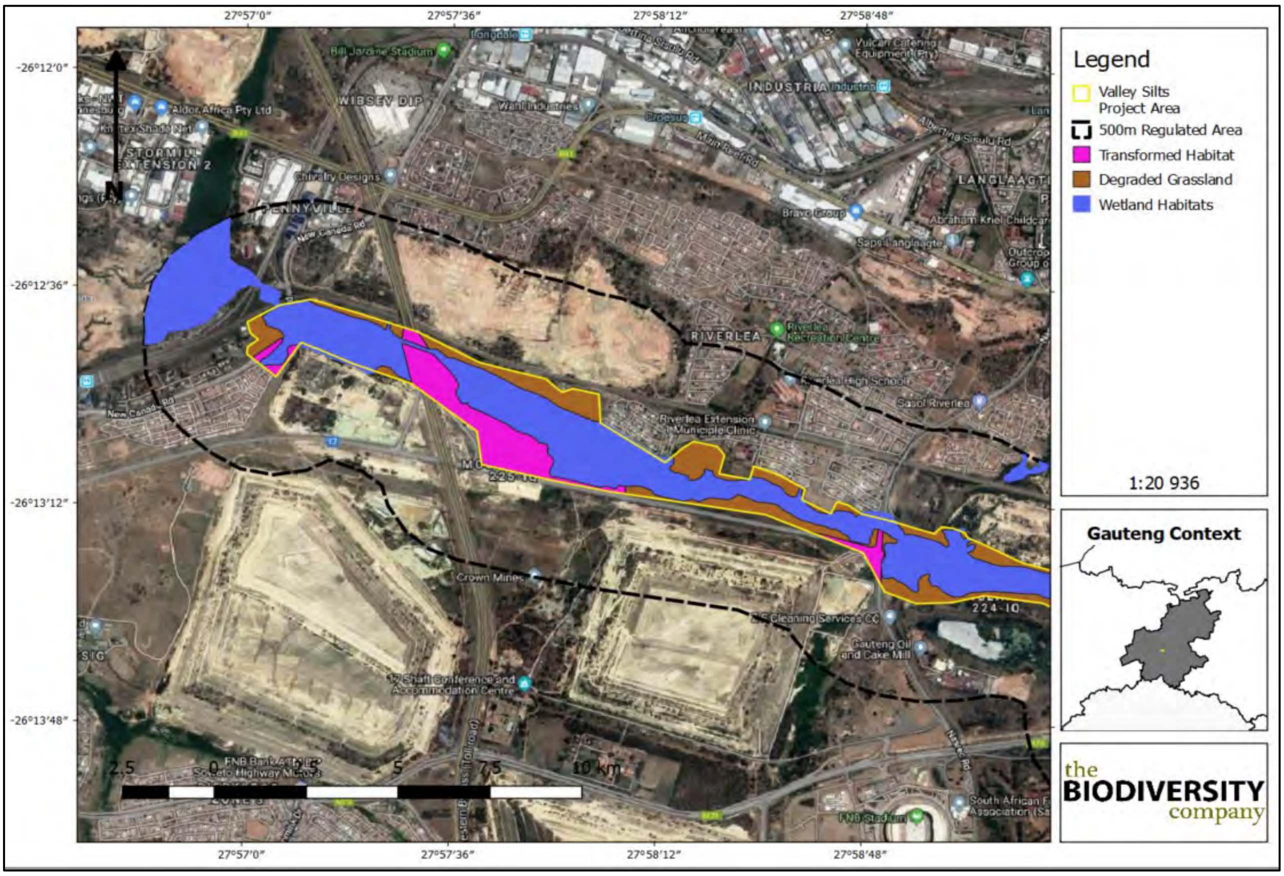


Figure 7-7: Habitats identified within the Valley Silts Project area

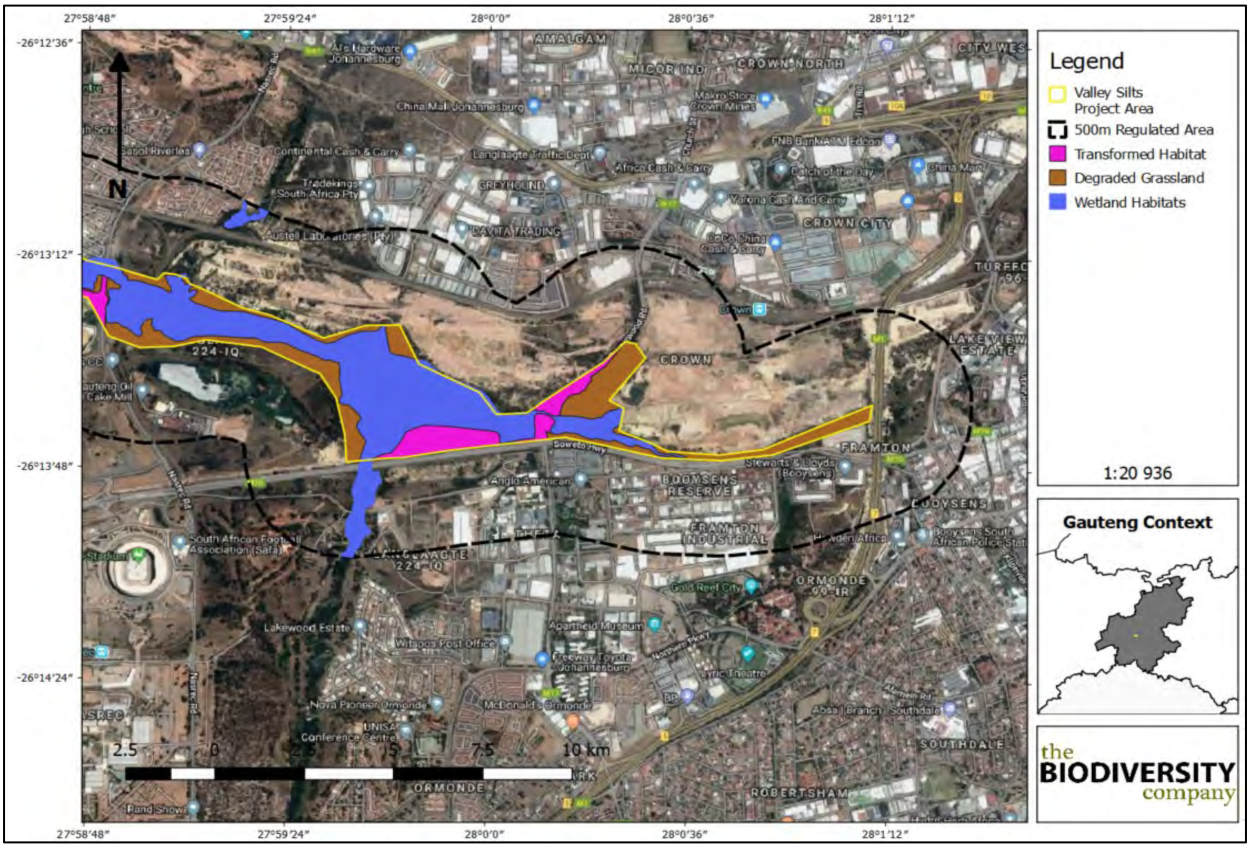


Figure 7-8: Habitats identified within the Valley Silts Project area.

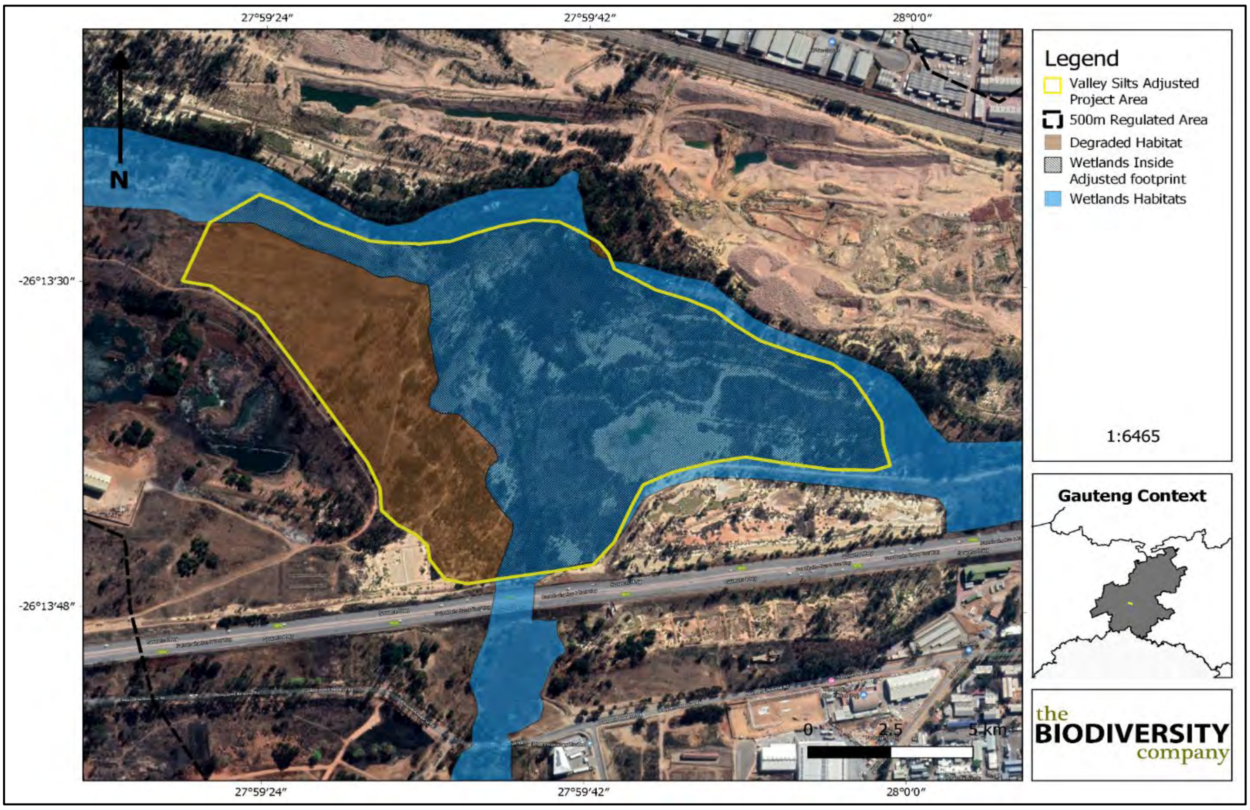


Figure 7-9: Habitats identified within the Valley Silts Project 'initial development area'.

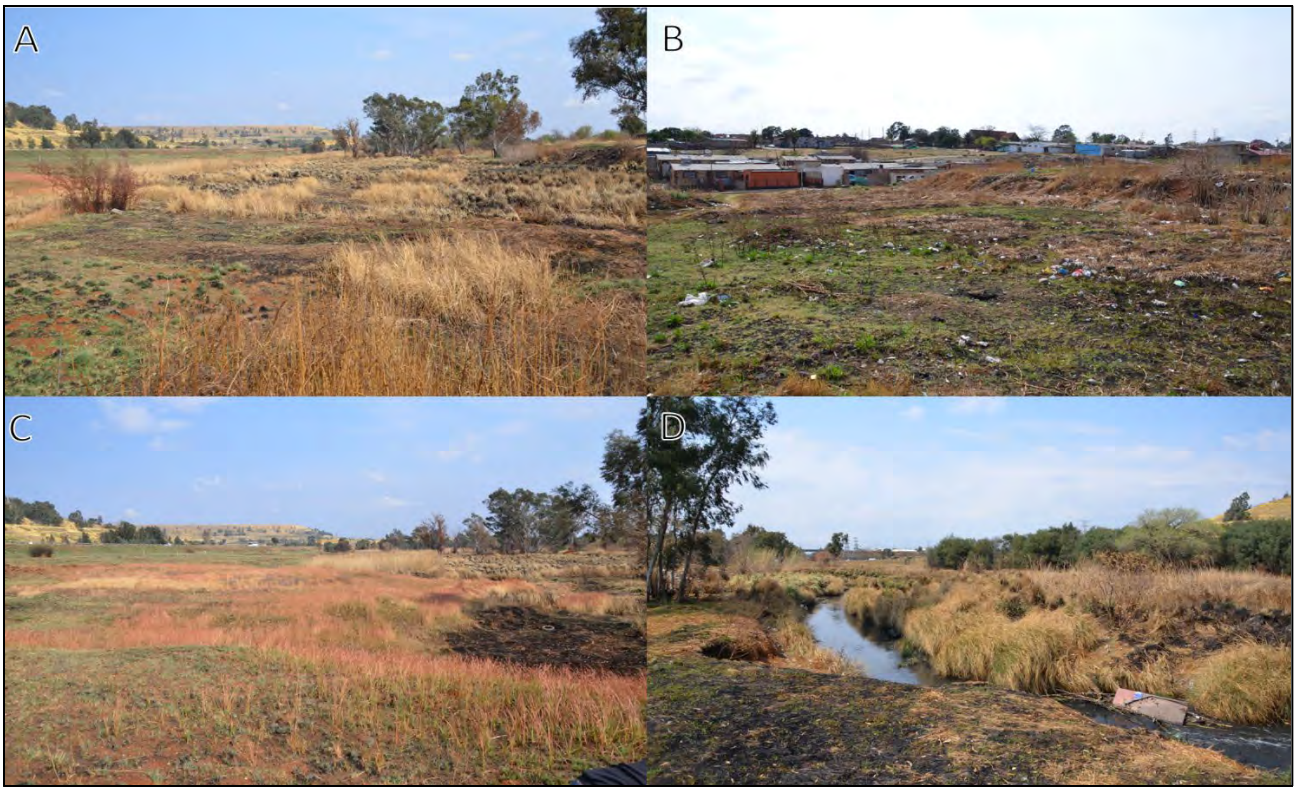


Figure 7-10: The habitats observed within the project area; A & C) Degraded Grassland, B) Transformed areas and D) Wetlands

7.3.2 Gauteng Biodiversity Conservation Plan

The Gauteng Conservation Plan (Version 3.3; GDARD, 2014b) classified areas on the basis of their contribution to reach the conservation targets within the province. These areas are classified as Critical Biodiversity Areas (CBAs) and Ecological Support Areas (ESAs) to ensure sustainability in the long term. The CBAs are classified as either 'Irreplaceable' (must be conserved), or 'Important'.

CBAs are terrestrial and aquatic areas 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. Thus, if these areas are not maintained in a natural or near natural state then biodiversity targets cannot be met.

According to the Gauteng Terrestrial CBA Plan (C-Plan), multiple sections of the proposed development intersect with CBA: Important and ESA areas (Figure 7-11).

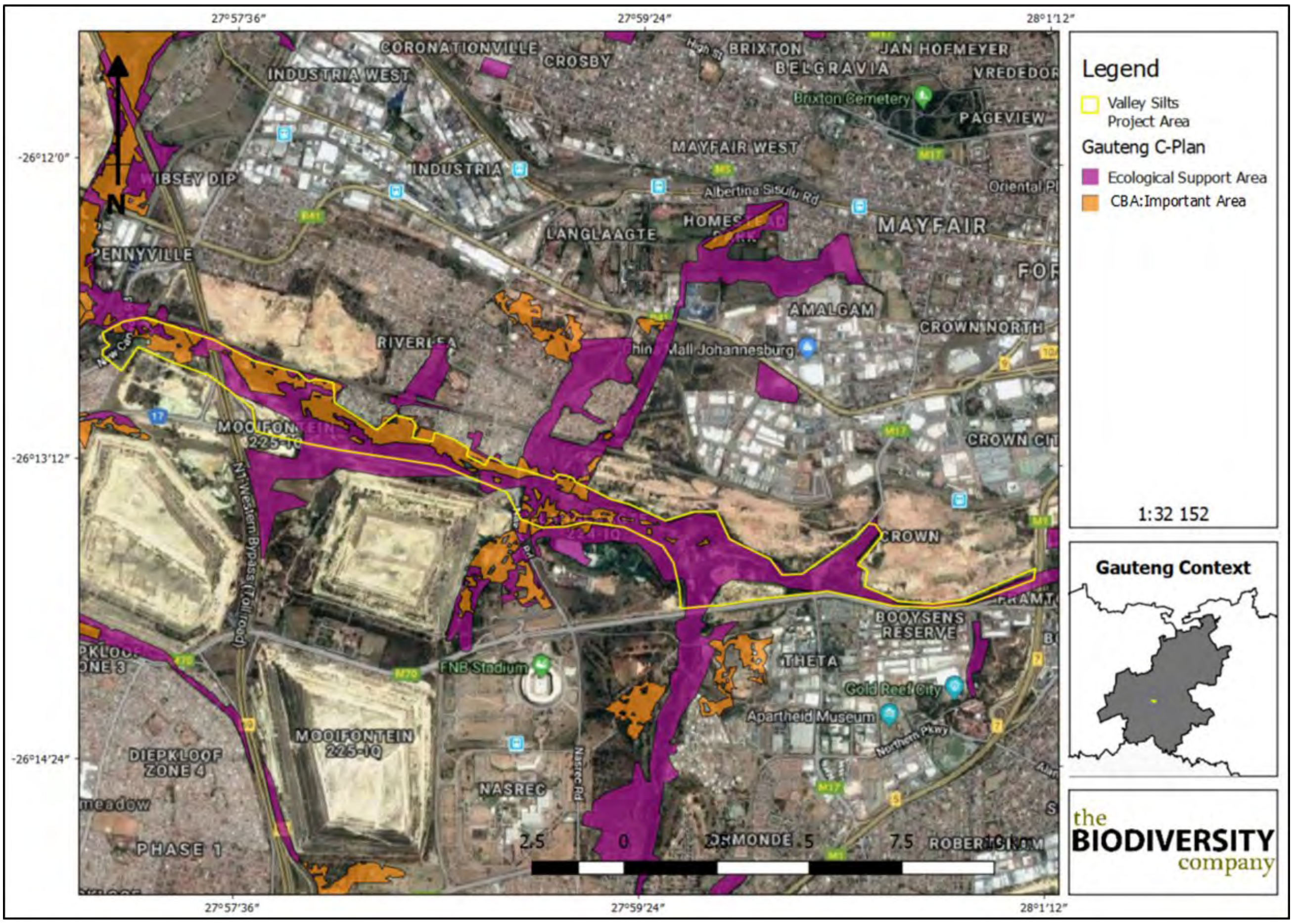


Figure 7-11: Gauteng C-Plan.

7.3.3 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.

A section of the project area falls on a class 4 ridge (Figure 7-12). Class 4 ridges include ridges of which less than 35% of the habitat is still in a natural condition. This ridge was found to be an old mine dump that was falsely identified by the spatial data as a ridge.

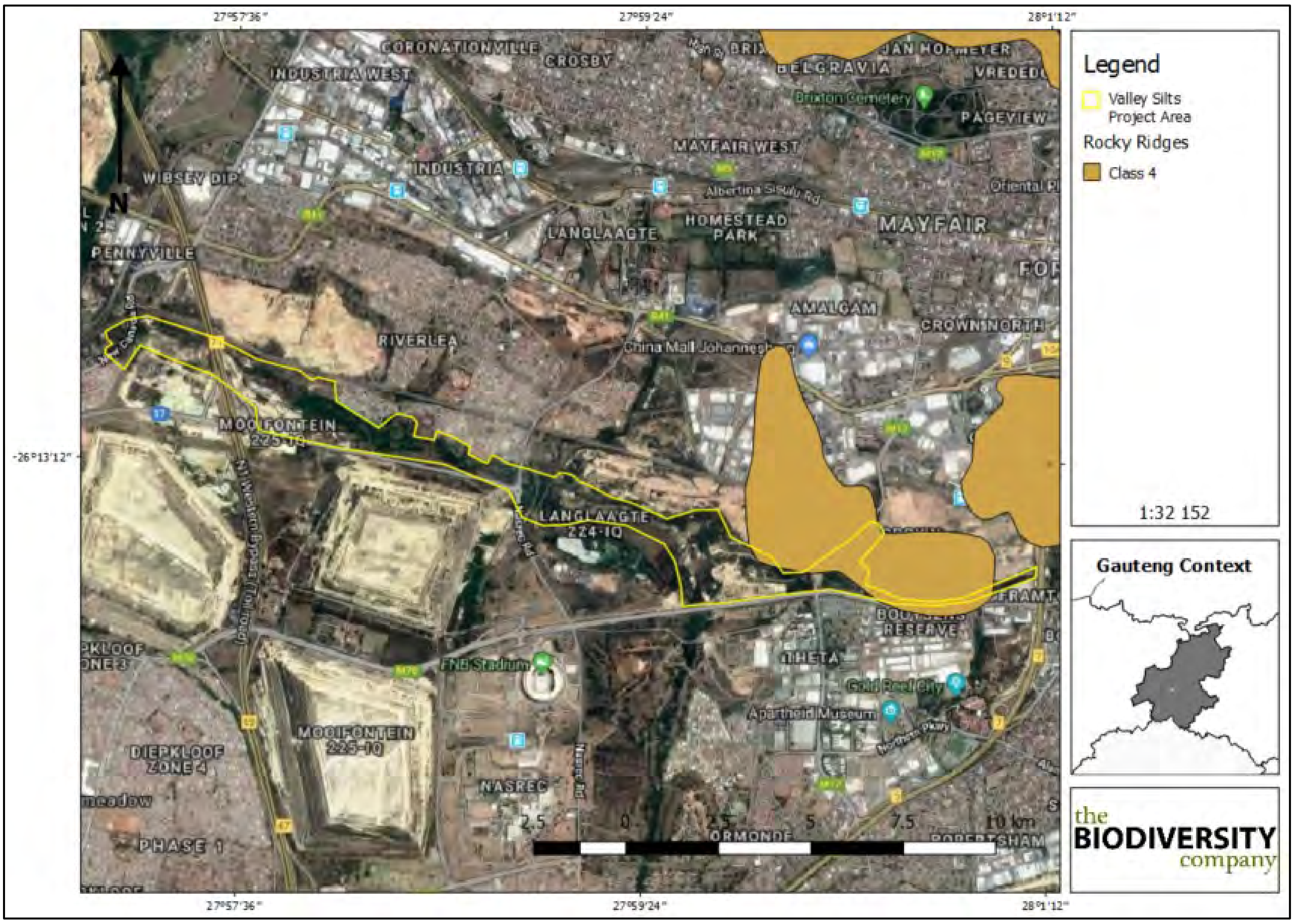


Figure 7-12: The project area in relation to Rocky Ridges.

7.3.4 National Biodiversity Assessment

The National Biodiversity Assessment (NBA) was completed as collaboration between the SANBI, the DEFF and other stakeholders, including scientists and biodiversity management experts throughout the country over a three-year period (Skonwo, 2018).

The two headline indicators assessed in the NBA are *ecosystem threat status* and *ecosystem protection level* (Skonwo, 2018).

7.3.4.1 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 (Skonwo, 2018).

The project area falls within ecosystems which are listed as CR and VU. These ecosystems were given their threat status based on the classification of the IUCN Red List Ecosystem status (Skonwo, 2018). This status is true for the whole ecosystem as they have been altered over time and are now under (Figure 7-13).

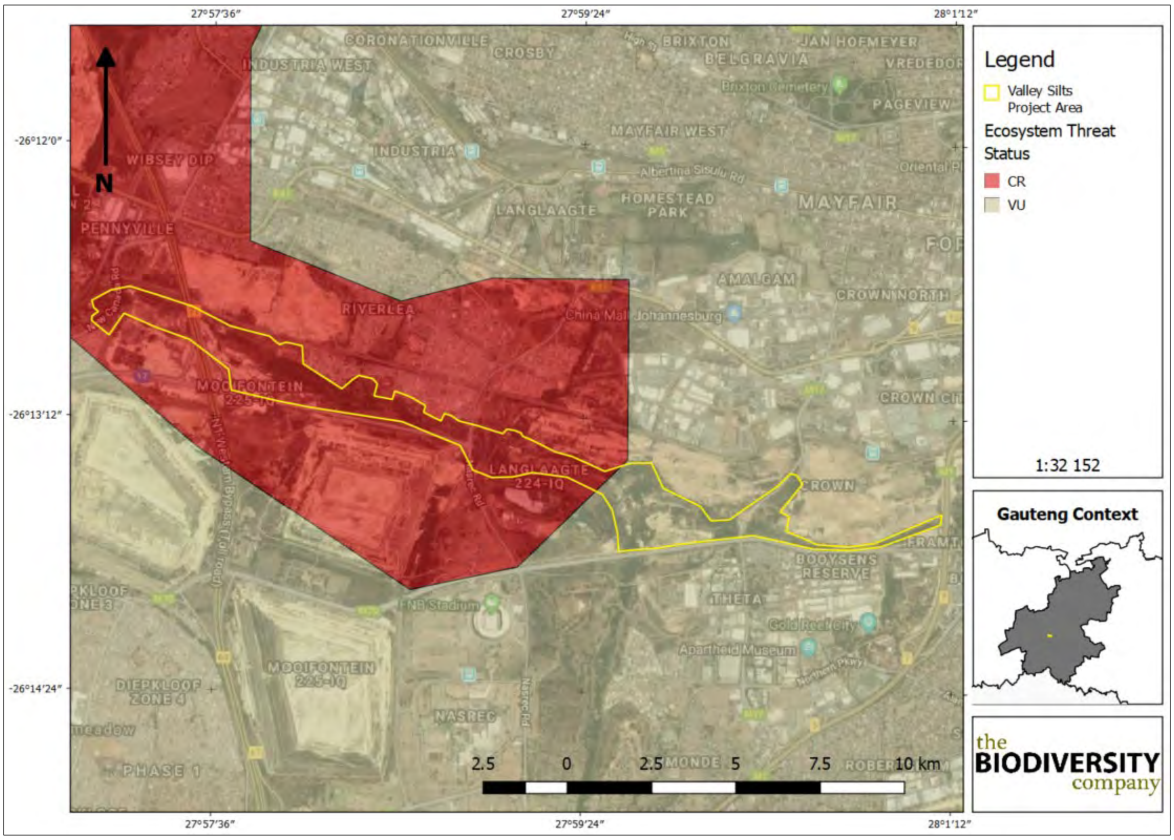


Figure 7-13: The project area showing the ecosystem threat status of the associated terrestrial ecosystems (NBA, 2018)

7.3.4.2 Ecosystem Protection Level

Ecosystem protection level -indicates whether ecosystems are adequately protected or under-protected. Ecosystems were 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 (Skonwo, 2018).

The project area falls within an area categorised as *not protected*. This means that none of this habitat type is protected in any protected areas

7.3.5 Project Area in relation to Protected Areas

Formally protected areas refer to areas protected either by national or provincial legislation. Based on the SANBI (2018) 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 5.6 km north which is the Melville Koppies Nature Reserve.

7.3.6 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 wetlands (Figure 7-14). These wetlands are both natural and artificial the Natural wetlands are discussed in section 8.5 but as the artificial wetlands do not contribute any ecosystem services as a result of their disturbed nature they were not discussed in the wetland assessment.

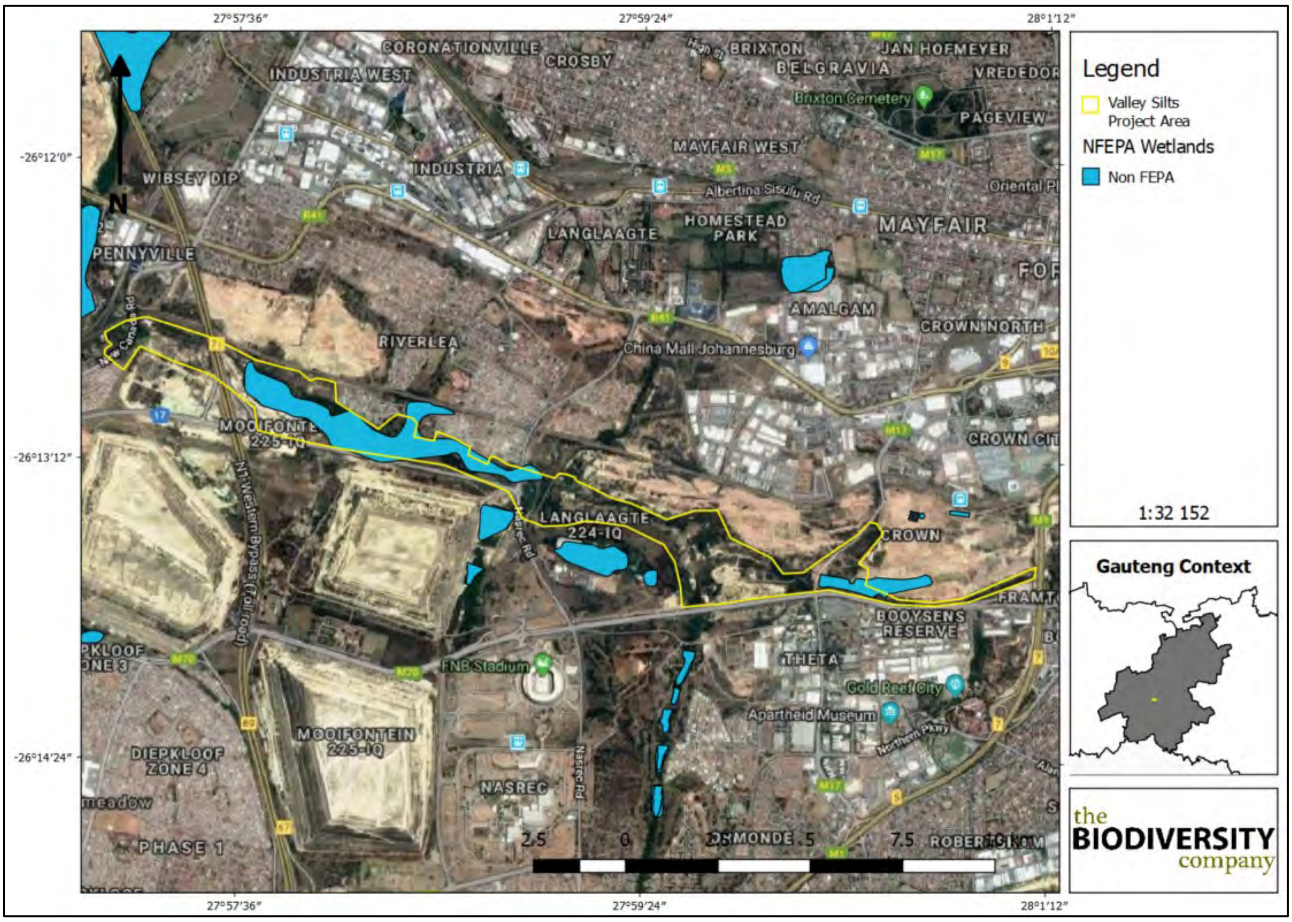


Figure 7-14: The project area in relation to the National Freshwater Ecosystem Priority Area.

7.3.7 Flora

7.3.7.1 Vegetation Assessment and Vegetation Types

The project area falls 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) Low 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. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grasslands and prevent the establishment of trees, except in a few localised habitats.

The project area falls within the Soweto Highveld Grassland vegetation type (Mucina & Rutherford, 2018 vegetation delineation.

7.3.7.2 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 consists of 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).

7.3.7.2.1 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, and 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).

7.3.7.3 Plant Species of Conservation Concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 122 plant species were previously recorded in the area (Figure 7-15). Of these, two species are listed as being SCC and is described in Table 7-4. They are both also protected on a provincial basis in Gauteng.

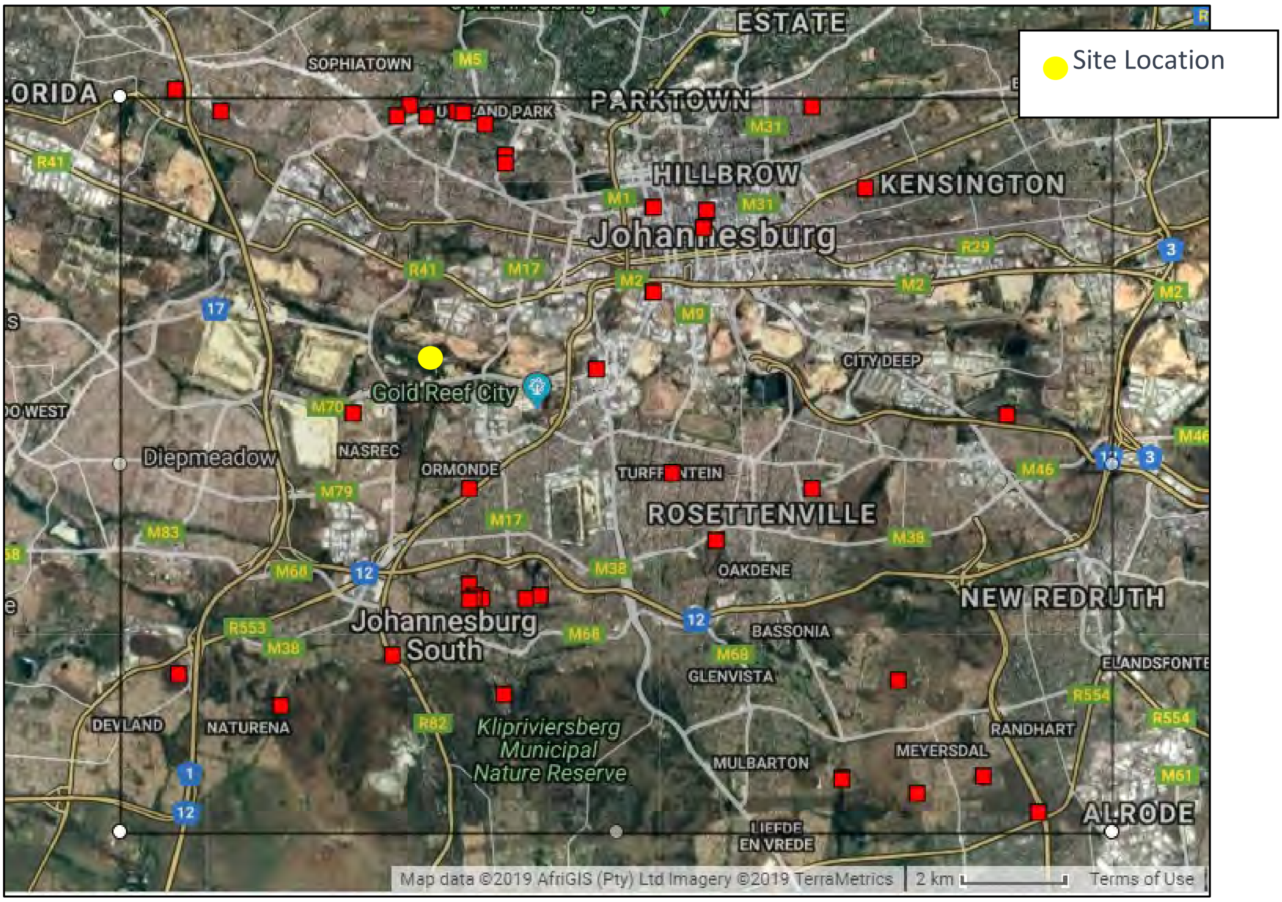


Figure 7-15: Map showing the grid drawn to compile an expected species list (BODATSA-POSA, 2016).

Table 7-4: Plant Species of Conservation Concern (SCC) expected to occur in the project area (BODATSA-POSA, 2016)

Family	Taxon	IUCN	Ecology
Asteraceae	*Cineraria longipes*	**VU**	Indigenous; Endemic
Aizoaceae	*Khadia beswickii*	VU	Indigenous; Endemic

Cineraria longipes is listed as VU according to the Red List of South African Plants (SANBI, 2017). This species is found in grassland, amongst rocks and along seepage lines, exclusively on basalt koppies on south-facing slopes. It is threatened by habitat loss and invasive alien species.

Khadia beswickii is categorised as VU according to the red list of South African plants (SANBI, 2017). This species is endemic to South African where they occur in Gauteng and the North West. The species is threatened by habitat loss, invasive alien species and harvesting.

The vegetation assessment was conducted throughout the extent of the project area. A total of 33 tree, shrub and herbaceous plant species were recorded (Table 7-5).

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. One endemic species *Hermannia transvaalensis* was observed, this species is found only in the Free State, Gauteng, KwaZulu-Natal and Mpumalanga provinces of South Africa.

Table 7-5: Trees, shrubs and weeds recorded at the proposed project area

SCIENTIFIC NAME	COMMON NAME	THREAT STATUS (SANBI, 2017)	SA ENDEMIC	NEMBA CATEGORY
Acacia mearnsii			**NEMBA Category 2**	*Acacia mearnsii*
Acacia melanoxylon			**NEMBA Category 2**	*Acacia melanoxylon*
Amaranthus hybridus			**Naturalized exotic**	*Amaranthus hybridus*
Bidens pilosa			**Naturalized exotic weed**	*Bidens pilosa*
Combretum erythrophyllum	LC	No		*Combretum erythrophyllum*
Cortaderia selloana			**NEMBA Category 1b**	*Cortaderia selloana*
Cynodon dactylon			**NEMBA Category 2**	*Cynodon dactylon*
Datura stramonium			**NEMBA Category 1b**	*Datura stramonium*
Eragrostis chloromelas	LC	No		*Eragrostis chloromelas*
Eragrostis curvula	LC	No		*Eragrostis curvula*
Eragrostis gummiflua	LC	No		*Eragrostis gummiflua*
Eragrostis lehmanniana	LC	No		*Eragrostis lehmanniana*
Eucalyptus camaldulensis			**NEMBA Category 1b**	*Eucalyptus camaldulensis*
Felicia muricata	LC	No		*Felicia muricata*
Hermannia transvaalensis	LC	No		*Hermannia transvaalensis*
Imperata cylindrica	LC	No		*Imperata cylindrica*
Ledebouria ovatifolia	LC	No		*Ledebouria ovatifolia*
Leonotis leonurus	LC	No		*Leonotis leonurus*
Melia azedarach			**NEMBA Category 1b**	*Melia azedarach*
Melinis repens	LC	No		*Melinis repens*
Pennisetum clandestinum			**NEMBA Category 1b**	*Pennisetum clandestinum*
Phragmites australis	LC	No		*Phragmites australis*
Phytolacca octandra			**NEMBA Category 1b**	*Phytolacca octandra*
Plantago lanceolata	LC	No		*Plantago lanceolata*

SCIENTIFIC NAME	COMMON NAME	THREAT STATUS (SANBI, 2017)	SA ENDEMIC	NEMBA CATEGORY
Robinia pseudo-acacia			**NEMBA Category 1b**	*Robinia pseudo-acacia*
Solanum mauritianum			**NEMBA Category 1b**	*Solanum mauritianum*
Sporobolus africanus	LC	No		*Sporobolus africanus*
Stoebe plumosa	LC	No		*Stoebe plumosa*
Tagetes minuta			**Naturalized exotic weed**	*Tagetes minuta*
Urochloa mosambicensis	LC	No		*Urochloa mosambicensis*
Verbena astrigera			**Naturalized exotic weed**	*Verbena astrigera*
Verbena bonariensis			**NEMBA Category 1b**	*Verbena bonariensis*
Walafrida densiflora	LC	No		*Walafrida densiflora*

Figure 7-16: Plant species recorded during the survey: A) Ledebouria ovatifolia, B) Hermannia transvaalensis, C) Walafrida densiflora, D) Imperata cylindrica

7.3.7.4 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.

Nine (9) 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 7-5).

7.3.8 Fauna

7.3.8.1 Avifauna

Based on the South African Bird Atlas Project, Version 2 (SABAP2) database, 375 bird species are known to occur in the vicinity of the project area (pentads 2605_2755; 2605_2800; 2605_2800; 2610_2755; 2610_2800; 2610_2805; 2615_2755; 2615_2800; 2615_2805). 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-nine (29) species are listed as SCC (Table 7-6). The SCC includes the following: The bird species protected under provincial legislation is indicated by *

- Six species that are listed as EN on a regional basis;
- Eight species that are listed as VU on a regional basis; and
- Eleven species that are listed as NT on a regional basis.

The likelihood of occurrence is based on literature describing their habitat preferences and the level of adaptability to disturbed areas (Birdlife SA, 2019; IUCN, 2019; Sinclair *et al.,* 2010; Hockey *et al.,* 2005; Del Hoyo *et al.,* 1996), this was then adjusted after the field assessment was completed to ensure the habitat can or cannot support the species. Of these only one species, the Lanner Falcon (*Falco biarmicus*) is considered likely to occur (sporadically, breeding is highly unlikely within the project area, none of the other species are expected to occur in the project area based on the disturbed nature of the habitat.

Table 7-6: List of bird species of regional or global conservation importance that are expected to occur in pentads 2605_2755; 2605_2800; 2605_2800; 2610_2755; 2610_2800; 2610_2805; 2615_2755; 2615_2800; 2615_2805 (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	Unlikely
Anthropoides paradiseus*	Crane, Blue	NT	VU	Unlikely
Aquila ayresii	Hawk-eagle, Ayres's	NT	LC	Unlikely
Aquila rapax	Eagle, Tawny	EN	LC	Unlikely
Aquila verreauxii	Eagle, Verreaux's	VU	LC	Unlikely
Ciconia abdimii	Stork, Abdim's	NT	LC	Unlikely
Ciconia nigra	Stork, Black	VU	LC	Unlikely
Circus macrourus	Harrier, Pallid	NT	NT	Unlikely
Circus ranivorus*	Marsh-harrier, African	EN	LC	Unlikely
Coracias garrulus	Roller, European	NT	LC	Unlikely
Eupodotis senegalensis	Korhaan, White-bellied	VU	LC	Unlikely
Falco biarmicus*	Falcon, Lanner	VU	LC	**Moderate**
Falco concolor	Falcon, Sooty	NA	NT	Unlikely
Glareola nordmanni	Pratincole, Black-winged	NT	NT	Unlikely
Gyps coprotheres	Vulture, Cape	EN	EN	Unlikely
Limosa lapponica	Godwit, Bar-tailed	LC	NT	Unlikely
Lioptilus nigricapillus	Blackcap, Bush	VU	NT	Unlikely
Macheiramphus alcinus	Hawk, Bat	EN	LC	Unlikely
Mirafra cheniana *	Lark, Melodious	LC	NT	Unlikely
Mycteria ibis	Stork, Yellow-billed	EN	LC	Unlikely
Oxyura maccoa	Duck, Maccoa	NT	NT	Unlikely
Phalacrocorax capensis	Cormorant, Cape	EN	EN	Unlikely
Phoenicopterus minor*	Flamingo, Lesser	NT	NT	Unlikely
Phoenicopterus ruber*	Flamingo, Greater	NT	LC	Unlikely
Polemaetus bellicosus*	Eagle, Martial	EN	VU	Unlikely
Rostratula benghalensis*	Painted-snipe, Greater	NT	LC	Unlikely
Sagittarius serpentarius*	Secretarybird	VU	VU	Unlikely
Sterna caspia	Tern, Caspian	VU	LC	Unlikely
Tyto capensis*	Grass-owl, African	VU	LC	Unlikely

Falco biarmicus (Lanner Falcon) has a moderate chance of occurrence in the project area. These birds are native to South Africa and inhabit a wide variety of habitats, from lowland deserts to forested mountains (IUCN, 2017). They may occur in groups up to 20 individuals but have also been observed solitary. Their diet is mainly composed of small birds such as pigeons and francolins. The likelihood of incidental records of this species in the project area is rated as moderate due to the presence of many bird species on which Lanner Falcons may predate.

Figure 7-17: Images of a Lanner Falcon

During the survey 12 bird species were recorded. None of the species recorded were SCCs.

Table 7-7: A list of the avifauna species recorded in the project area

SPECIES	COMMON NAME	CONSERVATION STATUS	
		REGIONAL (SANBI, 2016)	IUCN (2017)
Acridotheres tristis	Myna, Common	Unlisted	LC
Bostrychia hagedash	Ibis, Hadeda	Unlisted	LC
Cercotrichas leucophrys	Scrub-robin, White-browed	Unlisted	LC
Charadrius tricollaris	Plover, Three-banded	Unlisted	LC
Lanius collaris	Fiscal, Common (Southern)	Unlisted	LC
Passer domesticus	Sparrow, House	Unlisted	LC
Passer melanurus	Sparrow, Cape	Unlisted	LC
Phalacrocorax africanus	Cormorant, Reed	Unlisted	LC
Ploceus velatus	Masked-weaver, Southern	Unlisted	LC
Pycnonotus tricolor	Bulbul, Dark-capped	Unlisted	Unlisted
Vanellus armatus	Lapwing, Blacksmith	Unlisted	LC
Vanellus senegallus	Lapwing, African Wattled	Unlisted	LC

Figure 7-18: Avifaunal species recorded during the survey: A) African Wattled Lapwing (Vanellus senegallus) and Three-banded Plover (Charadrius tricollaris) , B) Blacksmith Lapwing (Vanellus armatus

7.3.8.2 Mammals

The IUCN Red List Spatial Data (IUCN, 2017) lists 84 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 75 small to medium sized mammal species, fifteen (14) (18.6%) are listed as being of conservation concern on a regional or global -scale (Table 7-8).

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 7-8)
- On a global scale, 1 species is listed as EN, 2 are listed as VU and 4 as NT (Table 7-8).

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

Table 7-8: 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	Unlikely
Atelerix frontalis*	South Africa Hedgehog	NT	LC	Unlikely
Crocidura maquassiensis	Makwassie musk shrew	VU	LC	Unlikely
Eidolon helvum	African Straw-colored Fruit Bat	LC	NT	Unlikely
Felis nigripes	Black-footed Cat	VU	VU	Unlikely
Hydrictis maculicollis*	Spotted-necked Otter	VU	NT	Unlikely
Leptailurus serval	Serval	NT	LC	**Moderate**
Mystromys albicaudatus	White-tailed Rat	VU	EN	Unlikely
Ourebia ourebi	Oribi	EN	LC	Unlikely
Panthera pardus	Leopard	VU	VU	Unlikely
Parahyaena brunnea	Brown Hyaena	NT	NT	Unlikely
Pelea capreolus	Grey Rhebok	NT	LC	Unlikely
Poecilogale albinucha	African Striped Weasel	NT	LC	Unlikely
Redunca fulvorufula	Mountain Reedbuck	EN	LC	Unlikely

Leptailurus serval (Serval) occurs widely through sub-Saharan Africa and is commonly recorded from most major national parks and reserves (IUCN, 2017). The Serval's status outside reserves is not certain, but they are inconspicuous and may be common in suitable habitat as they are tolerant of farming practices provided there is cover and food available. In sub-Saharan Africa, they are found in habitat with well-watered savanna long-grass environments and are particularly associated with reedbeds and other riparian vegetation types. Some suitable habitat is present adjacent to the project area, combined with the high number of rodents that can be found in the project area the likelihood of occurrence is rated as **moderate.**

No mammal species were observed in the project area during the site visit. The absence of species is ascribed to the large number of hunting/feral dogs that were observed on the property. As per the desktop assessment, the highest likelihood of occurrence was rated as moderate, which corresponds to the field results.

7.3.8.3 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) 64 reptile species are expected to occur in the project area (Appendix D of the Biodiversity Impact Assessment (Appendix D1 of this EIA)). Two SCC should be present according to the above-mentioned sources within the project area. The provincially protected species is indicated by an asterisk (*).

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 7-9: 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)	
Reptiles				
Crocodylus niloticus	Nile Crocodile	VU	VU	Unlikely
*Homoroselaps dorsalis**	Striped Harlequin Snake	NT	LC	Low
Amphibians				
Pyxicephalus adspersus	Giant Bullfrog	NT	LC	Moderate

Homoroselaps dorsalis (Striped Harlequin Snake) is partially fossorial and known to inhabit old termitaria in grassland habitat (IUCN, 2017). Most of its range is at moderately high altitudes, reaching 1,800 m in Mpumalanga and Swaziland, but it is also found at elevations as low as about 100 m in KwaZulu-Natal. The likelihood of occurrence was rated as low due to the lack of termitaria in the area.

The Giant Bull Frog (*Pyxicephalus adspersus*) is a species of conservation concern that may potentially occur in the project area. The Giant Bull Frog is listed as NT on a regional scale. It is a species of drier savannahs. It is fossorial for most of the year, remaining buried in cocoons. They emerge at the start of the rains, and breed in shallow, temporary waters in pools, pans and ditches (IUCN, 2017). This species is known to occur in this area, the likelihood of occurrence is increased by the presence of wetlands however due to their state the likelihood is rated as low.

No herpetofauna species were recorded in the project area. The low number of species recorded is ascribed to the early wet season in which the survey was conducted along with the high number of disturbed areas found in the project area. Some habitat does still occur to support the SCCs expected in the project area

It must be noted that where species '**Likelihood of occurrence'** has been indicated as **"low" or "Unlikely"** – 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.

7.4 Wetlands

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

7.4.1 Wetland Classification

The project area is situated in the Vaal Water Management Area (WMA) and quaternary catchment C22A. Drainage within the project area occurs in a westerly direction along the Russell Stream (Figure 7-19) and ultimately drains into the Klip River. The valley silts wetland has been extensively modified. For well over a century (since the 1890's) this system has received 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. Although the wetland acts as a sink in this regard, helping to remove toxicants and nutrients, its capacity to do so is finite which has resulted in an accumulation of these toxicants in its sediments. Due to the increased water inputs, most of the systems are considerably larger and more saturated than their historical reference state.

Figure 7-19: View of the Russell Stream (HGM 1)

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).

One wetland hydrogeomorphic (HGM) unit was 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 this system according to the national wetland classification system (Ollis *et al.,* 2013) is presented in the table below.

Table 7-10 Wetland classification as per SANBI guideline (Ollis et al. 2013)

WETLAND SYSTEM	LEVEL 1	LEVEL 2		LEVEL 3	LEVEL 4		
	SYSTEM	DWS ECOREGION/S	NFEPA WET VEG GROUP*	LANDSCAPE UNIT	4A (HGM)	4B	4C
Russell Stream							
HGM 1	Inland	Highveld	MHGG3	Valley-bottom	Channelled valley-bottom	N/A	N/A

*MHGG3 = Mesic Highveld Grasslands Group 3

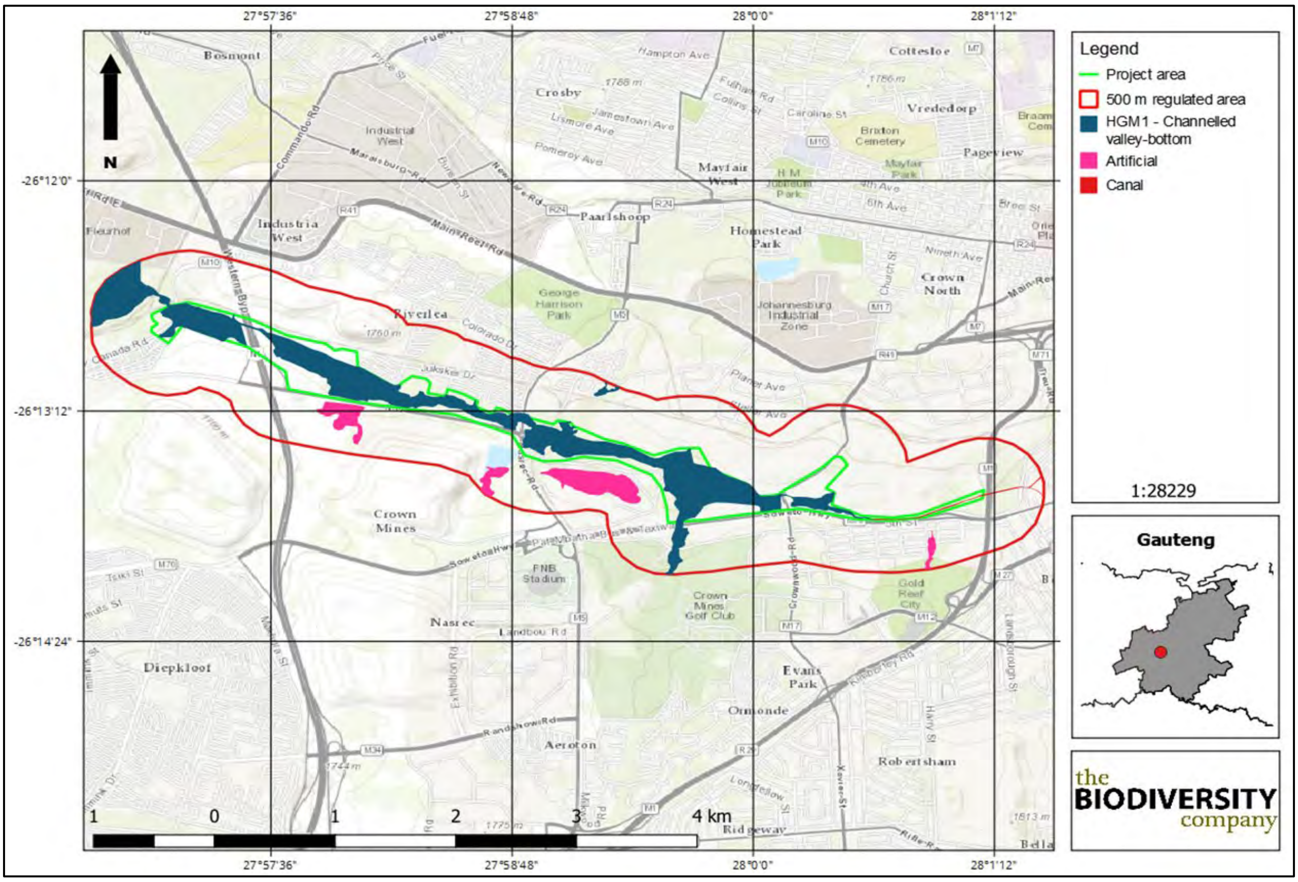


Figure 7-20: Delineation of wetlands within the 500m regulation area, overview

7.4.2 Description of Wetlands in the Project Area

Wetland resources within the valley silts project area comprise one hydrogeomorphic type namely channelled valley-bottom. Photographs are presented in Figure 7-21.

Channelled valley-bottoms are typically found on valley floors with a clearly defined, stream channel and generally lack floodplain features (Ollis *et al*., 2013). 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. It is important to note that due to their artificial and highly transformed state all systems classified as artificial, although delineated, were excluded from the wetland assessment as they cannot be seen to provide any appreciable level of ecosystem service.

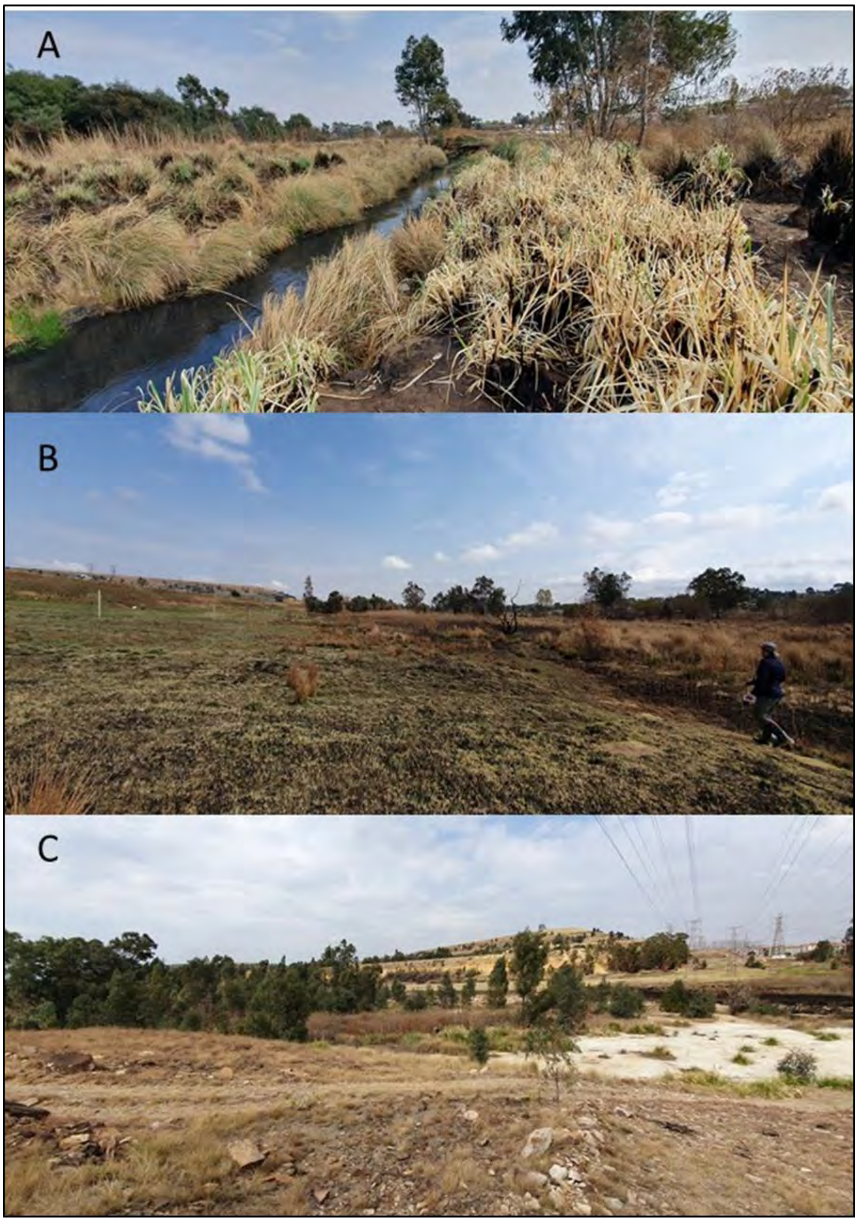


Figure 7-21: Photographs of the four main hydrogeomorphic types encountered within the project area; A) view of the channel, B) seasonal zone of HGM1, C) view looking south across HGM1 showing transition with terrestrial habitat.

7.4.3 Wetland Vegetation

Historically, the system would have been considerably less inundated with a more diffuse flow pattern and would have supported a more diverse compliment of low sedges and hydromorphic grassland species. Now, however, the drastically increased flow volumes are concentrated within a narrow channel with wetland vegetation being dominated by *Imperata cylindrica and Pennisetum* spp.

7.4.4 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 system provides Intermediate ecosystem services (Table 7-11). These services are almost exclusively limited to indirect regulating and supporting services as more direct services related to the provision of water or cultivated foods as well as recreational or educational services are precluded by the high levels of contamination. Heavy metals and / or radioactive substances as well as eutrophication from raw sewerage inputs means that the system is not capable of providing clean water or harvestable resources nor is it aesthetically pleasing or safe enough to be utilised from a recreational, cultural, tourism or educational perspective.

The system has a high potential to receive sediments from tailings dumps in its catchment and, due to its wide shallow slopes and high surface roughness, is particularly effective at attenuating floods, trapping sediments, removing nutrients and assimilating toxicants. Like other wetlands in the area this wetland plays an important role in mitigating the impact associated with gold mining in Johannesburg**.**

Table 7-11: The ecosystem services being provided by the identified wetlands

<table>
<tr><th colspan="5">WETLAND HGM UNIT</th><th>1</th></tr>
<tr><td rowspan="14">Ecosystem Services Supplied by Wetlands</td><td rowspan="8">Indirect Benefits</td><td rowspan="8">Regulating and supporting benefits</td><td colspan="2">Flood attenuation</td><td>3.1</td></tr>
<tr><td colspan="2">Streamflow regulation</td><td>2.7</td></tr>
<tr><td rowspan="5">Water Quality enhancement benefits</td><td>2.8</td><td>2.8</td></tr>
<tr><td>3.2</td><td>3.2</td></tr>
<tr><td>3.0</td><td>3</td></tr>
<tr><td>3.2</td><td>3.2</td></tr>
<tr><td>2.4</td><td>2.4</td></tr>
<tr><td colspan="2">Carbon storage</td><td>1.0</td></tr>
<tr><td rowspan="6">Direct Benefits</td><td colspan="3">Biodiversity maintenance</td><td>1.4</td></tr>
<tr><td rowspan="3">Provisioning benefits</td><td colspan="2">Provisioning of water for human use</td><td>0.9</td></tr>
<tr><td colspan="2">Provisioning of harvestable resources</td><td>0.8</td></tr>
<tr><td colspan="2">Provisioning of cultivated foods</td><td>0.8</td></tr>
<tr><td rowspan="2">Cultural benefits</td><td colspan="2">Cultural heritage</td><td>0.0</td></tr>
<tr><td colspan="2">Tourism and recreation</td><td>0.1</td></tr>
</table>

			Education and research	1.0
Overall				**26.5**
Average				**1.8**
Threats				**4.0**
Opportunities				**4.0**

7.4.5 The Wetland Health Assessment

The channelled valley bottom wetland (HGM 1) was assigned a Present Ecological State (PES) rating of Critically Modified (class F). The hydrological regime of the system has been substantially modified by various factors. Most of the catchment is covered by urban development and mine dumps. Urban sprawl has increased hardened surfaces while mine dumps have increased the slope of the catchment, the extent of bare surfaces and sediment sources.

Together these impacts have served to notably increase the potential for floodpeaks and have resulted in the deposition of a considerable amount of contaminated tailings sediments in the wetland. Augured samples showed tailings deposition well below the depth of the auger (1.5 m).

Several large roads and railway line crossings (i.e. N1 Western Bypass, M1, Nasrec Road and New Canada Road) act as significant impeding features resulting in backlogging upstream of the impeding feature and erosion downstream of it. Additionally, flows have been substantially modified by considerable mine discharge and raw sewerage inputs from ailing wastewater treatment works as well as urban greywater runoff. This has served to drastically increase flow volumes and velocities compounding channel erosion.

The water within the channel is opaque and black. No aquatic or emergent vegetation persists. The natural vegetation integrity has been severely comprised by sediment drowning as well as sulphate and iron oxide precipitation from acid mine drainage which have decreased overall cover and diversity of species. At present only some of the more resilient wetland species such as *Imperata cylindrica* persist.

Table 7-12: Summary of the scores for the Wetland PES

WETLAND	HYDROLOGY		GEOMORPHOLOGY		VEGETATION	
	Rating	Score	Rating	Score	Rating	Score
HGM 1	F: Critically Modified	9.5	E: Seriously Modified	7.1	E: Seriously Modified	7.2
Overall PES Score		8.2	Overall PES Class			F: Critically Modified

Figure 7-22: Examples of some the existing impacts influencing the PES ratings: A) evidence of tailings deposition, B) erosion downstream of culvert, C) alien vegetation (Eucalyptus spp.), D) signs of iron oxide precipitation, E) disused bridge (impeding feature), F) litter.

7.4.6 The Ecological Importance and Sensitivity Assessment

The results of the assessment are shown in Table 7-13. From a regional perspective no Code 1 NFEPA rivers or wetlands are located within the 500 m regulated area. The NFEPA Wetveg database does, however, recognises Mesic Highveld Grassland Group 3 channelled valley-bottoms 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. Given the large degree habitat transformation, high levels of human disturbance and the severely polluted state of the system no conservation important faunal or floral species are likely to occur. Instead the system in its present state poses a hazard to biodiversity and consequently its ecological importance and sensitivity is considered low.

Table 7-13: The EIS results for the delineated HGM types

WETLAND IMPORTANCE AND SENSITIVITY	HGM 1
Ecological Importance & Sensitivity	1
Hydrological/Functional Importance	2.7
Direct Human Benefits	0.5

7.5 Biodiversity and Wetlands Sensitivity Assessment

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 7-23 to Figure 7-25 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 transform 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 wetland areas that are still viable habitat for some species. Even though the wetlands are degraded based on the GDARD (2012) requirements: “The wetland and a protective buffer zone, beginning from the outer edge of the wetland temporary zone, must be designated as sensitive in a sensitivity map”.

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.

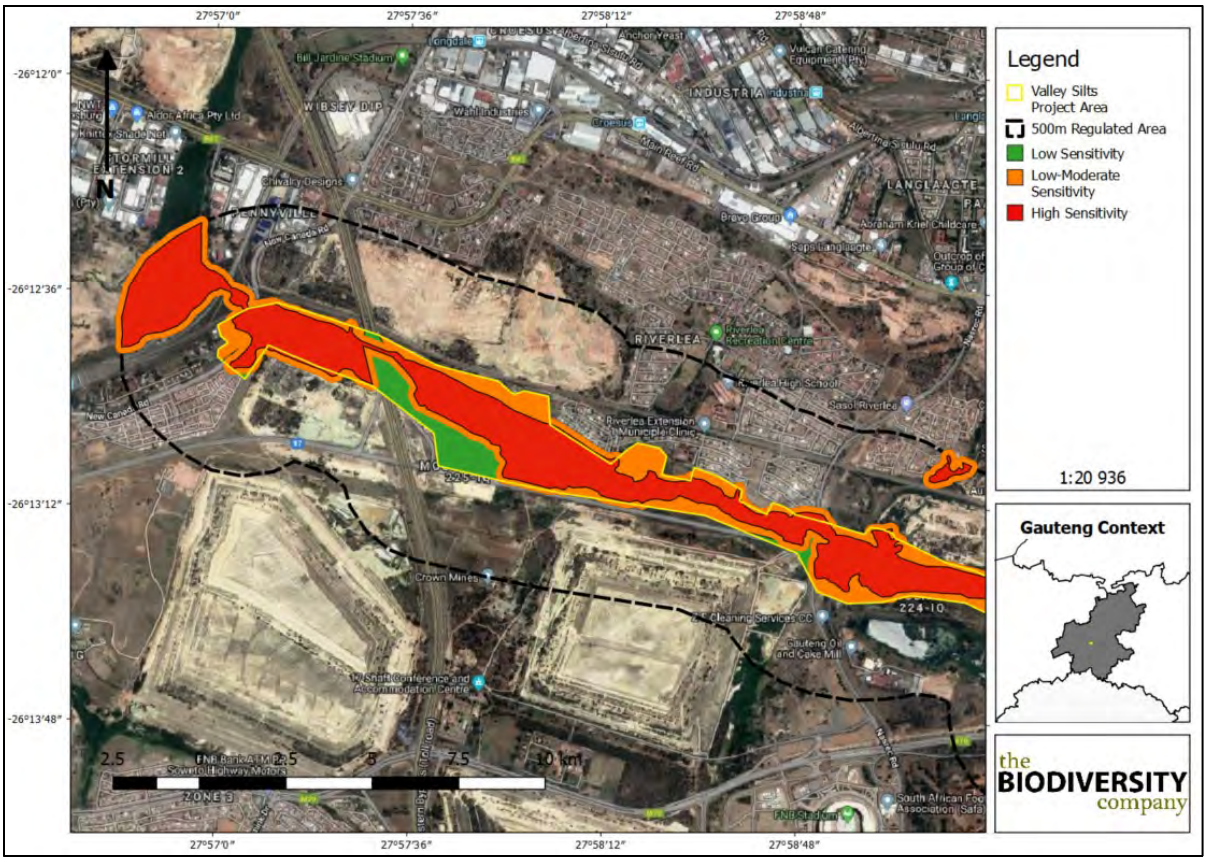


Figure 7-23: Habitat sensitivity within Valley Silts project area.

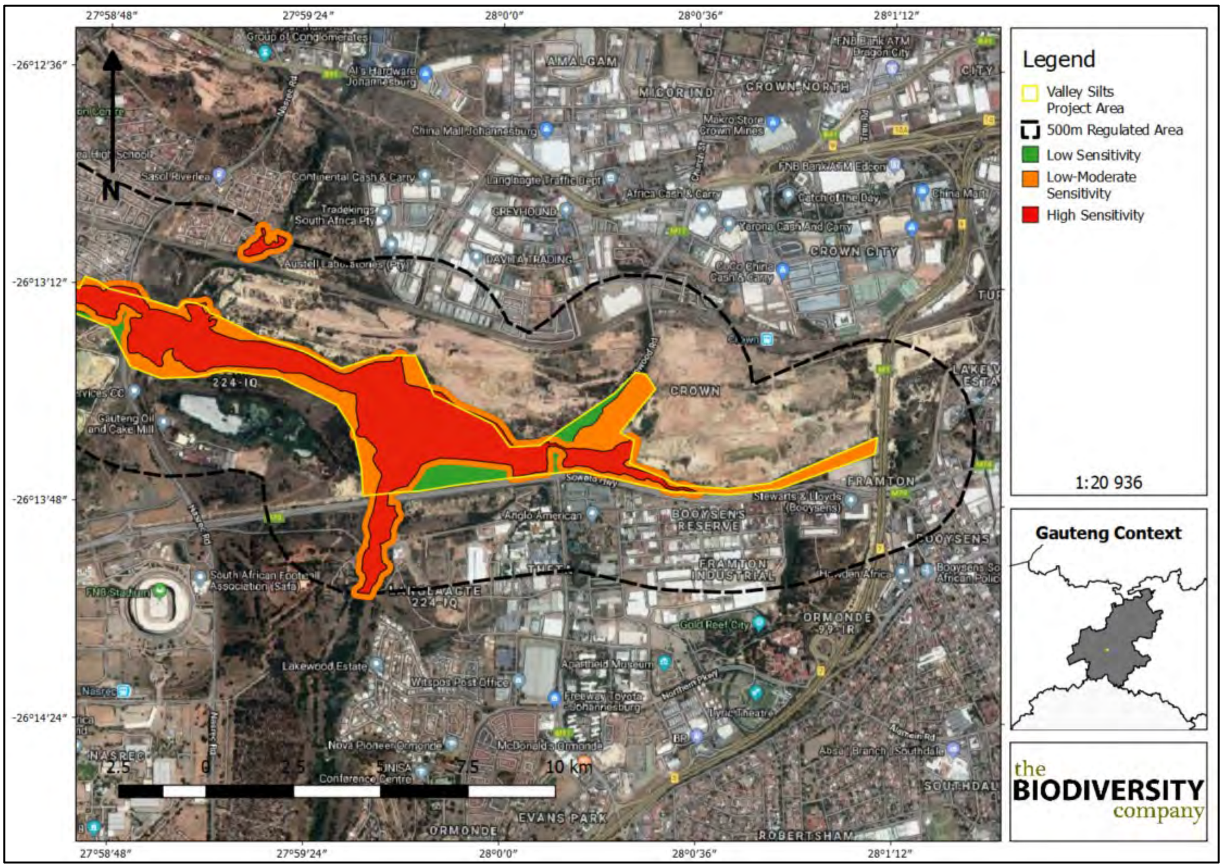


Figure 7-24: Habitat sensitivity within the project area.

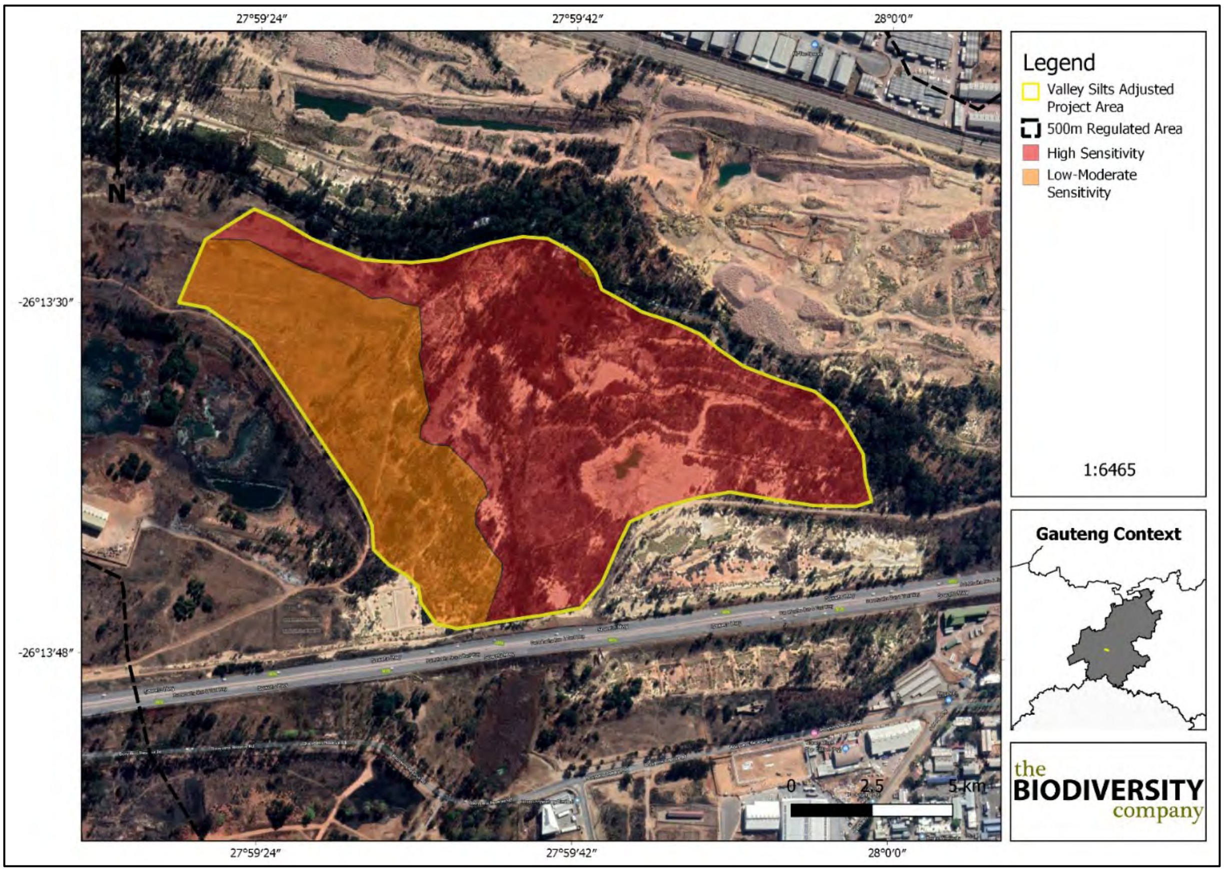


Figure 7-25: Habitat sensitivity within the initial development area

7.6 Surface Water

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

7.6.1 Regional Catchments and Drainage

The DWS 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 DWS 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 Vaal WMA, within quaternary catchment C22A in the Klip River Catchment. A number of small non-perennial tributaries drain the surrounding suburbs, industrial areas and the western portion of the Johannesburg CBD into the Russell Stream. The Russell Stream flows into a north-westerly direction and is a tributary of the Klip River, which flows into the Vaal River immediately above the Vaal Barrage, near the town of Vereeniging.

7.6.2 Surface Water Quality

Water quality data was obtained from Ergo which is currently monitoring the surface water quality of the Russell Stream. Monitoring results were available for the period of November 2017 to July 2019. The monitoring locations are summarised in Table 7-14.

Table 7-14: Summary of the Ergo surface water quality monitoring locations

MONITORING POINT	NO. OF OCCASIONS MONITORED	LOCATION FROM PROJECT AREA	LOCATION DESCRIPTION	LATITUDE*	LONGITUDE*
CR1	7	Upstream of project area	Russell Stream - Lake Road	-26.226111°	28.024167°
CR4	7	Within project area	Small bridge at CGR (Crownwood Road)	-26.226667°	28.002778°
CR7	7	Within project area	Russell Stream - bridge at Randshow Road (Riverlea)	-26.220556°	27.981667°
CR11	7	Within project area	New Canada Road bridge	-26.210556°	27.952778°
CR12	7	Downstream of project area	Mzimholpe - on bridge in Soweto	-26.222778°	27.928333°
CR13	7	Downstream of project area	Outlet of New Canada Dam	-26.220000°	27.932500°

The surface water quality results are indicated in Table 7-15. Results were compared to the Klip River catchment guideline limits, as the Russell Stream and its tributaries are located within the Klip River catchment. Where there were no parameter limits specified for the Klip River catchment, the South African National Standard (SANS) 241:2015 Drinking Water Quality limits were used. The guideline limits are described below. 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 Klip River catchment tolerable and unacceptable limits, are coloured in yellow and red respectively . The water quality results are summarised below:

- pH was within limits at all monitoring locations over the monitoring period;

- Electrical Conductivity (EC) and Total Dissolved Solids (TDS), which provides an indication of the dissolved salts, was within limits at all monitoring locations over the monitoring period; and
- Elevated levels of iron, manganese and nickel occurred at all monitoring locations over the monitoring period.

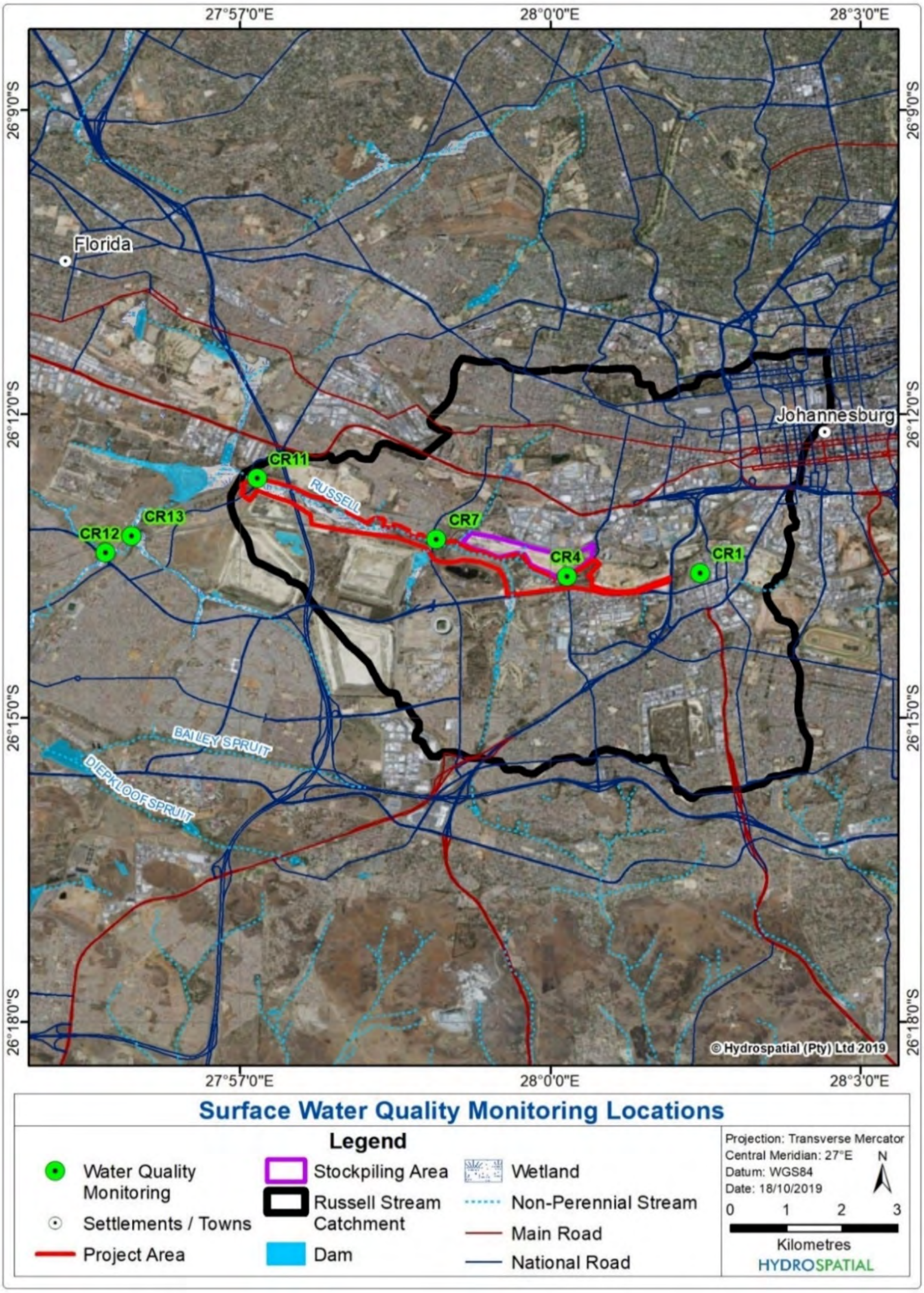


Figure 7-26: Ergo surface water quality monitoring locations

Table 7-15: Surface water quality results for the Valley Silts Project where limits are tolerable or exceeded

PARAMETER	UNITS	KLIP RIVER CATCHMENT GUIDELINE LIMITS				SANS 241:2015 DRINKING QUALITY LIMITS		NOVEMBER 2017						JANUARY 2018					
		Ideal	Acceptable	Tolerable	Unacceptable	Risk	Limit	CR1	CR4	CR7	CR11	CR12	CR13	CR1	CR4	CR7	CR11	CR12	CR13
Iron as Fe (Dissolved)	mg/ℓ	< 0.5	0.5 - 1.0	1.0 - 1.5	> 1.5	Chronic health	≤ 2	0.51	4.83	0.041	0.513	0.111	0.105	0.167	1.35	0.135	0.037	0.026	<0.025
Manganese as Mn (Dissolved)	mg/ℓ	< 1	1.0 - 2.0	2.0 - 4.0	> 4.0	Chronic health	≤ 0.4	0.096	2.77	4.78	3.22	2.06	1.75	0.069	0.888	3.31	3.81	3.81	3.28
Nickel as Ni (Dissolved)	mg/ℓ	---	---	---	---	Chronic health	≤ 0.07	<0.025	0.617	0.852	0.426	0.244	0.261	<0.025	<0.025	0.163	0.31	0.209	0.211
PARAMETER	**UNITS**	**KLIP RIVER CATCHMENT GUIDELINE LIMITS**				**SANS 241:2015 DRINKING QUALITY LIMITS**		**SEPTEMBER 2018**						**OCTOBER 2018**					
		Ideal	Acceptable	Tolerable	Unacceptable	Risk	Limit	CR1	CR4	CR7	CR11	CR12	CR13	CR1	CR4	CR7	CR11	CR12	CR13
Iron as Fe (Dissolved)	mg/ℓ	**< 0.5**	**0.5 - 1.0**	**1.0 - 1.5**	**> 1.5**	Chronic health	≤ 2	1.38	1.29	1.45	1.09	0.656	3.94	0.29	0.601	0.426	2.34	2.5	1.64
Manganese as Mn (Dissolved)	mg/ℓ	**< 1**	**1.0 - 2.0**	**2.0 - 4.0**	**> 4.0**	Chronic health	≤ 0.4	1.24	0.692	2.1	1.6	2.02	1.6	0.067	0.712	3.49	2.32	2.69	1.62
Nickel as Ni (Dissolved)	mg/ℓ	---	---	---	---	Chronic health	≤ 0.07	0.09	0.026	0.119	0.086	0.072	0.094	<0.025	<0.025	0.108	0.115	0.05	0.056
PARAMETER	**UNITS**	**KLIP RIVER CATCHMENT GUIDELINE LIMITS**				**SANS 241:2015 DRINKING QUALITY LIMITS**		**JANUARY 2019**						**MAY 2019**					
		Ideal	Acceptable	Tolerable	Unacceptable	Risk	Limit	CR1	CR4	CR7	CR11	CR12	CR13	CR1	CR4	CR7	CR11	CR12	CR13
Iron as Fe (Dissolved)	mg/ℓ	**< 0.5**	**0.5 - 1.0**	**1.0 - 1.5**	**> 1.5**	Chronic health	≤ 2	0.343	1.12	0.261	0.294	0.646	0.746	0.188	0.2	2.41	0.217	3.05	6.23
Manganese as Mn (Dissolved)	mg/ℓ	**< 1**	**1.0 - 2.0**	**2.0 - 4.0**	**> 4.0**	Chronic health	≤ 0.4	0.088	1.72	2.47	1.95	1.15	1.27	0.182	2.06	3.35	3.08	2.64	2.63
Mercury as Hg (Dissolved)	mg/ℓ	---	---	---	---	Chronic health	≤ 0.006	<0.001	0.002	0.001	<0.001	0.001	<0.001	0.034	<0.001	<0.001	<0.001	<0.001	<0.001
Nickel as Ni (Dissolved)	mg/ℓ	---	---	---	---	Chronic health	≤ 0.07	<0.025	0.179	0.254	0.228	0.218	0.183	<0.025	0.395	0.538	0.52	0.486	0.463

7.6.3 Peak Flows

The catchment parameters and calculated peak flows for the Russell Stream catchment are summarised in Table 7-16. The SCS method peak flow was adopted for the floodline modelling.

Table 7-16: Catchment parameters and calculated 1:100 year peak flows

Catchment Area (km^2)	53.03
Longest Watercourse (km)	10.15
Average Longest Watercourse Slope (m/m)	0.00574
Average Catchment Slope (%)	7.5
Tc (hrs)	2.9
SDF Basin	7
SCS Curve Number	85
Rational Method Runoff Coefficient (C)	0.651
SDF Method Runoff Coefficient (C)	0.600
Rational Method 1:00 Year Peak Flow (m^3/s)	308
SDF Method 1:100 Year Peak Flow (m^3/s)	344
SCS Method 1:100 Year Peak Flow (m^3/s)	346

7.6.4 Floodlines and 100 m Stream Buffer

The 1:100 year floodline is indicated on Figure 7-27.

The project falls within the 1:50 year floodline. Exemption from Government Notice No. 704 of the National Water Act, 1998 (Act 36 of 1998) (NWA) will be been applied for. Ergo will apply for water use licenses in terms of Sections 21 (c) and (i) of the same act.

Generally, the natural bed and flow of the stream will be used to prevent potentially diverse impacts that could result from a fifty year storm event, therefore during the silt removal activities, minimal disruption of the stream will take place.

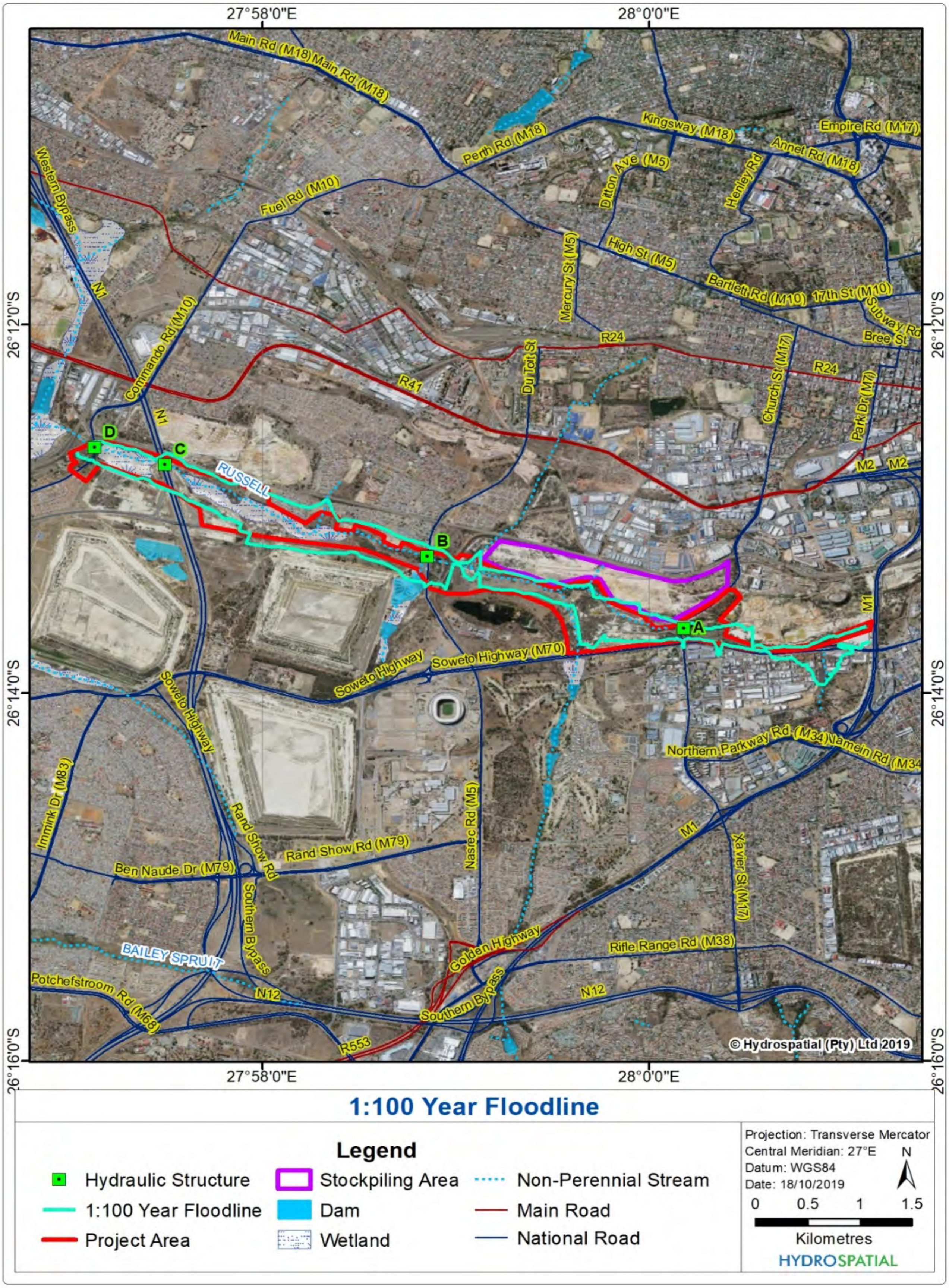


Figure 7-27: 1:100 year floodline

7.6.5 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.

7.6.5.1 Clean and Dirty areas

Dirty areas include the following areas:

- Reclamation area; and
- Stockpiling area.

Clean areas include all areas surrounding the above-mentioned dirty areas.

7.6.5.2 Proposed stormwater measures

that runoff from upslope areas must be diverted around the mining areas through the implementation of berms and cut-off channels. Downslope of the mining areas, it is proposed that dirty runoff from the operation is captured and contained in a series of paddocks. Furthermore, areas that are mined out should be paddocked, in order to contain water onsite, until the site is successfully rehabilitated. The stockpiling area which previously consisted of historical dumps that have now been reclaimed, will be managed in a similar fashion. Runoff from upslope areas will be diverted around the stockpiling area, whilst runoff from the stockpiles will be captured and contained in downslope paddocks. Figure 7-28 indicates the proposed conceptual SWMP.

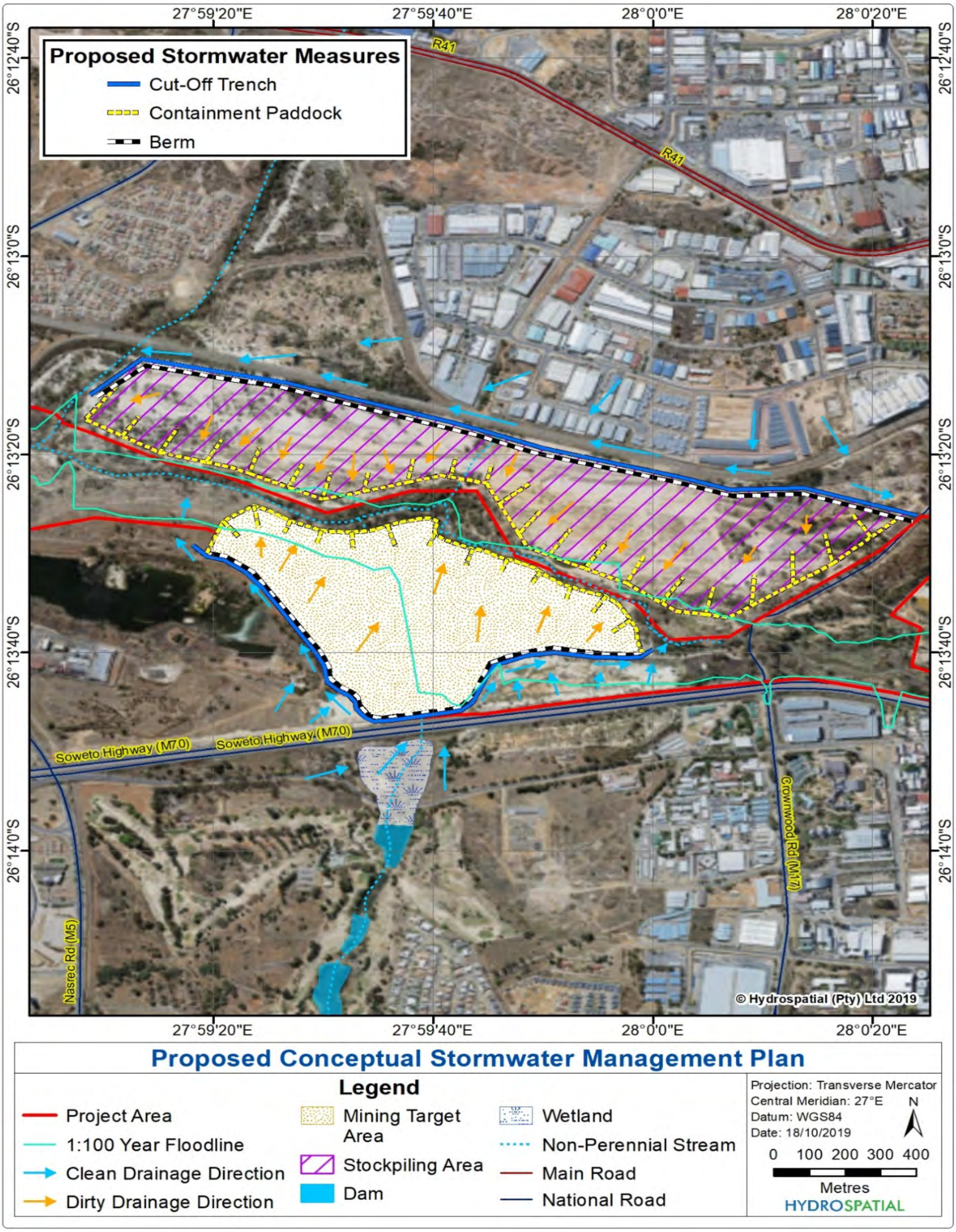


Figure 7-28: Proposed conceptual stormwater management Plan

7.7 Groundwater

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

7.7.1 Conceptual Hydrogeological Model

This section presents a general understanding of the site conditions in terms of geology, groundwater occurrence, groundwater level and water quality. According to Barnard (2000) various aquifer types are found in the area i.e. weathered and fractured aquifers. The 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. Groundwater is often encountered in both the saturated weathered material below the regional groundwater rest level and in the transition zone between weathered and fresh formations.

Historically, some of the mines in the project area, as well as slimes and sand dumps have discharged contaminated water and silt into the Russell Stream. Concern has been expressed about the concentration of contaminants in these silts and the ability of the wetlands associated with the streams to cope with the pollutants. Water analyses show that the wetlands do indeed reduce the metal loads in the water, although this hazard remains for a number of kilometres downstream of the pollution sources (Council for Geosciences, 2005).

7.7.1.1 Available Information and Project Limitations

A lack of boreholes, especially close to the Russell Stream was a limitation. Groundwater levels (and quality) at the Russell Stream are vital to define the surface water – groundwater interactions and the determine if the Russell Stream is disconnected from the underlaying aquifers. The silt to be excavated does not occur in a continuous layer and is not of homogeneous thickness. A detailed delineation of the silt pockets / mining footprint is not available for the full project area and will have to be delineated in detail to allow for a more accurate definition of groundwater impacts. A study completed by Ndasi (2007), with Crown Gold Recovery data from the Russell Stream, was used to approximate the extent of gold-bearing sediment deposited in the stream.

The following data sources were used in the definition of the conceptual model:

- Barnard HC, 2000. An explanation of the 1:500 000 General Hydrogeological Map Johannesburg 2526. Department of Water Affairs and Forestry.
- Digby Wells Environmental, November 2011. Hydrogeological Study to Establish Monitoring Boreholes at the Crown Mines Operations around Dams 3/L/40, 3/L/42 AND 4/L2.
- Geological and Geohydrological Maps produced by the Council for Geoscience and the Department of Human Settlements, Water and Sanitation, respectively.
- Ndasi MB, October 2007. Accumulation of heavy metals in sedimentary deposits in the Fleurhof and Russell Stream Dams of the Central Rand, Johannesburg.

7.7.1.2 Witwatersrand Formation Characteristics

The Witwatersrand formations (Central Rand Group) is composed of arenaceous and rudaceous rocks. When these formations decay, they generally produce sandy soils. The Central Rand Group lithologies produce borehole yields of 1 to 2.0 L/s (Barnard, 2000). Higher borehole yields are associated with faults and highly fractured systems – high permeability zones. The proposed Valley Silts desilting area is located on Witwatersrand formations, mainly the Booysens shale. It is thought that the permeabilities of the shale would be low compared to that of the over- and underlaying quartzite and conglomerate. The formations strike east-west and dip between 30° and 60° in a southerly direction (Figure 7-5). Many of the faults and diabase intrusions in the area have an east-west orientation.

The hydraulic parameters obtained during previous aquifer tests in the City Deep area (Digby Wells, 2011) indicate characteristics of low permeability, where groundwater movement at depth is controlled by limited discontinuous fractures in the quartzite/conglomerate bedrock. Water bearing zones can be associated with:

- the tailings material and rock contact zone;
- the shale and quartz contact; and
- fractures / faults within the quartzite.

The shallow depth to bedrock is favourable for the development of perched water tables as evident from perched groundwater zones observed on soft rock – hard rock interfaces. These zones are areas of potential preferential horizontal flow. The presence of pearched water tables could not be confirmed for the Valley Silts area. On average, the depth to water table in the Witwatersrand Formations is between surface and 5 metres below surface.

7.7.1.3 Historical Monitoring Borehole Details

There are two boreholes included in Ergo's water quality monitoring programme for the Valley Silts area. These are boreholes CRBH1 and CRBH2 (Figure 7-29). A review of the monitoring reports indicates that the boreholes have not been sampled / tested since November 2017, as they were destroyed (earliest data source) (Ergo Quarterly Water Quality Monitoring Reports, 2017 to 2019).

A review of the National Groundwater Archive (NGA) dataset also yielded no boreholes in the project area.

In 2011 Digby Wells Environmental drilled five groundwater exploration / monitoring boreholes at the 3L40, 3L42 and 4L2 dumps in the City Deep area. Ergo1 and Ergo2 are adjacent to Ergo's City Deep Plant; both boreholes have been destroyed and could not be located for follow up sampling. Ergo4 was sampled during April 2019, but Ergo3 and 5 could not be found. The 2011 groundwater study found that borehole yields are typically below 1 L/s. Water strikes are associated with the shallow weathered and fractured shale and quartzite aquifers. Table 7-17 is a summary of the borehole information. The locations of these boreholes and other monitoring positions evaluated as part of this study are indicated on Figure 7-29.

Table 7-17: 2009 Borehole drilling data

BOREHOLE	LATITUDE (WGS84)	LONGITUDE	DEPTH (M)	WATER LEVEL (M BGL)	YIELD (L/S)
Ergo1	S 26.22530°	E 28.06267°	50	9.48	0.70
Ergo2	S 26.22308°	E 28.05568°	50	15.82	0.83
Ergo3	S 26.21691°	E 28.10361°	50	None	Dry
Ergo4	S 26.21789°	E 28.10917°	50	5.21	0.70
Ergo5	S 26.21327°	E 28.10256°	50	None	Dry

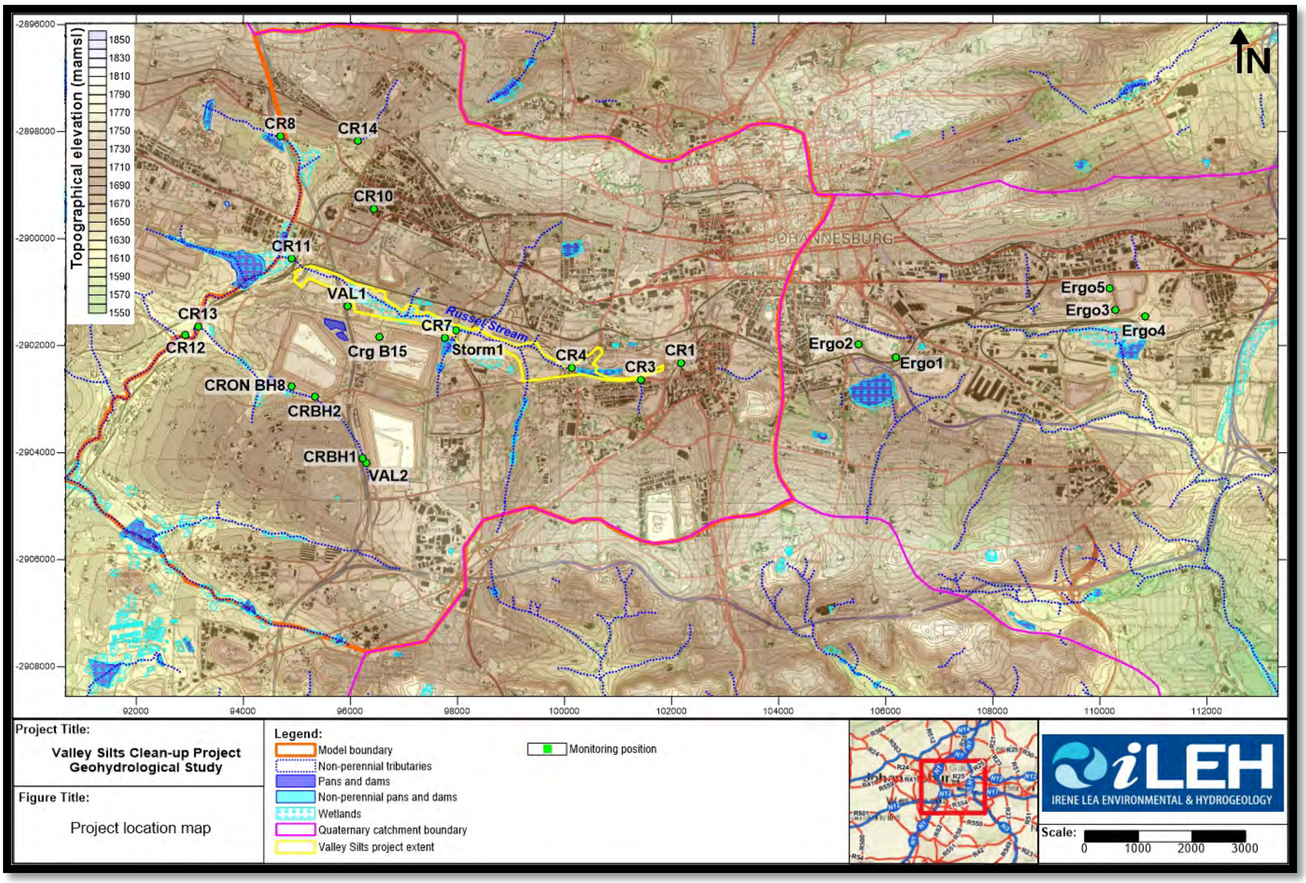


Figure 7-29: Valley Silts Mining Right Area including boreholes

Aquifer tests were conducted on three of the City Deep boreholes in 2011. Transmissivity values vary between 0.23 m2/day (shale) and 5.03 m2/d (quartzite), which indicate a low-yielding aquifer system (Digby Wells, 2011). The geological units and aquifer types are similar to the Valley Silts area and the information was subsequently used in characterisation of the Valley Silts aquifers.

7.7.1.4 Historical Groundwater Quality

Table 7-18 presents results of the 2011 Digby Wells study, as well as the groundwater sample collected in April 2019. It presents only the parameters where exceedances (SANS 241:2015 drinking water limits) were measured. The water quality for borehole Ergo4 is similar when the 2011 and 2019 results are compared.

The three sampling points are located very close to TSFs in the City Deep area and represent groundwater qualities underlaying or directly adjacent to a TSF. The data indicates exceedances (SANS Drinking Water Limits) for Sulphate, Calcium, Magnesium, Iron, Manganese, pH, Aluminium, Free and Saline Ammonia and Fluoride.

7.7.2 Hydrocensus

A hydrocensus was conducted across the Valley Silts area during October 2019. The survey included the Valley Silts project 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 four (4) boreholes were identified Table 7-19 (Figure 7-29). The hydrocensus included visits to several private and commercial properties in the area, e.g. Riverlea Primary School, residential areas, communication with community members, communication with other mining operations and security staff at the various tailing's storage facilities and sand mining dumps, and a visit to the old Crown Mines Golf Club. It was concluded that groundwater is not used in the area and all properties make use of municipal supply.

Boreholes Val2 and CRON BH8 were identified in the same area where CRBH1 and CRBH2 are mapped.

All four boreholes identified are open and not in use. Boreholes VAL1 and CRG B15 are the closest to the Russell Stream, 330 m and 600 m away, respectively.

- Borehole VAL1 is located at the Riverlea offramp from the N1 highway.
- Borehole CRG B15 is down gradient (northwest) from the Mooifontein (3L7) TSF; approximately 150 m from the TSF edge.
- Boreholes VAL2 and CRON BH8 are at the foot of the GMTS (3L8) and Homestead (3L5) TSFs respectively.

No boreholes were identified along the eastern portion of the project area, apart from the Ergo boreholes in the City Deep area – approximately 4 to 9 km away.

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.

Table 7-18. City Deep groundwater qualities

	TOTAL DISSOLVED SOLIDS	SULPHATE	CALCIUM	MAGNESIUM	IRON	MANGANESE	CONDUCTIVITY AT 25° C IN MS/M	PH-VALUE AT 25° C	ALUMINIUM	FREE AND SALINE AMMONIA AS N	FLUORIDE
SANS 241:2015 limits	**1,200**	**500**	**DHSWS limits - 32**	**DHSWS limits - 70**	**2.0**	**0.4**	**170**	**≥5 - ≤9.7**	**0.3**	**1.5**	**1.5**
Ergo1_2011	1975.0	1311.0	126.15	299.0	0.005	1.35	236.60	7.32	0.005	0.63	0.09
Ergo2_2011	3397.0	2437.0	348.0	286.0	1.27	76.5	334.00	4.85	6.44	1.89	1.68
Ergo4_2011	4662.0	3743.0	396.0	387.0	509.0	131.0	570.0	3.79	255.0	0.94	0.09
Ergo4_2019	5515.0	4784.0	279.0	321.0	265.0	109.0	594.0	2.80	354.0	0.58	-0.26

Concentrations as mg/L

Table 7-19. 2019 Hydrocensus data

SITE ID	LATITUDE	LONGITUDE	ELEVATION (M AMSL)	WATER LEVEL (M BGL)	STATUS
	WGS84				
CRG B15	S 26°13'20.8"	E 27°57'58.0"	1676	3.94	50m deep. PVC Screen casing 5 to 47m
VAL 01	S 26°13'02.4"	E 27°57'36.2"	1658	4.90	At highway offramp. 80 L/hr. 30m deep.
VAL 02	S 26°14'37.3"	E 27°57'49.9"	1685	0 m - level	
CRON BH8	S 26°13'51.1"	E 27°56'58.9"	1665	--	Can't open. 80m deep

7.7.3 Groundwater Quality

Based on the water quality results (Table 7-20), the following conclusions were drawn:

- Chronic Health effects:
  - Iron – An elevated iron concentration was measured for water sampled at the north-eastern corner of the Mooifontein TSF intercept trench (Storm1) (Table 7-20), 342 mg/L versus the maximum allowable concentration of 2 mg/L. The concentration of dissolved iron in water is dependent on the occurrence of other heavy metals, such as manganese, and the pH of the water. The two borehole water samples however indicate very low iron concentrations.
  - Manganese – Manganese is a relatively abundant element, constituting approximately 0.1% of the earth's crust. All three samples measured a manganese concentration that could result in chronic health effects (Table 7-20). Manganese tends to precipitate out of solution to form a black hydrated oxide which is responsible for staining problems. The highest concentration was measured in the surface water sample (Storm1) and the lowest in the borehole at the N1 highway (VAL1).
  - Total Organic Carbon – a high TOC value (13.3 mg/L) was measured for Storm1. In groundwater, the main natural sources of organic matter include buried peat, kerogen and coal; soil and sediment organic matter; and organic matter present in water infiltrating into the subsurface from rivers or dams/ pans. The two groundwater samples were within acceptable limits. The vegetation on and next to the TSF might explain the high TOC value for the surface water sample.
  - pH – the pH value for Storm1 (4.13) is below the SANS guideline limit of 5. This explains the high concentrations of the metals and salts in the surface water sample.
  - The mobility of trace elements is dependent on a number of parameters, including pH. All the trace elements examined are most mobile when the pH <4.5, and least mobile when the pH > 6. The pH for the two groundwater samples was near neutral.

- Acute Health effects:
  - Sulphate – Sulphate forms salts with various cations such as potassium, sodium, calcium, magnesium, barium, lead and ammonium (DWAF, 1996). Sulphate is a common constituent of water and arises from the dissolution of mineral sulphates in soil and rock. Since most sulphates are soluble in water it tends to accumulate to progressively increasing concentrations. Contamination by sulphate is to be expected in waters contaminated by Witwatersrand mining activities, due to the oxidation of sulphides in the ores and wastes.

    Sulphate concentrations were very high in Storm1 and borehole CRG B15 (Table 7-20), and also exceeded the aesthetic limits for borehole VAL1.

- Aesthetic effects:
  - Aluminium – Aluminium is the most common metal in the earth's crust. In acidic waters (sample Storm1), or where soluble aluminium complexes are present, the dissolved aluminium concentration can rise to high concentrations. Storm1 recorded an elevated Al concentration – 19 mg/L (0.3 mg/L allowed). The aluminium concentrations in the two groundwater samples were very low.

- Ammonium – A high ammonium concentration was measured in boreholes VAL1. Ammonia concentrations tend to be elevated in waters where organic decomposition under anaerobic conditions takes place.
- Sodium – Sodium is abundant in the environment and usually occurs as sodium chloride, but sometimes as sodium sulphate, bicarbonate or even nitrate (DWAF, 1996). Sodium is highly soluble in water and does not precipitate when water evaporates, unless saturation occurs. Storm1 and borehole CRG B15 exceed the aesthetic limits for drinking water. With the re-use or recycling of water, the sodium concentration will tend to increase with each cycle or addition of sodium to the water. For this reason, sodium concentrations are elevated in runoffs or leachates.
- Turbidity – Turbidity is indicative of the concentration of suspended matter in water and is also related to clarity, a measure of the transparency of water and settleable material. Turbidity in water is caused by the presence of suspended matter which usually consists of a mixture of inorganic matter, such as clay and soil particles, and organic matter. The latter can be both living matter such as micro-organisms and non-living matter such as dead algal cells. Turbidity was high in Storm1 and borehole CRG B15.
- Magnesium – Magnesium is an alkaline earth metal which reacts with oxygen and water to form magnesium oxide and magnesium hydroxide, respectively. Magnesium is a common constituent of water and the solubility is governed by the carbonate/bicarbonate equilibrium and the pH. Magnesium, together with calcium, is responsible for the hardness of water. High magnesium concentrations were measured in Storm1 and borehole VAL1.
- Total hardness – High total hardness values were measured in all 3 sites. The water is classified as very hard water and scaling is likely to occur in water heating appliances such as kettles and geysers. High concentrations of calcium were measured at all 3 sites.

Table 7-20. Valley Silts water quality – October 2019

PARAMETER	UNIT	SANS241 STANDARD LIMITS		DHSWS DRINKING STANDARDS	B15	STORM 1	VAL 1
Ammonium	mg N/ℓ	Aesthetic ≤1.5			0,451	0,202	3,61
Chloride	mg Cl/ℓ	Aesthetic ≤300			145	118	43,1
Aluminium	mg Al/ℓ	≤0.3			-0,002	19	-0,002
Cadmium	mg Cd/ℓ		Chronic health ≤0.003		-0,002	-0,002	-0,002
Calcium	mg Ca/ℓ			No health. Scaling intensifies from 32mg/L	330	577	76,4
Copper	mg Cu/ℓ		Chronic health ≤2		-0,002	-0,002	-0,002
Iron	mg Fe/ℓ	Aesthetic ≤0.3	Chronic health ≤2		-0,004	342	-0,004
Lead	mg Pb/ℓ		Chronic health ≤0.01		-0,004	-0,004	-0,004
Magnesium	mg Mg/ℓ			Diarrhoea and scaling issues from 70mg/L	249	93,6	37,7
Manganese	mg Mn/ℓ	Aesthetic ≤0.1	Chronic health ≤0.4		4,74	28,1	0,705
Nickel	mg Ni/ℓ		Chronic health ≤0.07		-0,002	-0,002	-0,002
Zinc	mg Zn/ℓ	Aesthetic ≤5			0,07	0,6	-0,002
Electrical Conductivity at 25°C	mS/m	Aesthetic ≤170			316	460	95,6
Fluoride	mg/ℓ		Chronic health ≤1.5		-0,263	0,615	-0,263
Nitrate	mg/ℓ		Acute health ≤11		0,303	-0,194	0,509
pH at 25°C		≥5 - ≤9.7			6,16	4,13	7,41
Potassium	mg K/ℓ			No aesthetic or health effects below 50mg/L	3,21	59,7	6,72
Sodium	mg Na/ℓ	Aesthetic ≤200			202	219	65,1
Sulphate	mg SO_4/ℓ	Aesthetic ≤250	Acute health ≤500		1843	3208	417
Total Alkalinity	mg $CaCO_3$/ℓ				55,4	13,1	39,2
Total Dissolved Solids	mg/ℓ	Aesthetic ≤1200			2807	4285	677
Total Hardness	mg $CaCO_3$/ℓ	60–120 mg/l, moderately hard	120–180 mg/l, hard	more than 180 mg/l, very hard	1848	1826	346
Orthophosphate (PO_4) as P	mg/ℓ				-0,005	-0,005	-0,005
Cobalt	mg/ℓ				0,208	0,945	0,041
Turbidity	NTU	Aesthetic ≤5			93	38,2	3,41
TOC			Chronic health ≤10		2,75	13,3	1,99

The chemicals of concern for the Valley Silts project area (associated with the 3 sampled sites) are pH, dissolved iron, manganese, sulphate and total organic carbon (Table 7-21). Parameters exceeding aesthetic limits include ammonium, aluminium, calcium, magnesium and sodium. Most of these are only elevated in the trench sample (Storm1) and also the borehole next to the Mooifontein TSF (B15). Based on the SANS241 drinking water guidelines and on the sampled water results, the sampled water is not fit for human consumption (unless treated).

A groundwater study by Rösner et al, 1998 (WRC Report K5/797/0/1) concluded that groundwater in close proximity to tailings dams are affected by salt loads. The groundwater quality improved with increasing distance down gradient from the pollution source, mainly because of dilution and solid speciation. Once contaminants have migrated through the unsaturated zone, into the groundwater zone, the rate of lateral movement increases by orders of magnitude. The implication of this is that although there is a dilution effect because of contact with groundwater, the potential impact on the environment is extended in a spatial and temporal sense.

Table 7-21. Parameters of Concern

SAMPLE SITE	PARAMETERS EXCEEDING ACUTE / CHRONIC HEALTH LIMITS	PARAMETERS EXCEEDING AESTHETIC LIMITS
Storm1 – trench along TSF foot	Iron, Manganese, Sulphate TOC, pH	Aluminium, Calcium, Magnesium, Sodium, Total Hardness, Turbidity
Borehole CRG B15 – close to TSF	Manganese, Sulphate	Calcium, Magnesium, Sodium, Total Hardness, Turbidity
Borehole VAL1 – not near TSF. Closest to Russell Stream - downstream	Manganese	Ammonium, Calcium, Sulphate, Total Hardness

The water qualities associated with Storm1 (Table 7-20) will be used as source quality information for the numerical model simulations (Sections 9.4 to 9.6 of the Groundwater impact assessment).

The gold containing silt and the adjacent TSF and sand dump facilities can potentially add sulphate, iron, chloride, calcium, magnesium, manganese and aluminium to the local groundwater system, if the management of contaminated water on site is not effective, but also through seepage from the adjacent dumps. This has been confirmed by the 2019 water sampling results (Table 7-20 and Table 7-21). Metals like cobalt, copper, nickel and zinc can also be elevated. In general, sulphate concentrations around the tailings complexes south and west of Johannesburg vary between 417 and 4,700 mg/L.

The pyrite present in the tailings and sand material is 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, leading to Acid Mine Drainage (AMD); often measured in leachate from these dumps. The rate at which pyrite oxidation takes place within the dump varies and decreases with depth. The addition of lime during the gold recovery process raises the pH to neutral conditions when tailings are deposited on the facilities. Negative quality impacts are expected when the silts are excavated and exposed to oxygen and water.

The Valley Silts area is surrounded by residential and industrial areas. Many pollution sources (industrial discharge, mining activities and poor waste and sanitation management) do exist that can contribute to groundwater contamination. It will be difficult to define the contaminants and concentration at all point sources in the area.

7.7.4 Groundwater Levels

Based on the information available (2019 hydrocensus), the depth to groundwater in the Valley Silts area varies between surface (level to surface) (around TSFs) and 5.0 metres below ground level (m bgl) (at N1 Riverlea offramp), with an average groundwater level depth of 1 m bgl. Groundwater monitoring boreholes are needed closer to the Russell Stream to determine if the stream is disconnected from the underlaying aquifers, or not.

The groundwater levels are 5 to 16 metres below surface in the City Deep area. The Ergo boreholes in the City Deep area are in a different quaternary catchment and between 4 and 9 km from the Valley Silts project area.

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, which 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 Valley Silts area, the groundwater flow direction will be in a westerly to south-westerly direction, towards the Klip River (Figure 7-30).

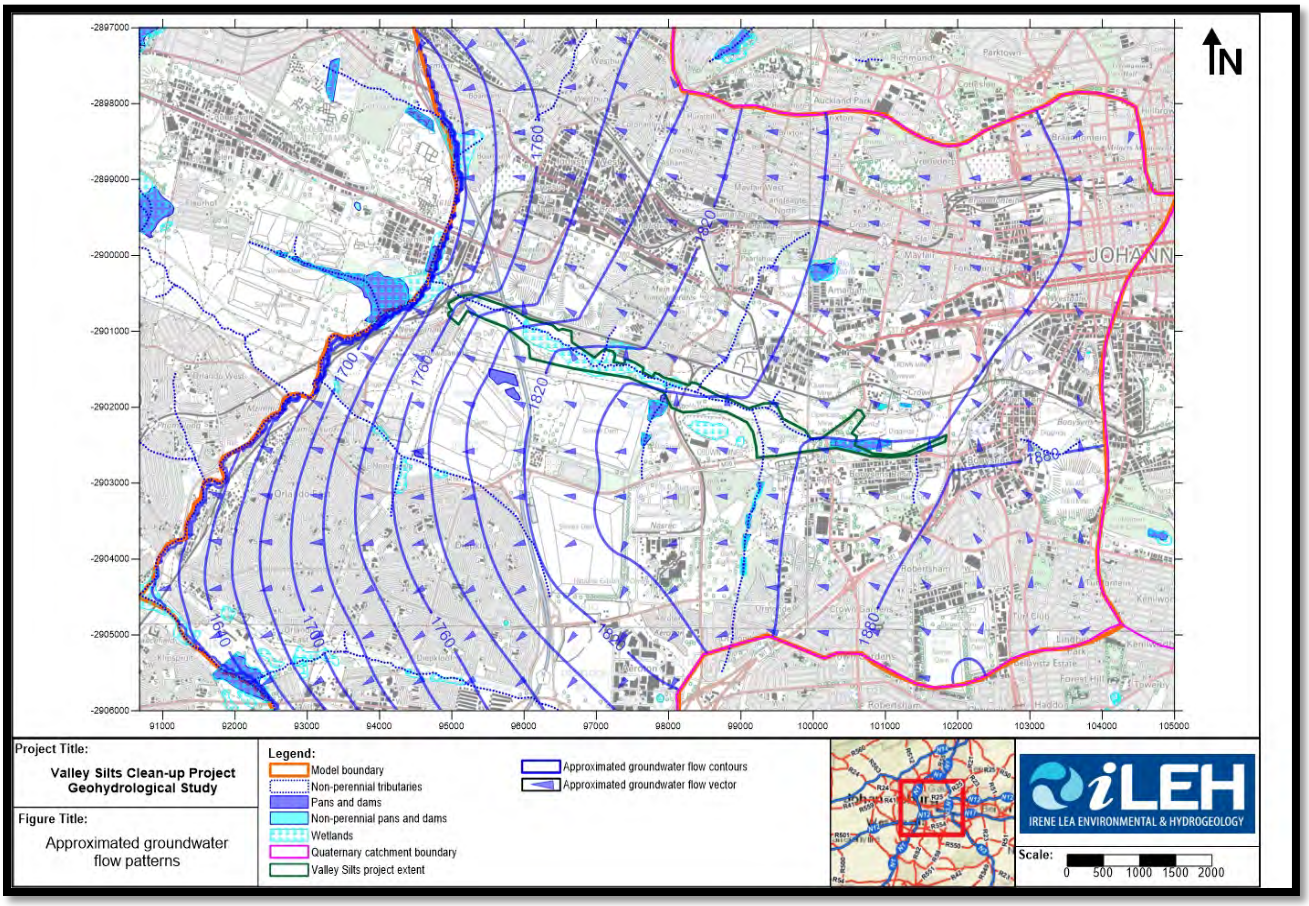


Figure 7-30: Approximated groundwater flow patterns

7.7.5 Surface Water

Ergo conducts water monitoring on a quarterly basis, in accordance with the conditions stipulated in its Water Use Licence (WUL). Results are compared to the Klip River catchment guideline limits, as the monitoring points fall within the Klip River catchment. There are currently five water sampling points in the Valley Silts project area – CR1, CR3, CR4, CR7 and CR11. The sample sites represent:

- CR1 – Russell Stream, Lake Road. Eastern perimeter of project area;
- CR3 – Russell Stream, Pedestrian Bridge on Soweto Highway;
- CR4 – Russell Stream, small bridge Crownwood Road;
- CR7 – Russell Stream, Randshow Road, Riverlea; and
- CR11 – Russell Stream, New Canada Road.

Based on the July 2019 sampling results all parameters are within acceptable limits according to the instream water quality guidelines for the Klip catchment. During the May 2019 sampling run total iron exceeded the unacceptable catchment limits for CR7. Total iron was also elevated in CR11 during the October 2018 sampling run, as well as for CR4 during the January 2018 run. All measured at near neutral pH levels.

Several institutions, including Rand Water, the DHSWS and City of Johannesburg undertake surface water monitoring, associated with the Klip River. Data for three points in the Valley Silts area were found on the Klip River Forum website (Table 7-22 and Figure 7-29). Based on the monitoring data available on the Klip River Forum website, elevated ammonia, phosphate, COD and E. coli counts are the elements of concern at the RP1 and RP2 sites (east of Valley Silts project area). At the New Canada Road bridge ammonia and E. coli were of concern. The basic salts and metals were within acceptable limits. From the surface water results it would seem as if the element concentrations reduce further downstream.

Refer to the Surface Water Impact Assessment Report (Hydrospatial, October 2019) for a detailed assessment of the surface water qualities and flow.

Table 7-22. Rand Water surface water qualities – April to June 2019

SAMPLING SITE ID	AREA	TOLERABLE CONCENTRATIONS	UNACCEPTABLE CONCENTRATIONS
RP1	Eastern perimeter of project area. Booysens/ Ophirton area. Sampled by City of Johannesburg.	Phosphate Chloride	Ammonia Phosphate E. coli COD Microbiological Index
RP2		---	Ammonia E. coli COD Microbiological Index
Russell Stream @ New Canada Rd	Western perimeter of project area. Sampled by DHSWS.	Phosphate	Ammonia E. coli

7.7.6 Geochemistry

During the 2004 / 2005 Council for Geosciences study, wetland samples were submitted for XRF analysis. During their assessment Co, Ni, Cu, As and U were identified as the principal elements of concern.

The Council for Geosciences found – "The leachable fractions determined from the compliance batch leach tests are uniformly low, with nickel slightly more mobile than the other elements, indicating that the contaminant metals are well bound to the sediment samples.

This result is in fact not surprising. The samples were all deposited in a sub-aqueous environment and are in contact with water for most of the year. Any easily mobilised metals will therefore be mobilised, while the more strongly bound fraction will require a more aggressive leachate than clean water to remobilise them. As long as the current conditions are maintained in these wetlands, i.e. continuous discharge of water to the wetlands and the maintenance of reducing conditions, it is unlikely that the metals will be mobilised."

With changing conditions, particularly oxidizing and/or acidic conditions, remobilization is however possible. The Council for Geosciences (2005) has identified processes which could favour the remobilization of metals from wetland sediments:

"The most likely processes are:

- Acidification:
  - Acid rain; and
  - Acid mine drainage.
- Oxidation:
  - Drying out of sediments during droughts;
  - Drying out of sediments during draining of wetlands for mining of rehabilitation purposes; and
  - Fire, which could lead to the burning of raised peat-beds.

The proposed plan at Valley Silts will be to remove the silts, stockpiling it at 3L10-12 to dry out, and then transporting the dry silt to the Ezekiel site. The excavation of the silt from the water course will trigger oxidation reactions that could result in acidic conditions and leaching of salts and metals. Negative surface and groundwater quality impacts are expected in the excavated areas and also the stockpile areas. Seepage into the ground and discharge to the surface water resource must be managed to limit the flow of contaminants into these resources. Water found in the excavated areas and also from the drying pads need to be removed from site / surface as soon as possible.

In the deeper silt pockets the pH will be much lower and element concentrations higher, but due to current stable conditions that include saturation, low permeability and low oxygen levels, metal and salt leaching does not happen readily. This will change when the silt excavation process introduces oxygen and disturbs the stable conditions.

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 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 excavated silt and any water must be removed from open and exposed formation surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper fractured aquifers. The desilting will be a continuous process and water will be in the silts while excavation takes place. It has to be assumed that the groundwater system will take a portion of this load and ways to manage, contain and minimise the mobilisation of loads must be adopted. This water must be put into the pipelines and removed from site.

The water qualities associated with Storm1 (Table 7-20) were used as source quality information for the numerical model simulations (Sections 9.4 to 9.6 of the Groundwater Impact Assessment).

7.7.7 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.

All aquifers in the Valley Silts area are classified as minor aquifer systems according to the South African aquifer system management classification. The groundwater is of limited quantity and not used by anyone, but important for base flow to the rivers.

7.7.7.1 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 Witwatersrand formations are classified as "less vulnerable".

7.7.7.2 Aquifer Susceptibility

Aquifer susceptibility is a qualitative measure of the relative ease with which a groundwater body can 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 formations have a low susceptibility to contamination.

7.7.8 Groundwater Modelling

Due to the limited amount of information available to characterise the aquifers present in the immediate vicinity of the Russell Stream, the model capability will be constrained. 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 silts accumulating in the water course, on groundwater quality;
- To assess the impact of silt excavation and removal on groundwater quality;
- To assess the potential long-term impacts associated with the removal of the silts from the Russell Stream; and
- To evaluate the long-term impact of the silts in the Russell Stream if the proposed project is not implemented.

7.7.8.1 Key Modelling Assumptions and Limitations

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 for the project area. To complete an assessment of the impacts of silt excavation on groundwater quality, literature-based aquifer parameters were considered. These are listed in Table 7-23 It is shown that a wide range of values are reported for the affected geological formations and is expected in fractured aquifers, where groundwater flow is complex and changes with time. However, for the purpose of simulations, simplifications are required. For this reason, average, 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 limited 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 two boreholes situated south of the Valley Silts project area (Val 1 and CRG B15). The provisional model calibration completed suggests that the average permeability of the fractured crystaline formations is 6,74E-2 m/d and that of the shale is an order of magnitude lower, around 2,78E-3 m/d. Under these conditions the rate of recharge to the aquifers is around 1,5% of MAP. The simulated and calibrated groundwater flow patterns for the average aquifer conditions are presented in Figure 7-30. It is shown that groundwater flows regionally in a westerly direction. The Booysens shale band in the central part of the model results in a retardation of groundwater flow patterns due to its lower permeability.
- It is noted that the inadequate level of model calibration limits the level of confidence in the output. This needs to be updated before any desilting starts through drilling and testing and evaluating best management options of minimising impacts to the groundwater system and receiving environments.

Table 7-23: Literature-based aquifer parameters considered

FORMATION	PERMEABILITY (M/D)		SPECIFIC STORAGE (M^{-1})	POROSITY (%)	
	FREEZE & CHERRY (1979)	DOMENICO & SCHWARTZ (1990)	ANDERSON & WOESSNER (1992)	IRENE LEA (2016)	FREEZE & CHERRY (1979)
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

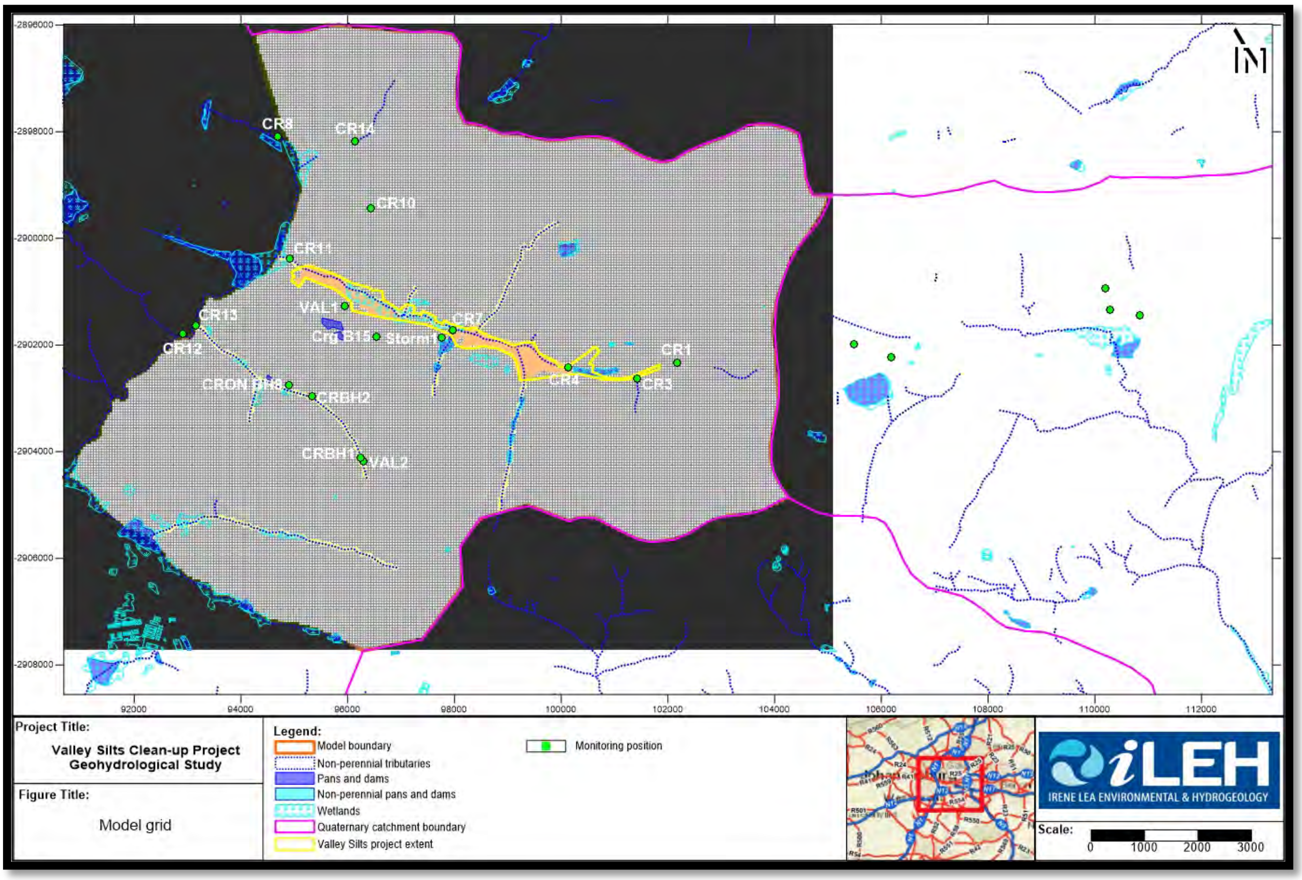


Figure 7-31: Model Grid

To test the model's sensitivity to possible variations in aquifer permeabilities, average, 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 Table 7-24. This means that the difference between inflows and outflows simulated are within generally acceptable bounds.

Table 7-24. Model water balance

FLOW TERM	INFLOW (M^3/D)	OUTFLOW (M^3/D)	BALANCE (M^3/D)
Storage	1,54E+01	4,42E+02	-4,27E+02
Constant Head	0,00E+00	2,55E+00	-2,55E+00
Drains	0,00E+00	5,71E+01	-5,71E+01
Recharge	4,58E+03	0,00E+00	4,58E+03
Head Dependent Boundaries	1,32E+01	4,12E+03	-4,11E+03
Total	4,61E+03	4,62E+03	-1,46E+01
		Water Balance Error (%)	-0,32

- 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 anticipated historical impact of the tailing's dams situated south of the Valley Silts project 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.

7.7.9 Impact Prediction

To incorporate uncertainty in the permeabilities of the aquifers present, average as well as enhanced and reduced aquifer conditions were evaluated for both sulphate and iron, for each scenario listed below. To test enhanced aquifer conditions, permeabilities were increased by an assumed order of magnitude. Reduced aquifer conditions were tested with an assumed order of magnitude reduction in permeabilities. This should be followed-up with additional simulations once site-specific data becomes available. The following scenarios were tested as part of the project:

- An estimation of the extent of groundwater pollution at the end of the various phases of the project; and
- An estimation of the long-term impact of the project.

7.7.9.1 Outcome of Simulations Completed

The model discussed above was used to estimate the extent of pollution during and at the end of the operational phase, as well as in the long-term post completion of the project. Please note that a low level of confidence is currently attached to the outcome of the simulations presented due to the limited dataset and the completion of limited model calibration and sensitivity analysis. The results are however suitable to demonstrate a first approximation of the potential impacts of sediment excavation from the Russell Stream.

The outcome of the simulations is presented as sulphate and iron concentration contours. For each scenario tested, average, enhanced and reduced aquifer conditions were tested in the absence of site-specific information. The extent of the plumes is delineated by the 200 mg/L sulphate contour and the 0,1 mg/L iron concentration contour. Also provided are concentration contours for sulphate and iron, for average aquifer conditions based on the provisional model calibration process.

All simulations suggest that groundwater quality are currently impacted regionally by impacts associated with the historical sediments

A summary of the outcome of simulations are discussed at the end of this section for ease of reference.

7.7.9.2 Simulated Sulphate concentrations

The simulations suggest that under low aquifer potential conditions, the extent of sulphate contamination will be mainly limited to the footprint areas of the desilting areas and of the drying footprints. Due to the fact that the Valley Silts project is mainly situated on low permeable shale, it is unlikely that sulphate contamination would migrate significantly from the desilting areas during the operational phase, as well as in the long-term. Potential contamination movement in the higher permeability crystalline aquifers will most likely be more rapid and spread further from the potential sources of contamination, like the existing drying footprints – although this impact is all likelihood already exists.

During desilting, sulphate concentrations may increase within the disturbed areas for a short period of time due to exposure to oxygen. As no water will be introduced during excavation, the rate at which leachate may leak into the surrounding aquifers will most likely be controlled by rainfall conditions and stormwater management. The potential sulphate plumes are not expected to migrate more than 450 m from the Valley Silts desilting areas, even under the assumed enhanced aquifer conditions. The affected zone is likely to extent 200 to 300 m from the desilting areas.

Regionally, the sulphate plumes from both the Valley Silts are expected to migrate in a westerly direction towards the tributary of the Klip River adjacent to the project area. It is likely that the sulphate plume associated with the Valley Silts project would reach this stream in the long-term, which may affect baseflow quality.

Under average aquifer conditions, sulphate concentrations are expected to increase to above the Klip River unacceptable water quality guideline (>500 mg/L) within the desilting areas. If the silts and sediments are removed and the disturbed areas rehabilitated, sulphate concentrations are expected to reduce to below acceptable management target concentrations (250 to 300 mg/L). In the long-term, sulphate concentrations in plumes reaching the tributary of the Klipspruit to the west of the Valley Silts project area are also expected to reduce to within the acceptable management target concentration of 250 to 300 mg/L.

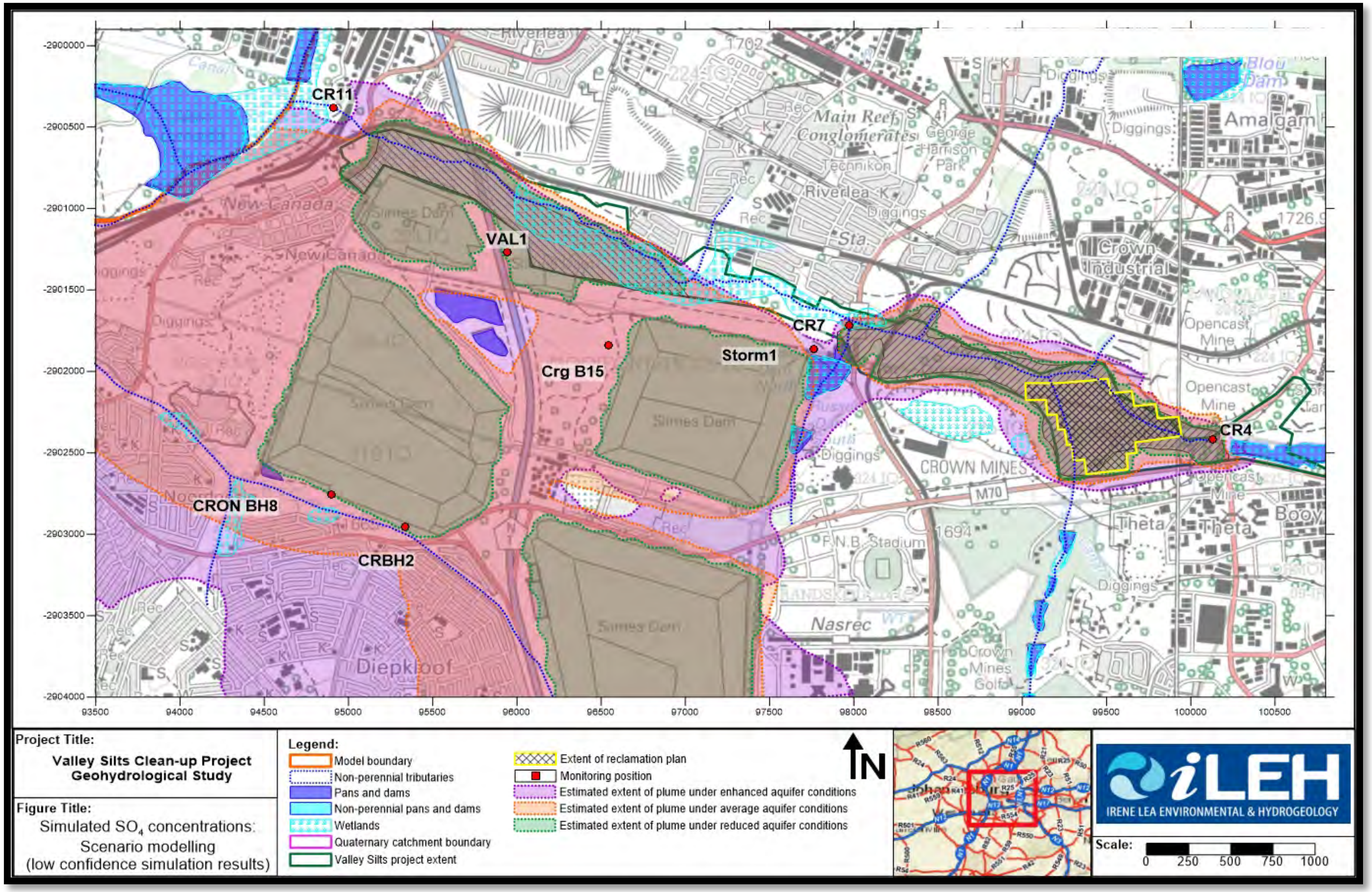


Figure 7-32. Simulated extent of sulphate plumes for average, enhanced and reduced aquifer conditions

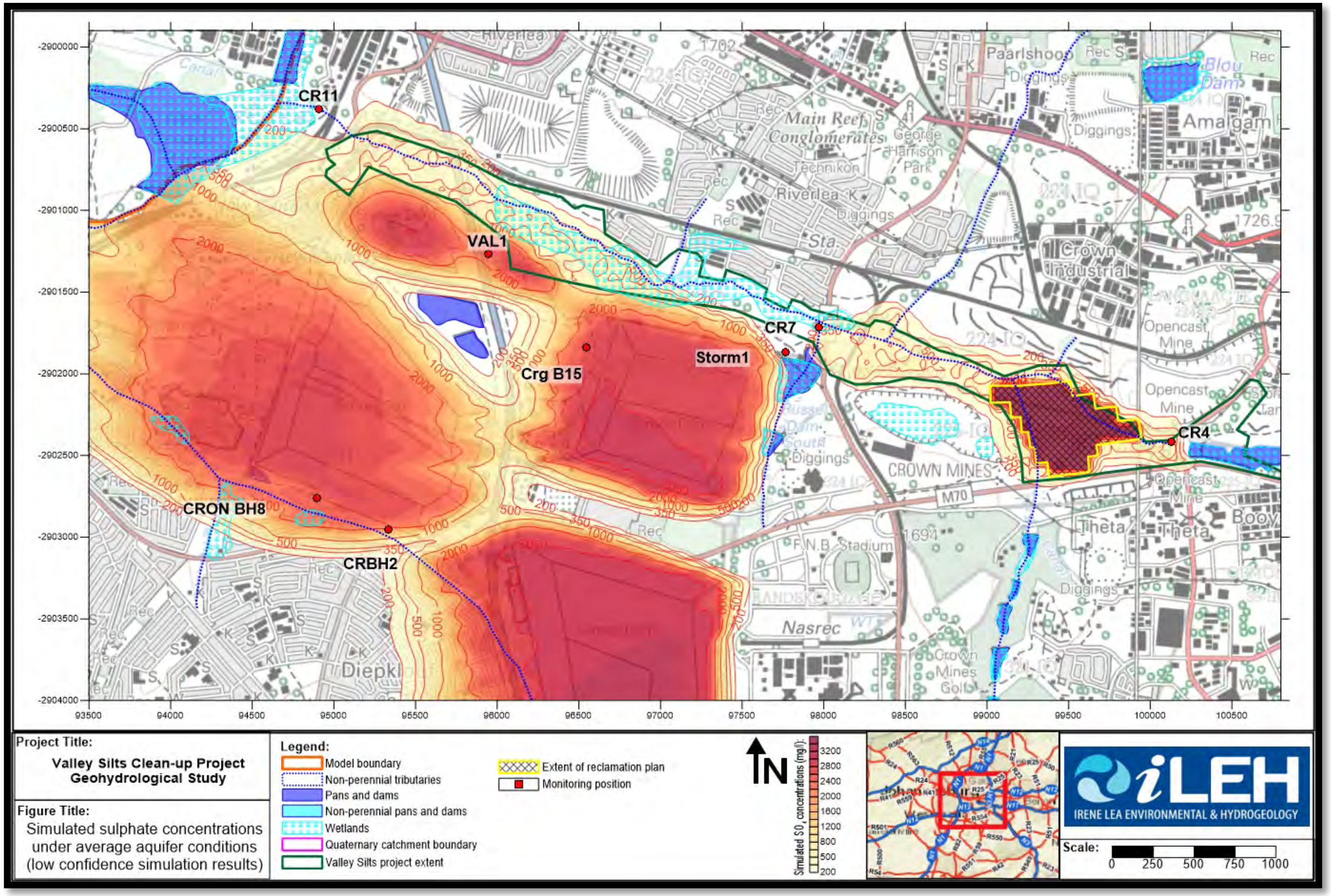


Figure 7-33. Simulated sulphate concentrations for average aquifer condition

7.7.9.3 Simulated Iron Concentrations

The extent of the iron plumes is greater compared to that for the sulphate concentrations discussed above. This is mainly due to the fact that the extent of the plumes is defined by lower concentrations, thus resulting in larger plumes. The extent of the plumes is delineated by the 0.5 mg/L iron concentration contour, which represents the ideal catchment background concentration for the Klip River catchment, as explained earlier.

It is likely that the iron plume, as defined, may migrate further than 500 m from the desilting areas during the operational phase, especially under enhanced aquifer conditions. Under average aquifer conditions, the plumes are not expected to migrate more than 350 m from the areas to be excavated. The simulated concentrations at measured points are overestimated by the model, most likely because site specific geochemistry / leach potential data was not available and a conservative approach was used for the modelling. As for the simulated sulphate plumes, the impacts are expected to be restricted to close to the footprint areas, under reduced aquifer conditions.

In the long-term the extent of the zone of impact for iron is expected to increase, especially in a westerly direction along regional groundwater flow pattern. It is likely that the iron plume may migrate more than 900 m in the long-term from the desilting areas in this direction, most likely because of mobility of iron at lower pH. This movement will be curbed by pH and the extent could be much less at more alkaline conditions.

Iron concentrations are expected to exceed the Klip River tolerable water quality guideline (1 to 1,5 mg/L) during the operational phase. It is possible that the unacceptable guideline (1,5 mg/L) may also be exceeded, especially within disturbed areas. This impact will most likely be restricted to the disturbed areas and is not likely to extend further than 200 m from the areas where desilting will take place. Once the sediments and slimes are removed, iron concentrations are expected to reduce to within acceptable management target guidelines, provided that all slimes and sediments that are disturbed, are removed. As with the discussion on the sulphate plumes, the extent of the contamination during the operational phase would be controlled by the fact that the desilting will be dry. Stormwater management measures must however be sound to avoid spills outside the disturbed areas.

In the long-term, the plume is expected to preferentially flow along the Russell Stream towards the tributary of the Klip River to the west of the site. Iron concentrations are likely to exceed the tolerable interim water quality guideline of 1 mg/L in groundwater reaching the stream, thus affecting baseflow quality. There is a possibility that iron concentrations may continue to exceed 1 mg/L in the long-term despite removal of silt and sediments from the Russell Stream due to the regional impact of tailings deposition in the area and the proximity of these old tailings dams to the Valley Silts project.

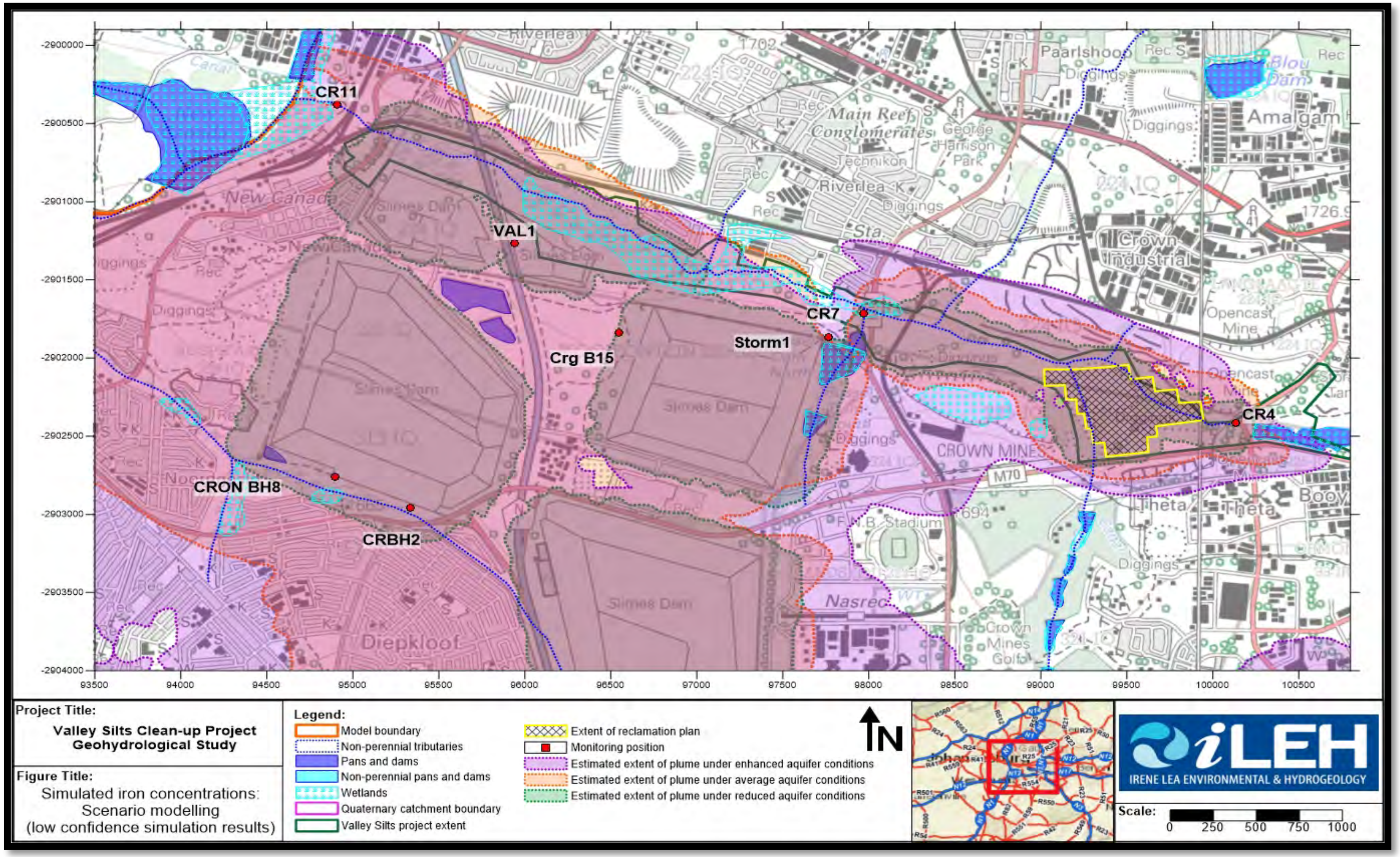


Figure 7-34. Simulated extent of iron plumes for average, enhanced and reduced aquifer conditions

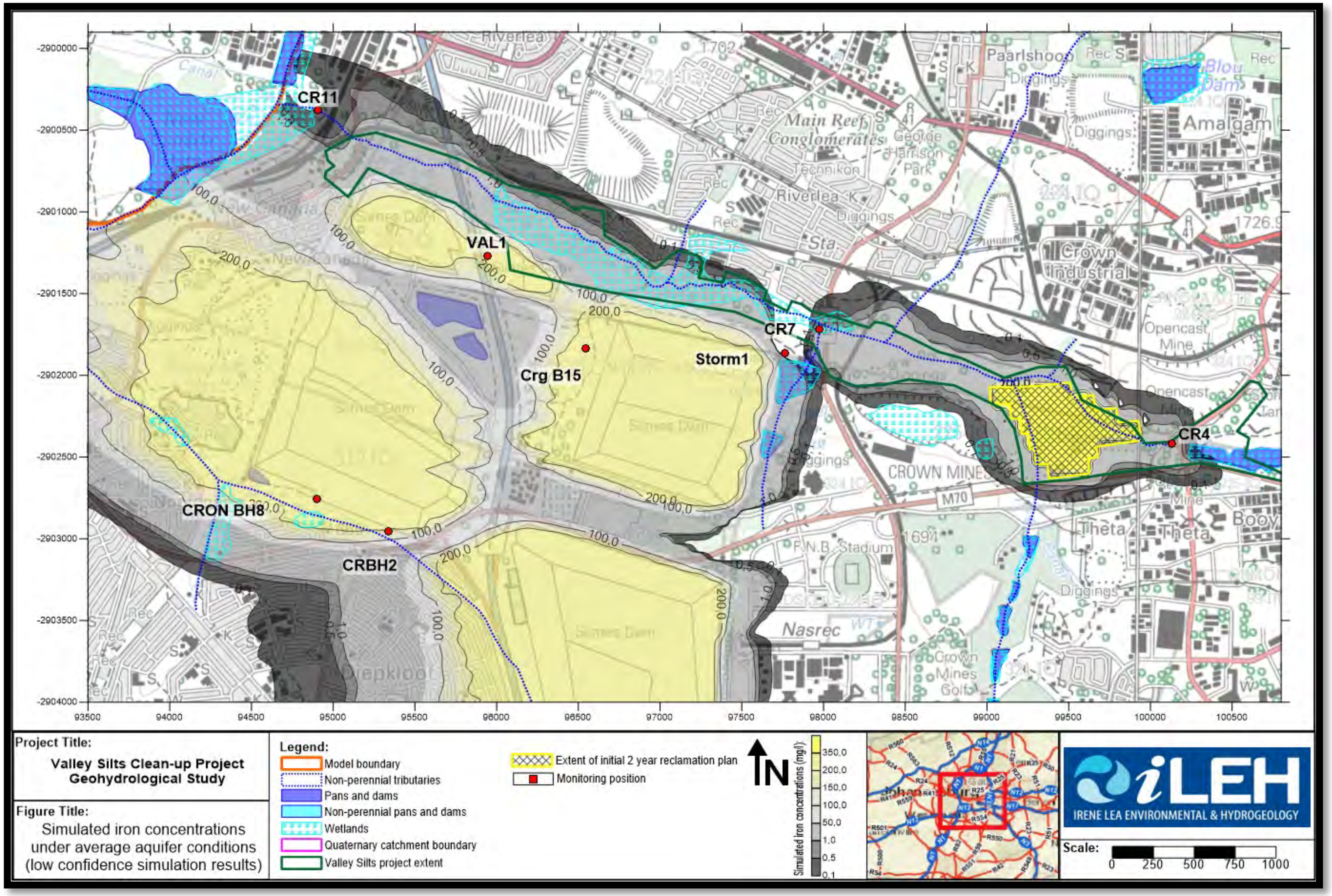


Figure 7-35. Simulated iron concentrations for average aquifer condition

7.7.9.4 *Impact on Wetlands*

The extent of sulphate and iron contamination of the wetlands associated with the Russell Stream and the tributary of the Klip River to the west is demonstrated in

Figure **7-32** to Figure 7-35.

The wetland situated immediately east of the desilting area for the first two years may experience an increase in both sulphate and iron concentrations in the long-term. The area over which this impact may occur is however limited and the impact should therefore not be significant in extent. It is possible that iron concentrations may increase to above 1 mg/L in groundwater that may feed this wetland. Iron precipitation will occur in the sediment as soon as lower pH conditions are encountered. Sulphate concentrations may exceed 500 mg/L for a short period of time while desilting takes place in this area but are expected to reduce to below 250 mg/L in the long-term.

It is likely that the wetland associated with the tributary of the Klip River, situated west of the Valley Silts project will be affected by a reduction in groundwater quality. The impact of historical tailings deposition in this area will most probably have a far more significant impact on this wetland, compared to the Valley Silts project. Simulations with average aquifer conditions suggest that sulphate concentrations may increase to above 300 mg/L during the operational phase of the project but is expected to reduce to below 200 mg/L in the long-term.

There is currently no information available to assess the interaction between groundwater and surface water, as well as the wetlands with any confidence. To make this calculation, it is important to understand the depth to the groundwater table in the areas of interest, as well as to determine the permeabilities of the sediments present. In the absence of this information, it is not feasible to calculate the salt load onto the wetlands and streams as a result of the project.

7.8 Air Quality

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

7.8.1 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 Project 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 Project 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 7-25).

Table 7-25: 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

7.8.1.1 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).

7.8.1.2 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).

7.8.2 Ambient Air Quality

The proposed Valley Silts Project is located in the City of Johannesburg Metropolitan Municipality, in Gauteng Province. The City of Johannesburg AQMP found exceedances of both the PM_{10} and $PM_{2.5}$ NAAQS (CSIR and Airshed Planning Professionals, 2017). They found that fine particulate concentrations are elevated throughout much of the city, however, concentrations are highest in low-income areas. The emissions inventory showed that there are several sectors that emit pollutants which affect the ambient air quality of the city. 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.

There are many dust fallout monitoring stations and one air quality monitoring station within a 5 km radius of the Valley Silts project area (Figure 7-36) Although some of these stations are currently not in operation, the large number of dust fallout monitoring stations are an indication of the concern for air quality in the area. Four of the operational stations lie within 250 m of the Valley Silts Project area boundary. They are Wilhelmina L.P. School, Stockwell, Sand Street and Gabiebula. The graph of the measured average dust deposition rates at these monitoring stations. Figure 7-36 illustrates that there have been no exceedances of the National Dustfall Standard of 600 mg/m^2/day for these residential areas in the period from July 2016 to June 2019.

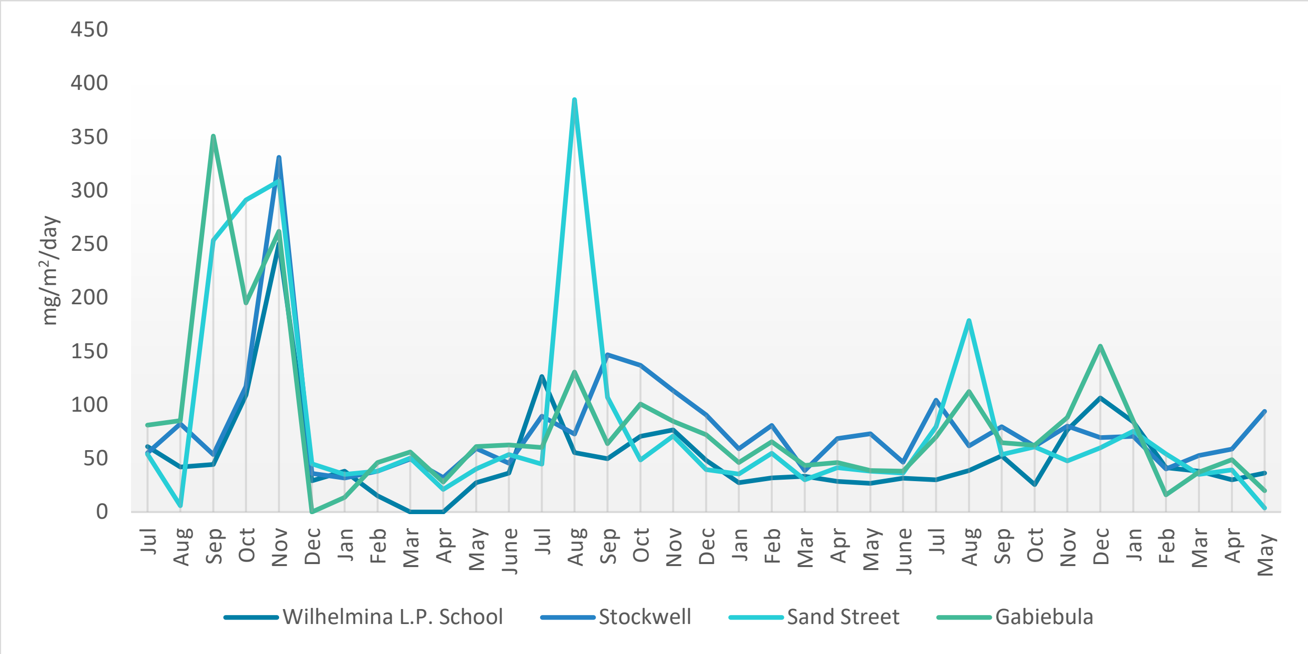


Figure 7-36: Monthly average dust deposition rates from July 2016 to June 2019.

Figure 7-39 and Figure 7-38 are graphs, compiled on the South African Air Quality Information System (SAAQIS) website, of the measured average daily PM_{10} and $PM_{2.5}$ ambient concentrations at the Diepkloof air quality monitoring station. They indicate high ambient concentrations of these criteria pollutants, with several exceedances of the NAAQS. Although the Diepkloof air quality monitoring station lies approximately 3.5 km away from the Valley Silts Project area, it does highlight and confirm the concern about air quality in this area.

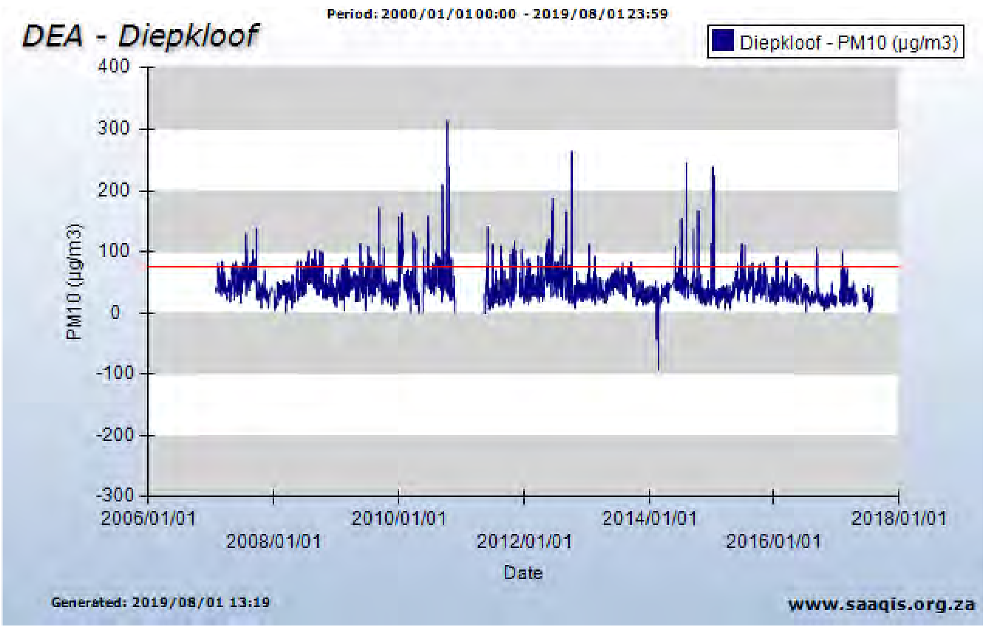


Figure 7-37: Daily average PM_{10} concentrations for the Diepkloof air quality monitoring station (SAAQIS, 2019).

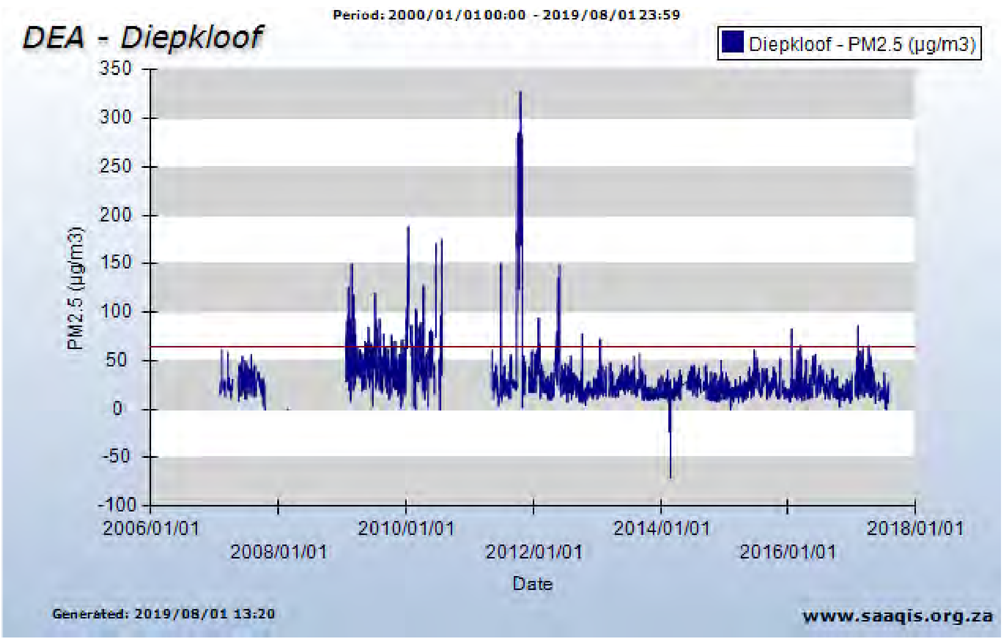


Figure 7-38: Daily average $PM_{2.5}$ concentrations for the Diepkloof air quality monitoring station (SAAQIS, 2019).

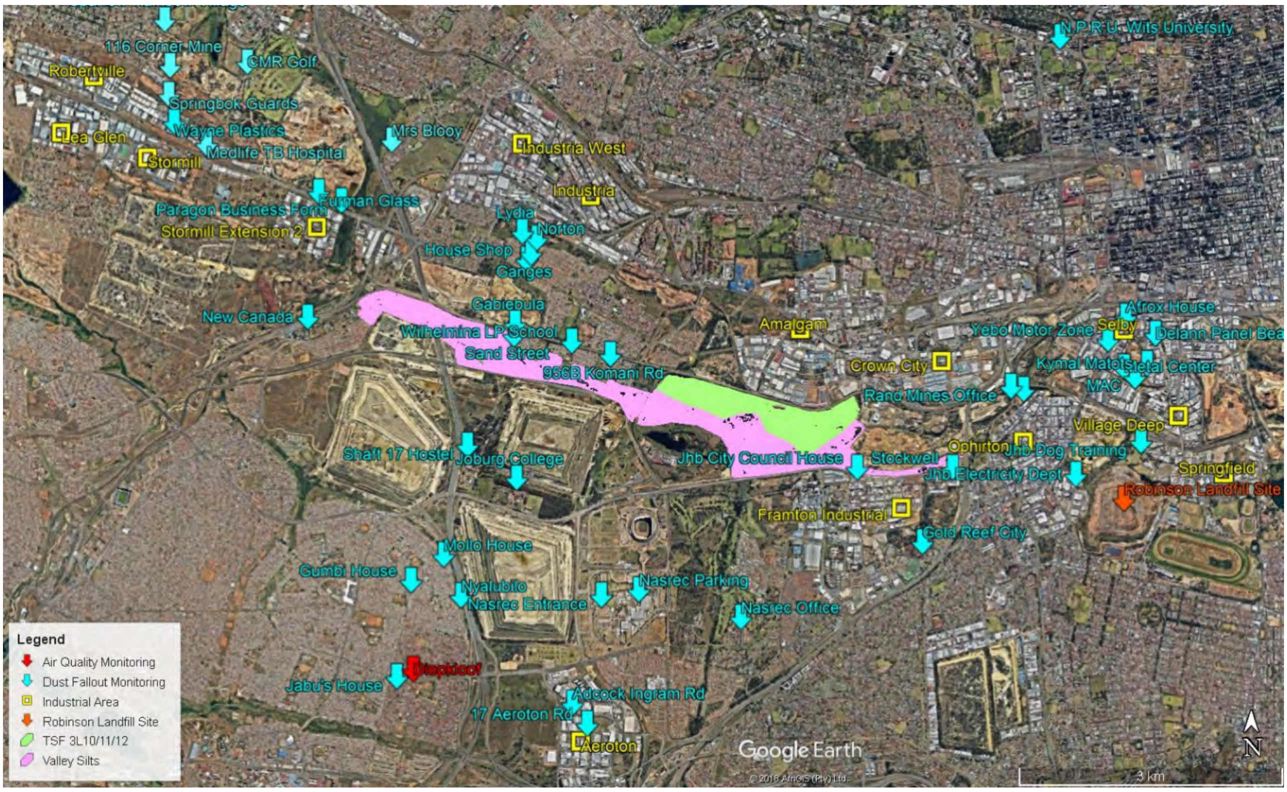


Figure 7-39: Industrial areas and monitoring stations in the vicinity of the Valley Silts

7.8.3 Dispersion Modelling

Dispersion simulations were undertaken to determine ambient concentrations of $PM_{2.5}$ and PM_{10} resulting from activities related to the Valley Silts project. There will be two reclamation fronts in the valley, each producing a maximum of 50 000 tons of silt per month. The modelling was split into two areas: a) the central area which is situated directly to the south of the drying area between Crownwood Road and Nasrec Road and b) the eastern and western areas which lie to the east of Crownwood Road and to the west of Nasrec Road respectively. Because of the proximity of the western areas to a residential area, different haulage options were simulated to illustrate the impact on the residents. The following scenarios were simulated:

- Reclamation from the central project area.
- Reclamation from the eastern and western areas with haulage along the southern boundary of the western area.
- Reclamation from the eastern and western areas with haulage along the northern boundary of the western area.
- Reclamation from the eastern and western areas with haulage from the western area split equally between the northern and southern boundary roads.

Four scenarios were simulated – one showing the reclamation of two faces in the central area to the south of the drying area and three different scenarios for reclamation of the western and eastern parts of the project area. One scenario with hauling only on the southern boundary, one with hauling only on the northern boundary and one with half (25 000 t) of the material hauled along the northern boundary and half along southern boundary.

The dispersion of particulate matter was modelled up to a distance of 5 km from the centre of the project area. The isopleths of the modelling results for $PM_{2.5}$ and PM_{10} are given in Figure 7-40 to Figure 7-55 below. The red isopleths represent the NAAQS, therefore all areas within the red coloured isopleth in the figures can be expected to experience exceedances of the relevant National Standards.

It should be noted that isopleth plots reflecting the 24-hour averaging periods contain the 99th percentile or the average of the fifth-highest predicted ground level concentrations, over the three-year period for which simulations were undertaken. In other words, the model calculates the fifth-highest concentration at each receptor for each year modelled, and then averages those fifth-highest concentrations at each receptor across the three years of meteorological data for plotting. This is in line with the NAAQS which allows for four exceedances per year. Concentrations are presented in µg m^{-3}.

7.8.4 Evaluation of the Central Area Modelling Results

7.8.4.1 PM_{10}

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m^3 up to approximately 175 m from the roads and up to approximately 300 m from the drying area footprint. This includes exceedances over the part of the residential suburb of Riverlea which lies to the east of Nasrec Road and parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.

- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m^3 up to approximately 140 m from the roads and up to approximately 175 m from the drying area footprint. This includes exceedances over the closest part of the residential suburb of Riverlea which lies to the east of Nasrec Road and parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.

7.8.4.2 $PM_{2.5}$

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m3 up to approximately 90 m from the roads and up to approximately 140 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.
- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 20µg/m3 up to approximately 100 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north of the 3L10/11/12 footprint. Exceedances of the NAAQS are not expected from road emissions for this scenario except where the roads curve causing concentrations to be amplified.

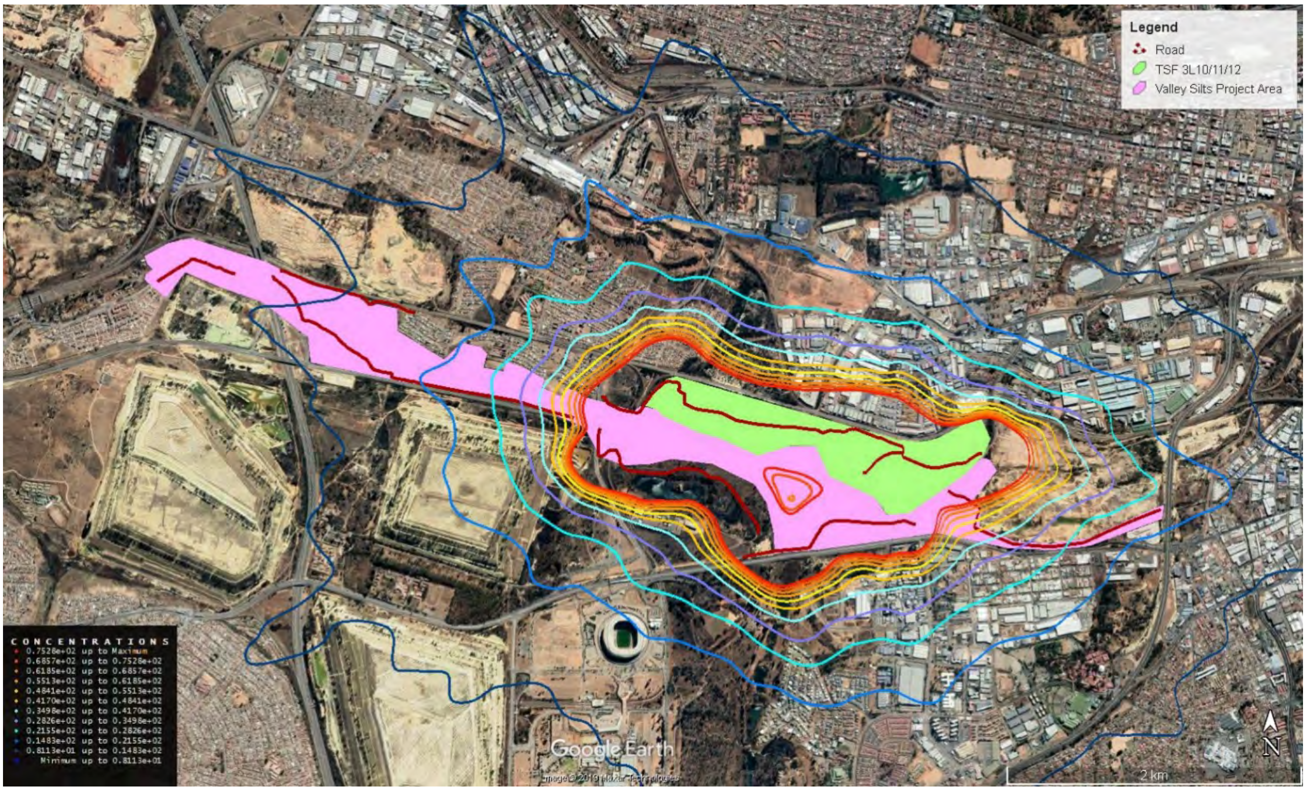


Figure 7-40: Modelled prediction of highest 24-hour average PM10 concentrations resulting from the reclamation of the Valley Silts central area.

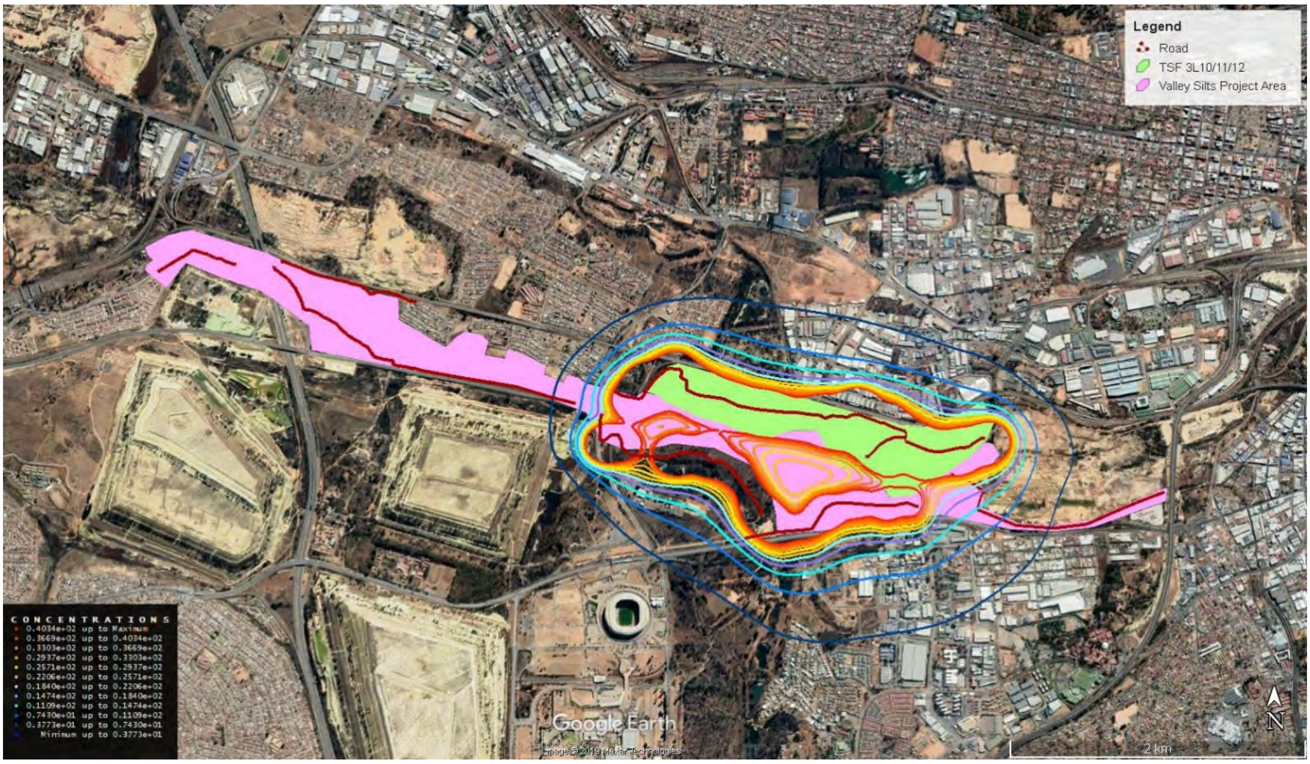


Figure 7-41: Modelled prediction of the annual average PM_{10} concentrations resulting from the reclamation of the Valley Silts central area

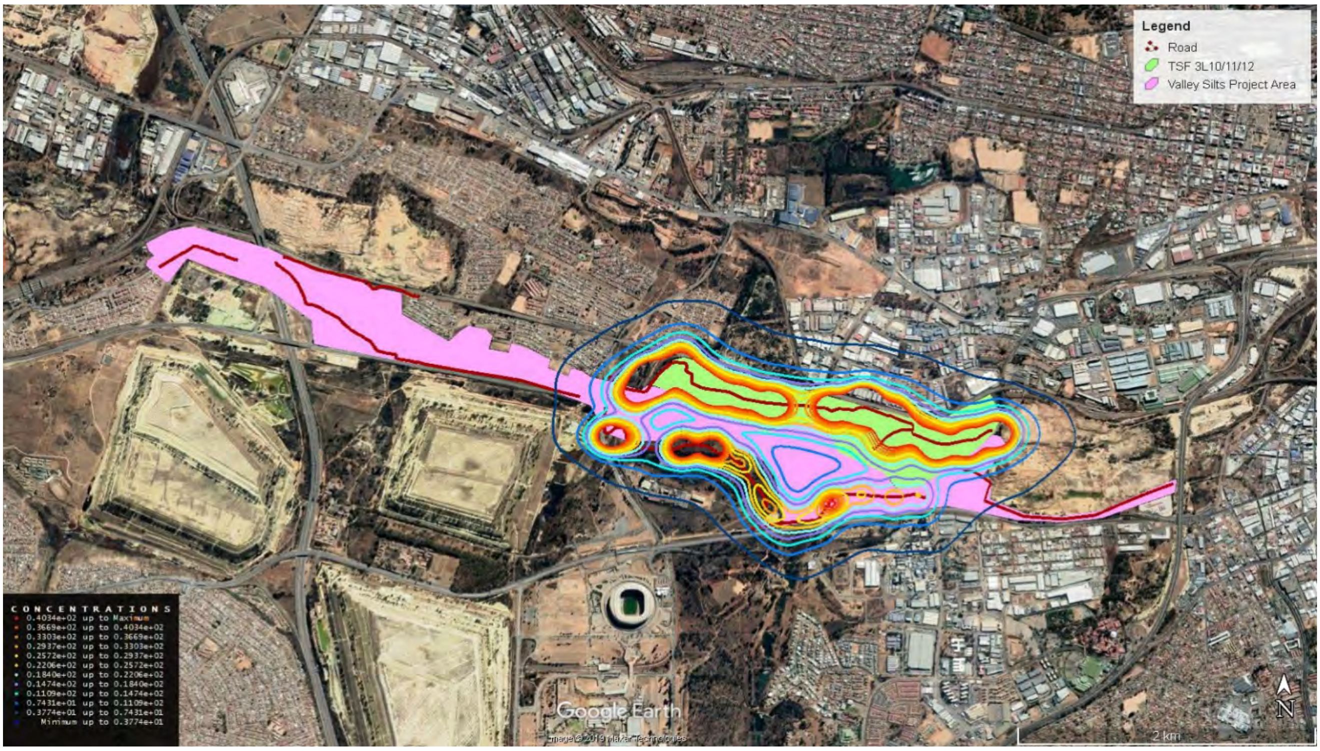


Figure 7-42: Modelled prediction of highest 24-hour average $PM_{2.5}$ concentrations resulting from the reclamation of the Valley Silts central area.

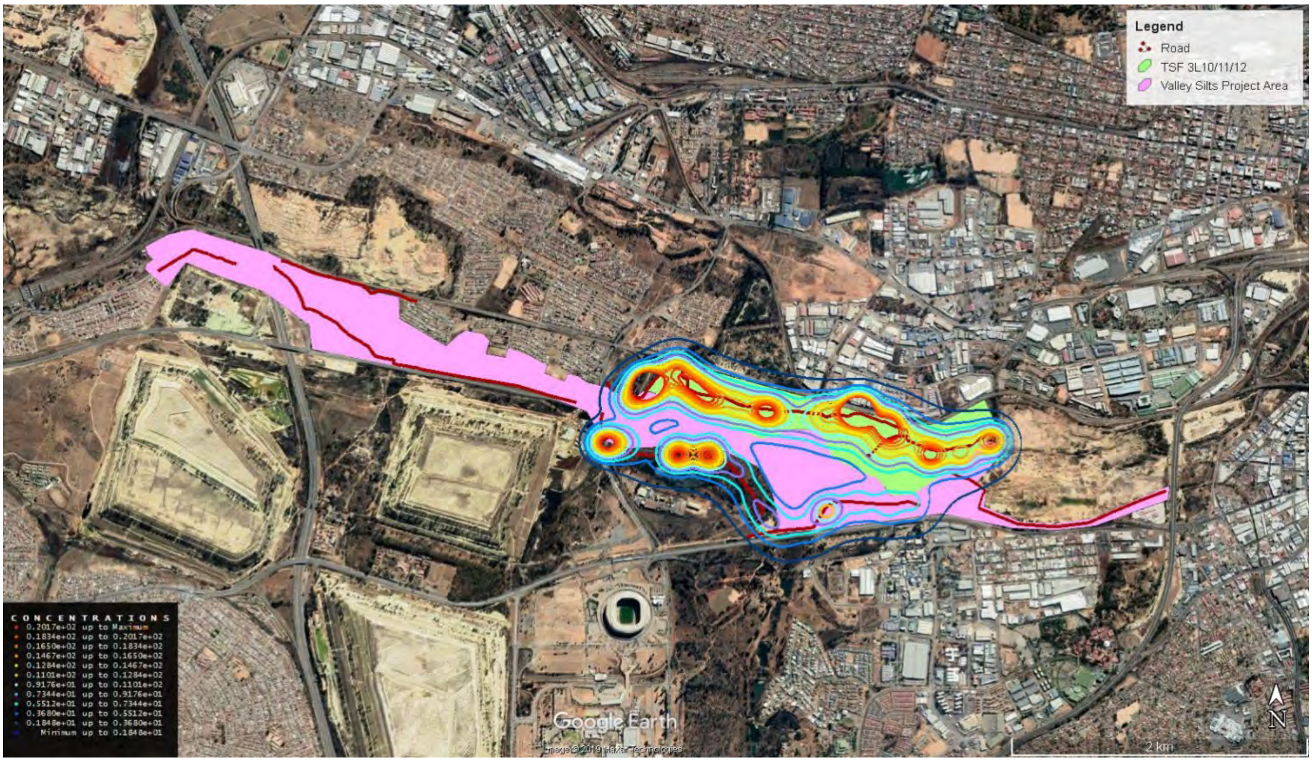


Figure 7-43: Modelled prediction of the annual average $PM_{2.5}$ concentrations resulting from the reclamation of the Valley Silts central area.

7.8.5 Evaluation of the Eastern Area and Western Area – Southern Road Modelling Results

7.8.5.1 PM_{10}

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m3 up to approximately 175 m from the roads and up to approximately 300 m from the drying area footprint. This includes exceedances over the part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.
- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m3 up to approximately 140 m from the roads and up to approximately 175 m from the drying area footprint. This includes exceedances over the closest part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.

7.8.5.2 $PM_{2.5}$

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m3 up to approximately 90 m from the roads and up to approximately 140 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.

- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 20µg/m3 up to approximately 100 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north of the 3L10/11/12 footprint. Exceedances of the NAAQS are not expected from road emissions for this scenario except where the roads curve causing concentrations to be amplified.

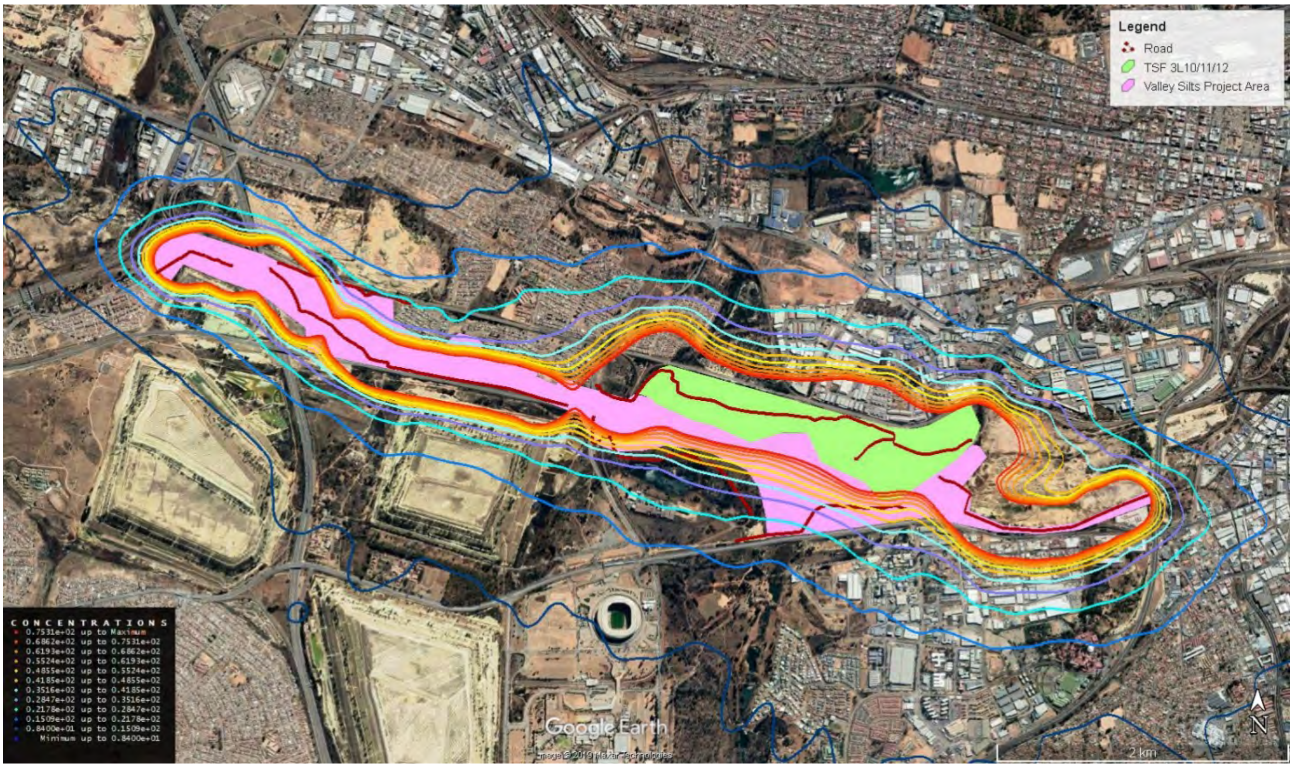


Figure 7-44: Modelled prediction of the highest 24-hour average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using southern roads for hauling.

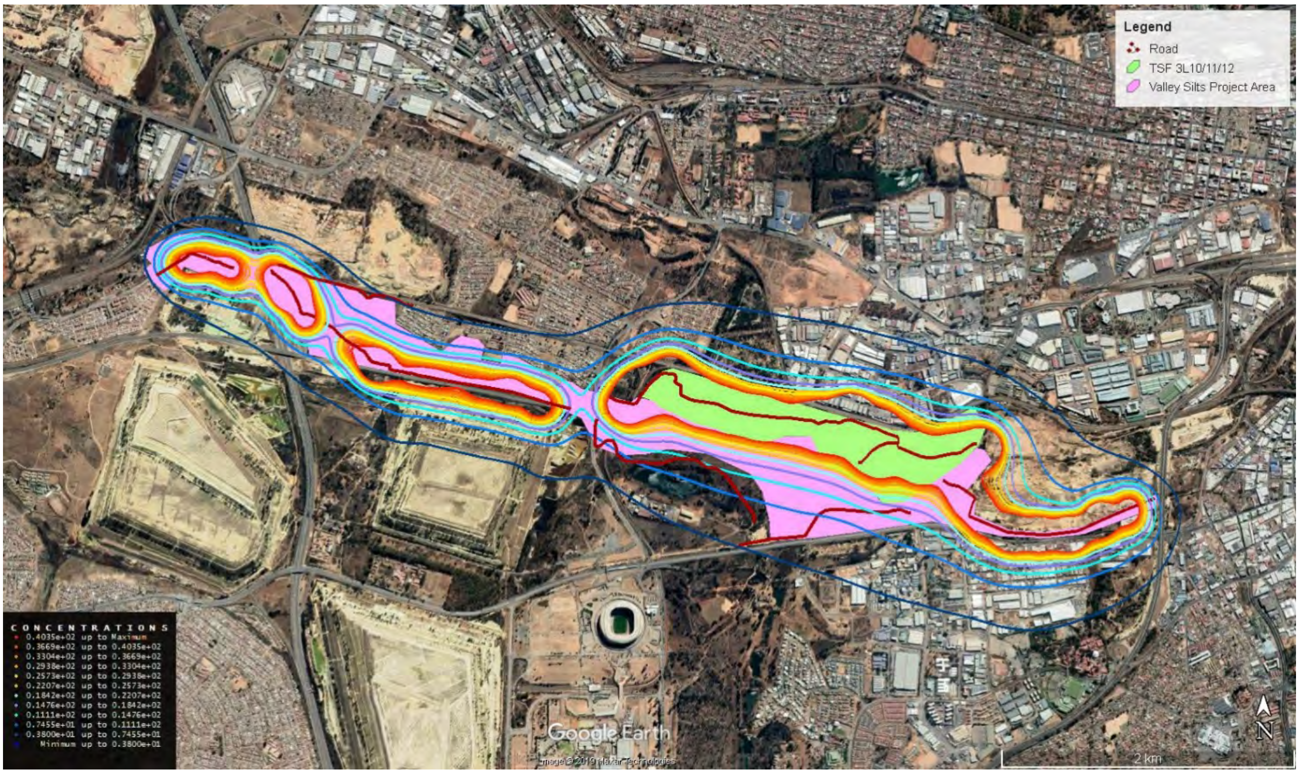


Figure 7-45: Modelled prediction of annual average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using southern roads for hauling.

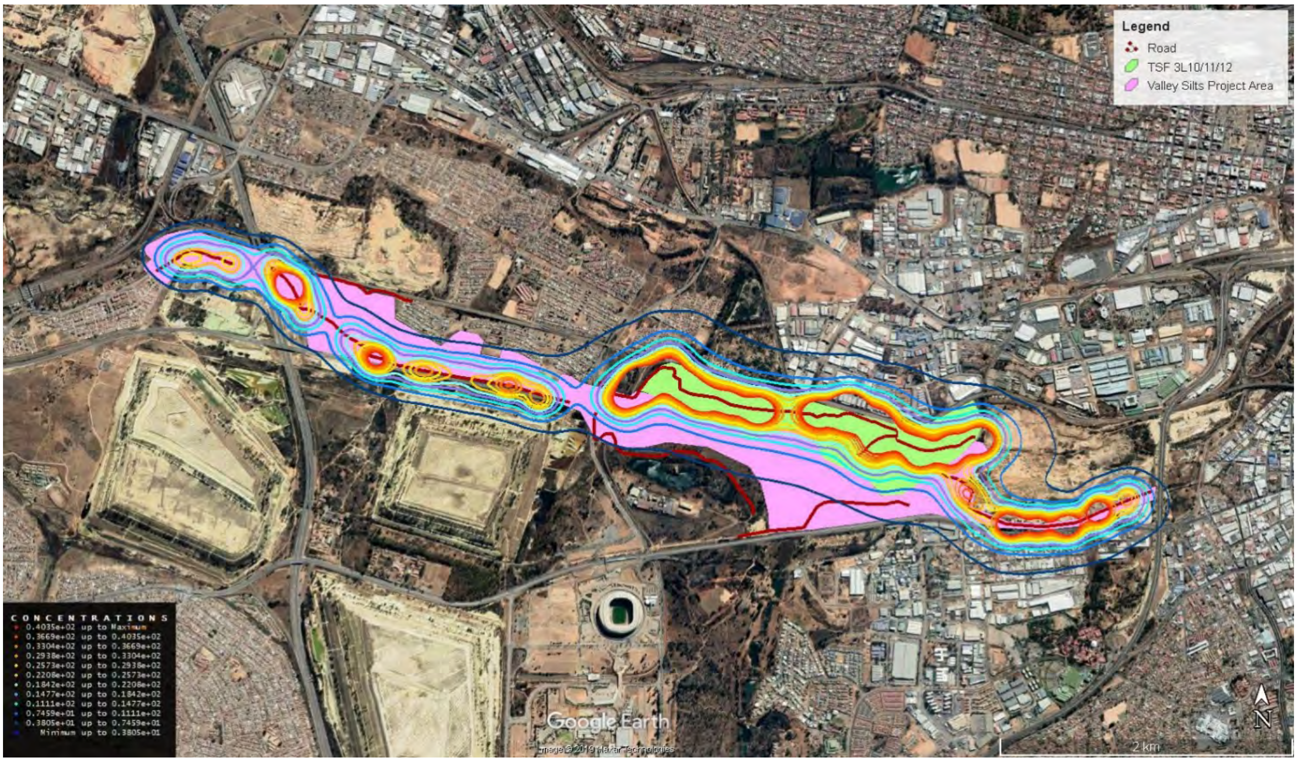


Figure 7-46: Modelled prediction of the highest 24-hour average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using southern roads for hauling.

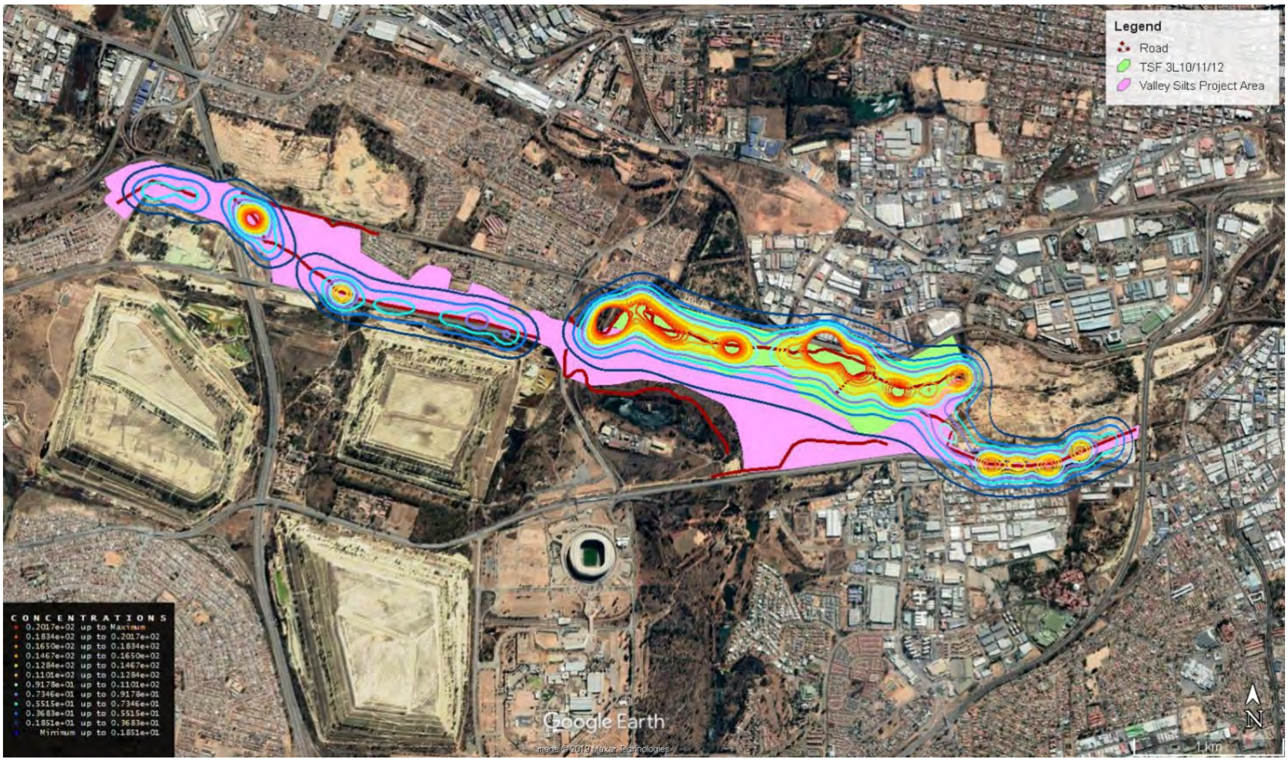


Figure 7-47: Modelled prediction of annual average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using southern roads for hauling.

7.8.6 Evaluation of the Eastern Area and Western Area – Northern Road Modelling Results

7.8.6.1 PM_{10}

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m3 up to approximately 175 m from the roads and up to approximately 300 m from the drying area footprint. This includes exceedances over the part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.
- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m3 up to approximately 140 m from the roads and up to approximately 175 m from the drying area footprint. This includes exceedances over the closest part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.

7.8.6.2 $PM_{2.5}$

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m3 up to approximately 90 m from the roads and up to approximately 140 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.

- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 20µg/m3 up to approximately 100 m from the drying area footprint. This includes exceedances over parts of the industrial areas which lie to the north of the 3L10/11/12 footprint. Exceedances of the NAAQS are not expected from road emissions for this scenario

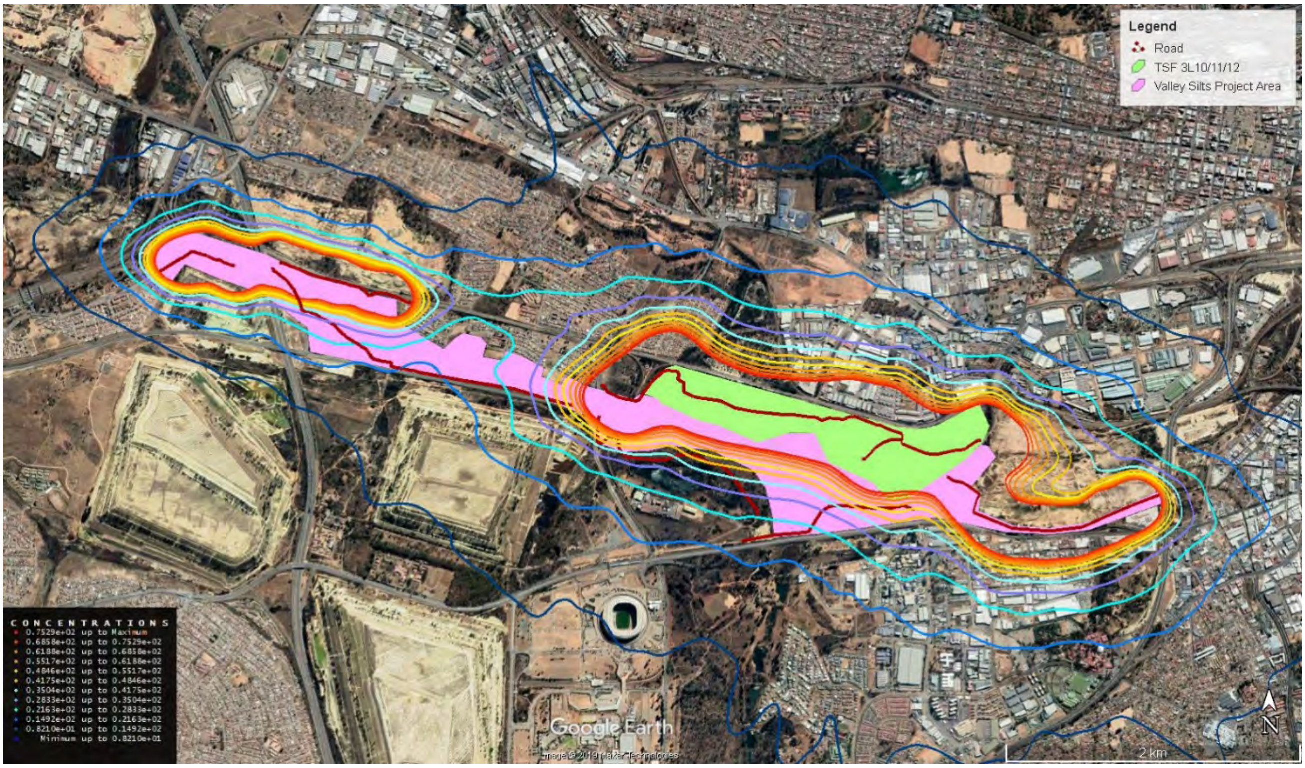


Figure 7-48: Modelled prediction of the highest 24-hour average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using northern roads for hauling.

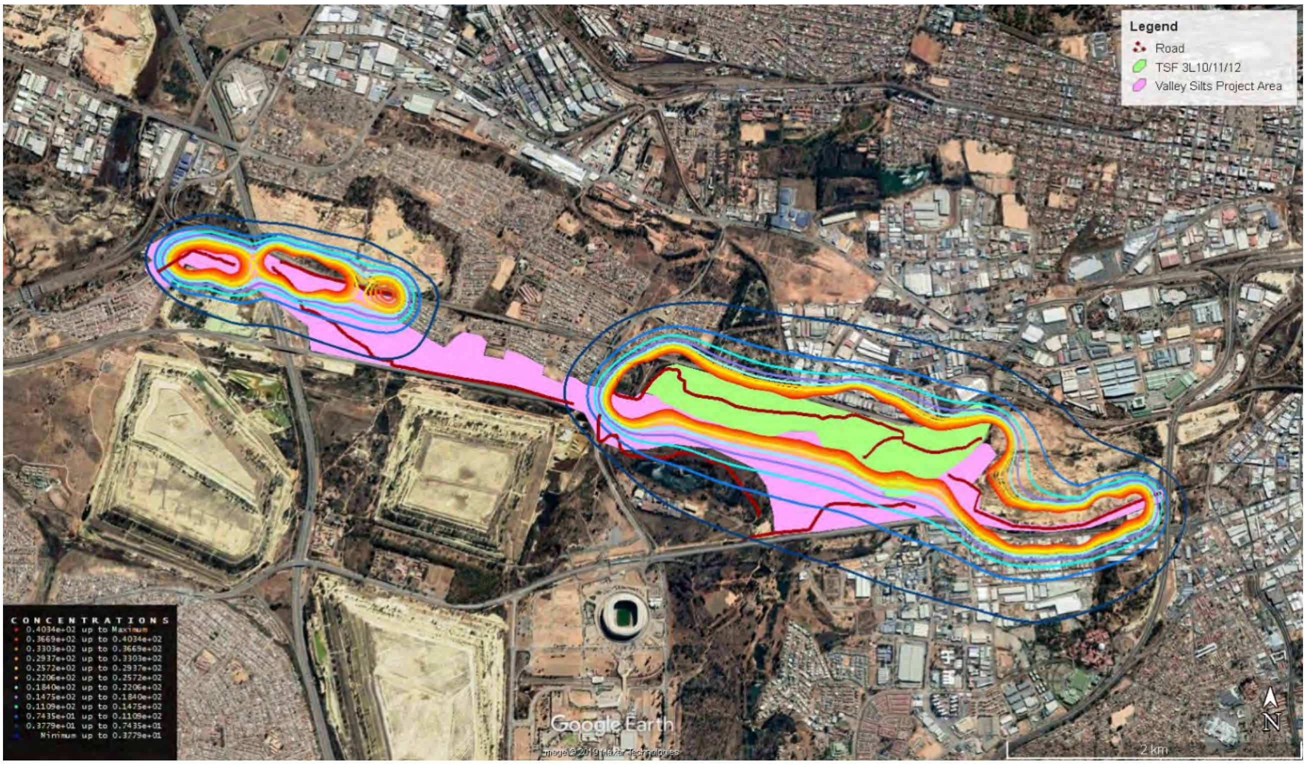


Figure 7-49: Modelled prediction of annual average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using northern roads for hauling.

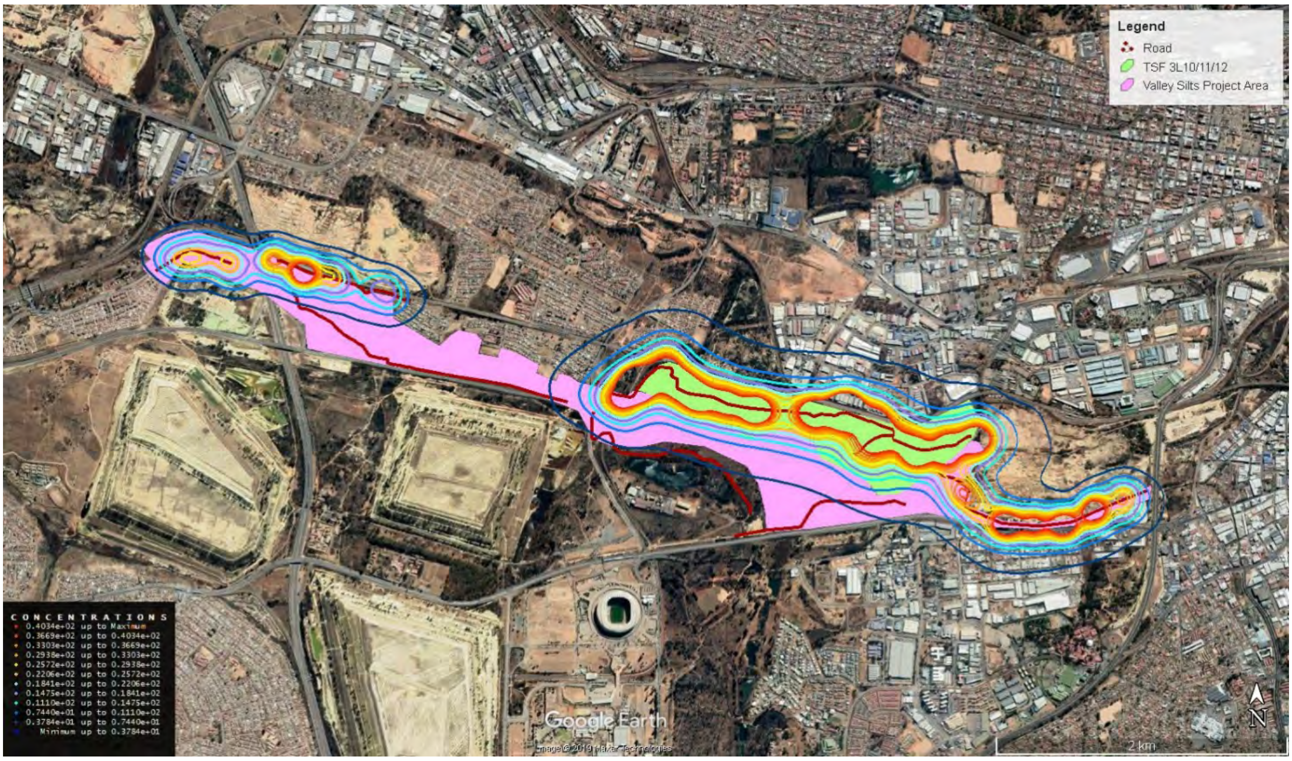


Figure 7-50: Modelled prediction of the highest 24-hour average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using northern roads for hauling.

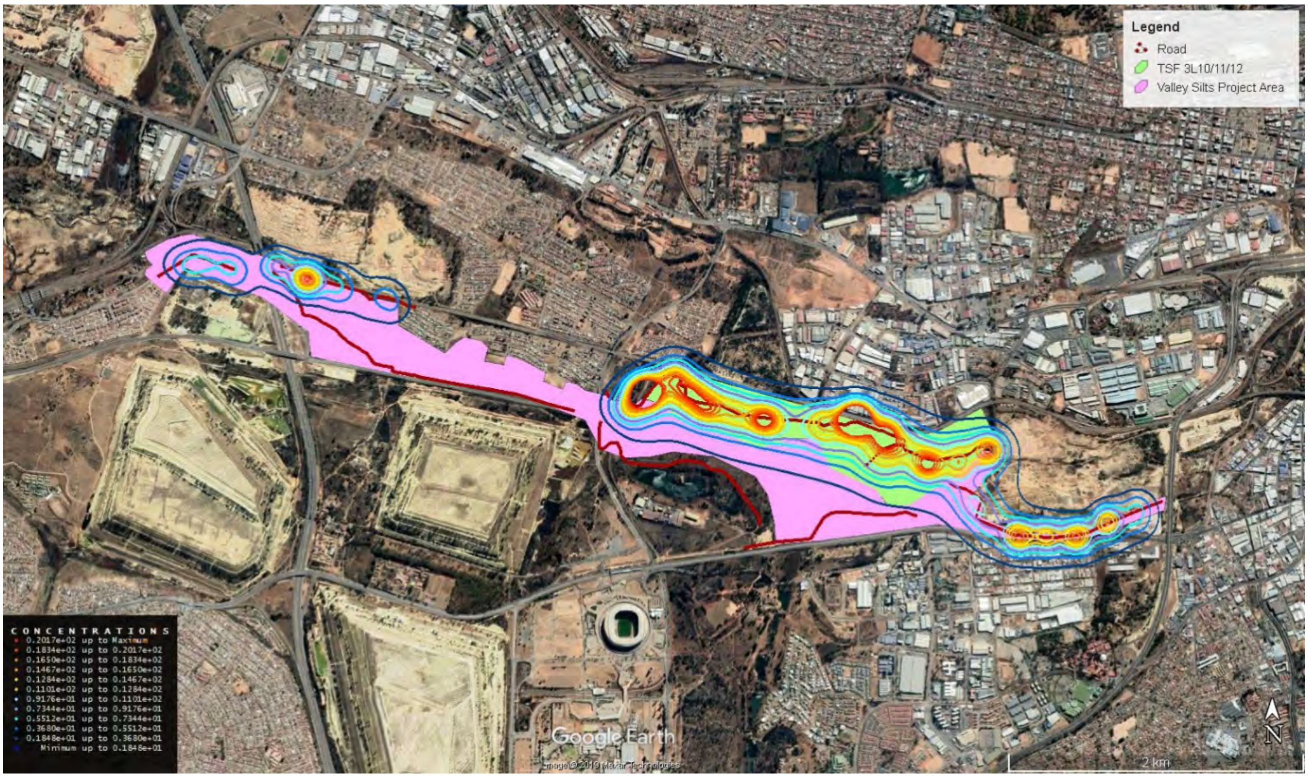


Figure 7-51: Modelled prediction of annual average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using northern roads for hauling.

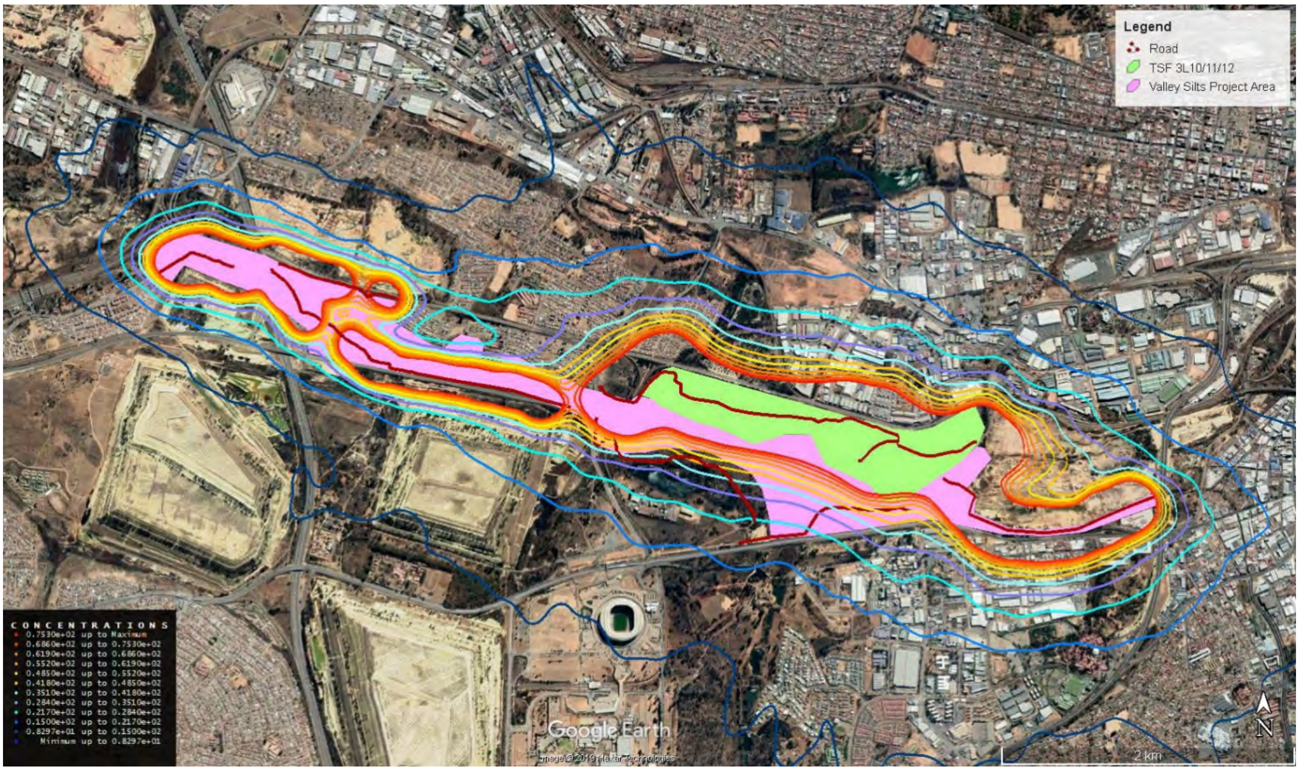


Figure 7-52: Modelled prediction of the highest 24-hour average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using both the southern and northern roads for hauling.

7.8.7 Evaluation of the Modelling Results for the Eastern Area and Western Area – Shared Tonnage over Both the Southern and Northern Roads

7.8.7.1 PM_{10}

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the national daily standard of 75µg/m3 up to approximately 175 m from the roads in the eastern area, 120 m from the roads in the western area and up to approximately 300 m from the drying area footprint. This includes exceedances over the part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.
- Annual Average Concentrations – the predicted maximum annual average concentrations exceed the national annual average standard of 40µg/m3 up to approximately 140 m from the roads in the eastern area, 80 m from the roads in the western area and up to approximately 175 m from the drying area footprint. This includes exceedances over the closest part of the residential suburb of Riverlea which lies to the east of Nasrec Road, parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint and parts of the Booysens Reserve industrial area to the south.

7.8.7.2 PM2.5

- 24-hour Average Concentrations – the predicted maximum daily average concentrations exceed the current national daily standard of 40µg/m3 up to approximately 90 m from the roads in the eastern area and up to approximately 140 m from the drying area footprint. No exceedances are expected in the western area for this scenario except for at the far western end where the northern and southern roads are closer than 150 m apart. This includes exceedances over parts of the industrial areas which lie to the north and east of the 3L10/11/12 footprint.

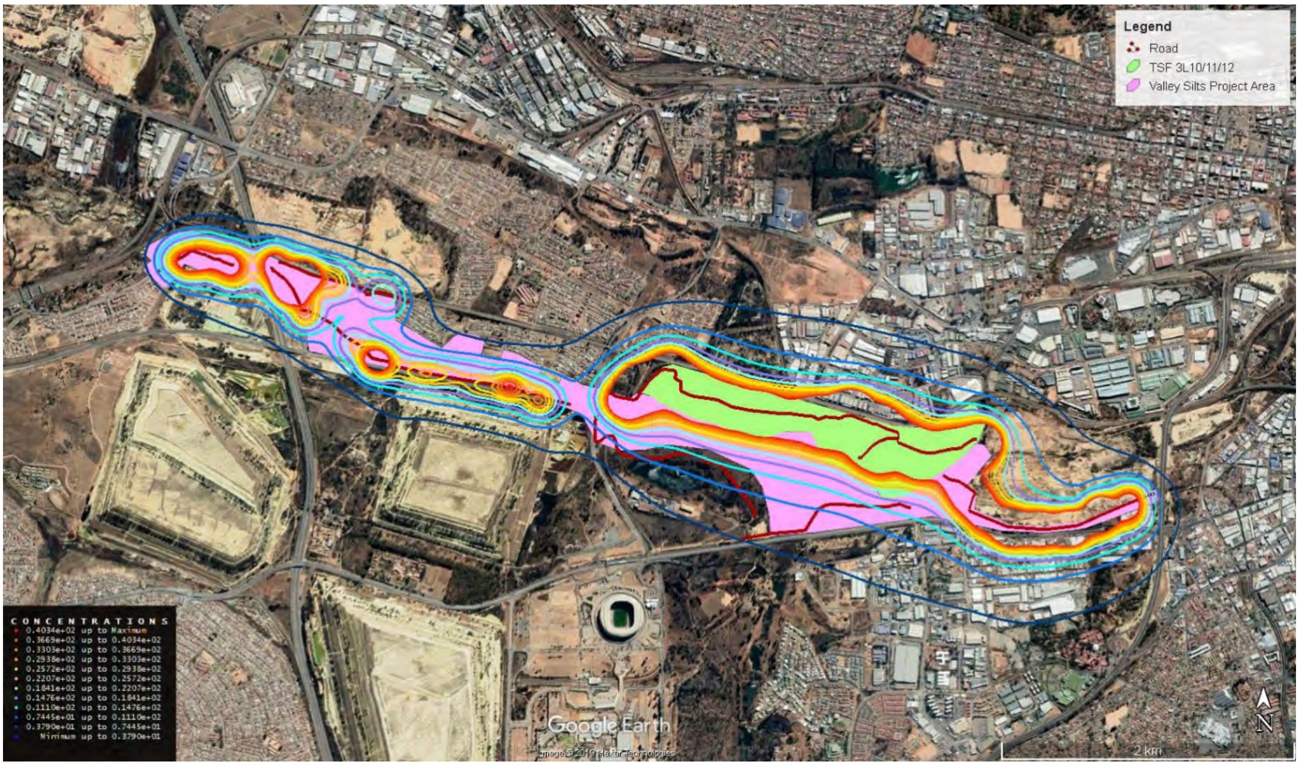


Figure 7-53: Modelled prediction of annual average PM_{10} concentrations resulting from the reclamation of the eastern and western areas using both the southern and northern roads for hauling.

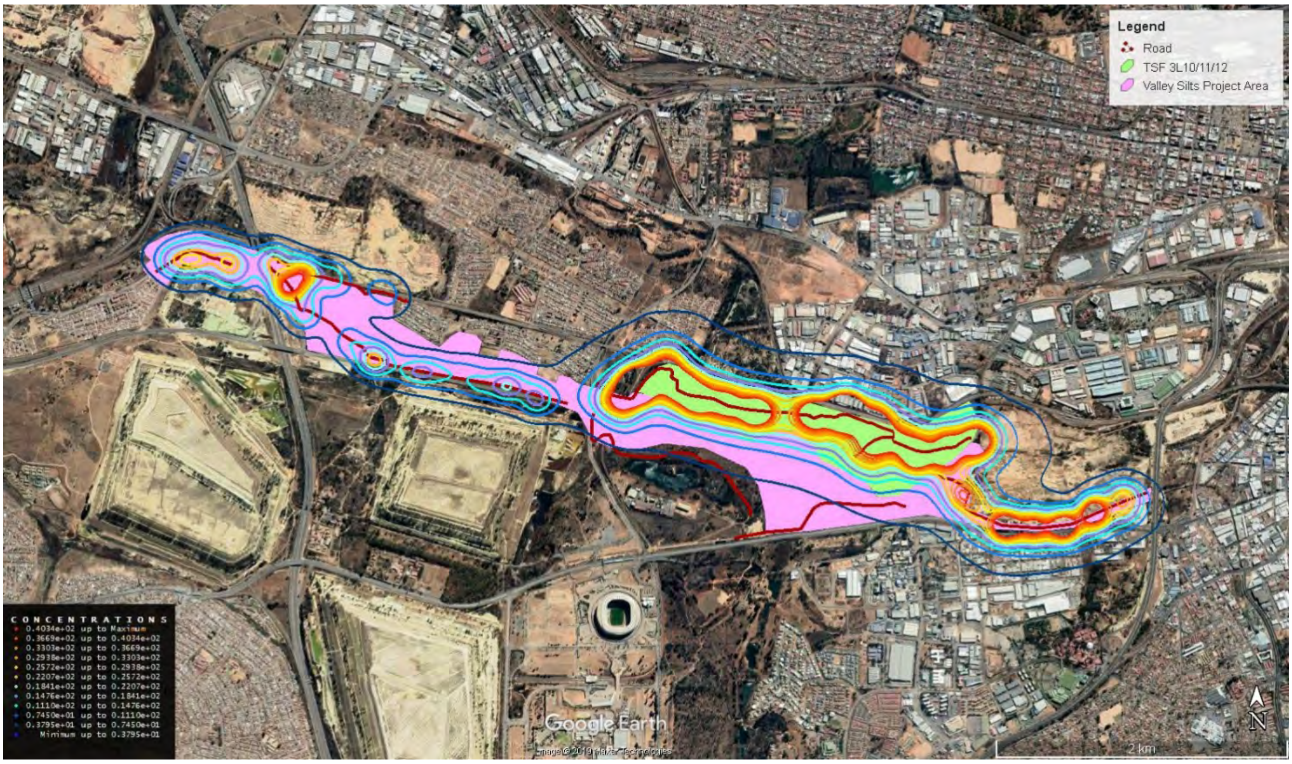


Figure 7-54: Modelled prediction of the highest 24-hour average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using both the southern and northern roads for hauling.

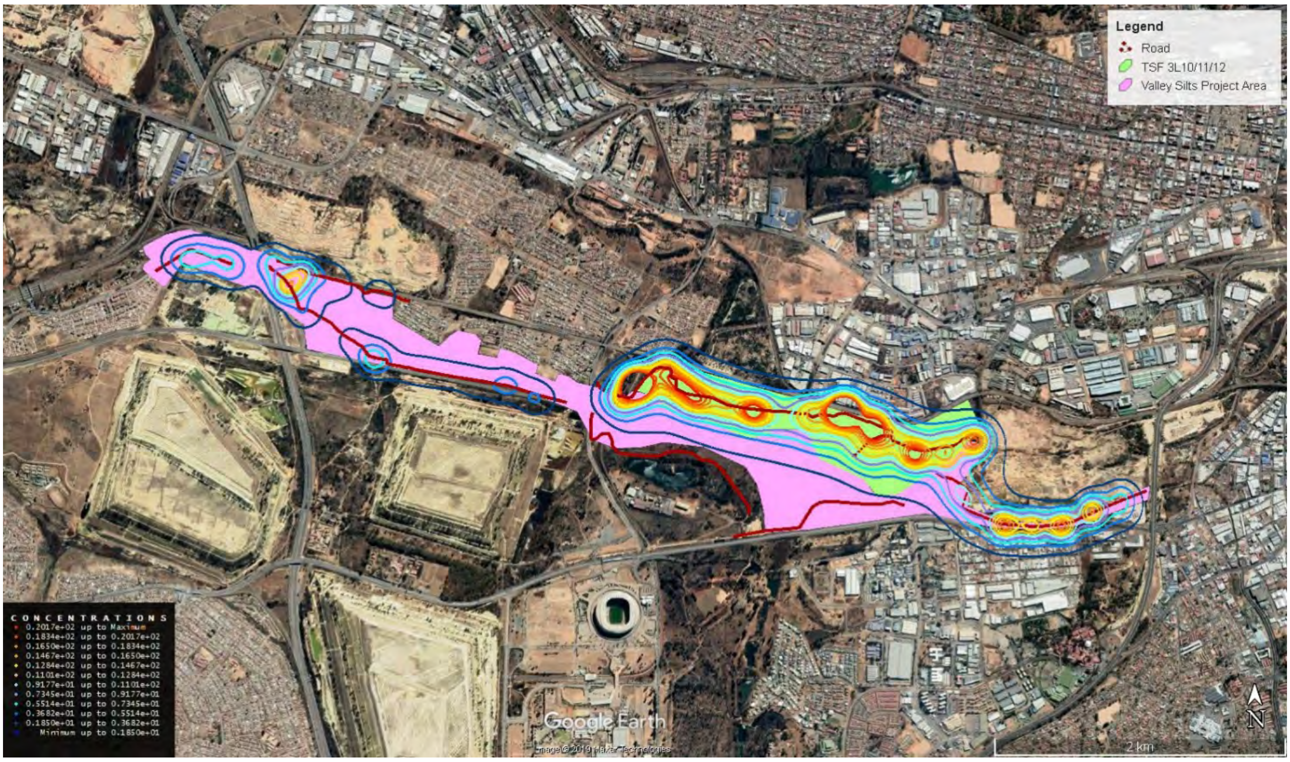


Figure 7-55: Modelled prediction of annual average $PM_{2.5}$ concentrations resulting from the reclamation of the eastern and western areas using both the southern and northern roads for hauling.

7.8.8 Conclusions drawn from the modelling results

The following conclusions can be made from the modelling results:

- It is assumed that silts will be hauled with a 40% moisture content, thereby reducing the effects of dust fallout during hauling. Trucks are to be covered with Tarpaulin when hauling.
- With 50 000 t of silt moved per month from a reclamation front, exceedances of the NAAQS can be expected up to approximately 175 m from the haul roads. This affects the residents of Riverlea to the north of the western project area, and the industrial area to the south of the eastern project area. Doubling up the amount of silt moved and hence the number of haul trucks required leads to exceedances being experienced up to approximately 320 m from the haul roads. Halving the number of haul trucks leads to exceedances being experienced up to approximately 120 m from the haul roads.
- The modelled configuration of roads and drying area indicates that exceedances of the NAAQS may be expected up to 300 m from the 3L10/11/12 footprint boundary. This affects some of the residents of Riverlea living to the east of Nasrec Road and parts of the industrial area to the north of the boundary of 3L10/11/12.
- For the purposes of the modelling, it was assumed that during reclamation of areas to the north of the river in the western project area, haul trucks will use the existing tarred roads of Riverlea Extension 1. If unpaved roads are used in this area, exceedances may be expected up to 175 m from the roads.

- The modelling indicates that sharing the hauling between the northern and southern roads in the western project area results in the lowest impact on the residents of Riverlea.

The air quality impacts from the Valley Silts Reclamation Project can be mitigated by keeping roads as far from the residential areas as possible, preferably more than 175 m away. Alternatively, wet or chemical suppression of unpaved roads should be used. Where possible, existing tarred roads should be used, and these roads should be swept/vacuumed regularly. To reduce the impact on the residential and industrial area to the north of the drying area, roads should be placed as far south as possible. Areas for drying and loading the silt should also be kept as far from the northern TSF footprint boundary as possible.

Furthermore, dust fallout rates 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 Dust Control Regulations, the mitigation programme will have to be increased until compliance is achieved

7.9 Heritage and Palaeontology

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

7.9.1 Site Description in terms of Heritage Resources

The greater Johannesburg region is synonymous with historical mining activities since the original farms including Langlaagte and Randjieslaagte were proclaimed as public diggings by the then Zuid-Afrikaansche Republiek (ZAR) government in 1886.

Existing surrounding land uses associated with the project area include a combination of:

- informal settlements, low-cost residential areas;
- community and municipal facilities;
- industrial areas;
- manufacturing and distribution facilities, commercial businesses;
- historical mine housing and historical mine infrastructure (slimes dams, shafts, derelict/abandoned buildings and water dams);
- illegal informal mining activities, formal mining activities;
- open land, and
- road infrastructure.

As a result, the vast majority of the Valley Silts Rehabilitation Project footprint overlays highly disturbed developed terrain. There is also evidence of illegal mining and dumping activities within the project area. Overall, the accessibility of the project footprint area was variable, with some sections more accessible than others. In the accessible areas the site detection visibility was relatively good as some areas had been burned, although other areas were obscured by dense vegetation (to Figure 7-65).

Figure 7-56: Access from Crownwood road to the Crown mines area

Figure 7-57 - View of the silted stream just east of the Crownwood road bridge crossing

Figure 7-58 - Illegal mining activity close to Crown Mines

Figure 7-59 - View of old Crownwood road bridge

Figure 7-60 - Silted up stream area just east of the Russell stream

Figure 7-61 - View of silted wetland originally called Golf Lake

Figure 7-62 - Stream just to the south of Riverlea

Figure 7-63 - Silts to the west of the Riverlea residential area

Figure 7-64 – Rocky ridge between The N1 and Riverlea extension

Figure 7-65 – Silted stream and wetland just west of Riverlea

7.9.2 Overview of Study Area and Surrounding Landscape

DATE	DESCRIPTION
2.5 million to 250 000 years ago	The Early Stone Age is the first and oldest phase identified in South Africa's archaeological history and comprises two technological phases. The earliest of these is known as Oldowan and is associated with crude flakes and hammer stones. It dates to approximately 2 million years ago. The second technological phase is the Acheulian and comprises more refined and better made stone artefacts such as the cleaver and bifacial hand axe. The Acheulian dates back to approximately 1.5 million years ago (Korsman, & Meyer, 1999).
250 000 to 40 000 years ago	The Middle Stone Age (MSA) is the second oldest phase identified in South Africa's archaeological history. This phase is associated with flakes, points and blades manufactured by means of the so-called 'prepared core' technique (Korsman, & Meyer, 1999).
40 000 years ago, to the historic past	The Later Stone Age (LSA) is the third archaeological phase identified and is associated with an abundance of very small artefacts known as microliths. (Korsman, & Meyer, 1999).

AD 450 – AD 750	Early Iron Age (EIA) sites in the Witwatersrand area date between 500 AD and 900 AD. The Magaliesberg mountain range represents the most southern point of distribution of these sites. The Mzonjani facies of the Kwale Branch of the Urewe Ceramic Tradition represents the earliest known Iron Age period within the surroundings of the study area. The decoration on the ceramics from these facies is characterised by punctuates on the rim as well as spaced motifs on the shoulder (Huffman, 2007). No EIA sites are known from the immediate vicinity of the footprint area
	The Late Iron Age (LIA) occupation of this area by Sotho-Tswana communities is represented by four ceramic sequences of the Urewe tradition: Ntsuanatsatsi (1450-1650), Olifantspoort (AD 1500 -1700), Uitkomst (AD 1700-1850) and Buispoort (1700-1840) (Huffman 2007). No LIA sites are known from the immediate vicinity of the footprint area.
AD 1450 – AD 1650	The Ntsuanatsatsi facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the second known Iron Age period within the surroundings of the study area. The decoration on the ceramics from this facies is characterised by a broad band of stamping in the neck, stamped arcades on the shoulder and appliqué. Huffman (2007) suggest that the Ntsuanatsatsi facies can be directly linked to the early Bafokeng who were the first Mbo Nguni people to leave present-day KwaZulu-Natal.
AD 1500 - AD 1700	The Olifantspoort facies of the Moloko Branch of the Urewe Ceramic Tradition is the third Iron Age facies to be identified within the surroundings of the study area. The Olifantspoort facies can likely be dated to between AD 1500 and AD 1700. The key features of the decoration used on the ceramics from this facies include multiple bands of fine stamping or narrow incision separated by colour (Huffman, 2007). The type site for this facies is located on the farm Olifantspoort 328 JQ, near Rustenburg in the North West Province. The Olifantspoort facies holds an important position in the sequence of the Moloko or Sotho-Tswana group. The earliest facies to be associated with the Moloko is the Icon facies (AD 1300 – 1500), with sites found across large sections of what is today the Limpopo Province. The Icon facies resulted in three different and parallel Iron Age facies, namely the Madikwe facies (AD 1500 – 1700) (which in turn led to the Buispoort facies between AD 1700 and 1850), the Letsibogo facies (AD 1500 – 1700) and thirdly the Olifantspoort facies. The Olifantspoort facies developed into the Thabeng facies (AD 1700 – 1850) (Huffman, 2007). It is therefore evident that the Olifantspoort facies represents a key pillar in our understanding of the origins and sequence of the Sotho-Tswana people of today (Huffman, 2007).
AD 1650 – AD 1850	The Uitkomst facies of the Blackburn Branch of the Urewe Ceramic Tradition represents the third Iron Age period to be identified for the surroundings of the study area. This facies can likely be dated to between AD 1650 and AD 1820. The decoration on the ceramics associated with this facies is characterised by stamped arcades, appliqué of parallel incisions, stamping and cord impressions and is described as a mixture of the characteristics of both Ntsuanatsatsi (Nguni) and Olifantspoort (Sotho) (Huffman, 2007). The type-site Uitkomst Cave, was excavated by Professor R.J. Mason of the University of the Witwatersrand as part of a project to excavate five cave sites (Glenferness, Hennops

	River, Pietkloof, Zwartkops and Uitkomst) in the Witwatersrand-Magaliesberg area. Uitkomst was chosen as the type site for the particular Iron Age material excavated at these sites, as its deposit was found to be well stratified and the site "...illustrates the combination of a certain kind of pottery with evidence for metal and food production and stone wall building found at the open sites..." (Mason, 1962:385). The Uitkomst pottery is viewed as a combination of Ntsuanatsatsi and Olifantspoort, and with the Makgwareng facies is seen as the successors to the Ntsuanatsatsi facies. The Ntsuanatsatsi facies is closely related to the oral histories of the Early Fokeng people and represents the earliest known movement of Nguni people out of Kwazulu-Natal into the inland areas of South Africa. Regarding this theory, the Bafokeng settled at Ntsuanatsatsi Hill in the present-day Free State Province. Subsequently, the BaKwena lineage had broken away from the Bahurutshe cluster and crossed southward over the Vaal River to come in contact with the Bafokeng. As a result of this contact a Bafokeng-Bakwena cluster was formed, which moved northward and became further 'Sotho-ised' by coming into increasing contact with other Sotho-Tswana groups. According to this theory, this eventually resulted in the appearance of Uitkomst facies type pottery which contained elements of both Nguni and Sotho-Tswana speakers (Huffman, 2007). Huffman states that the Uitkomst facies is directly associated with the Bafokeng (Huffman, 2007). However, it worth noting that not all researchers agree with this proposition of the Bafokeng origins. In their book on the history of the Bafokeng, Bernard Mbenga and Andrew Mason indicate that the research of Prof. R.J. Mason and Dr. J.C.C. Pistorius "...would indicate that the Bafokeng originated from the Bahurutshe-Bakwena-Bakgatla lineage cluster. Tom Huffman holds a different view..." (Mbenga & Mason, 2010).
AD 1700 – AD 1840	The Buispoort facies of the Moloko branch of the Urewe Ceramic Tradition is the next phase to be identified within the greater Witwatersrand area. It is most likely dated to between AD 1700 and AD 1840. The key features on the decorated ceramics include rim notching, broadly incised chevrons and white bands, all with red ochre (Huffman, 2007). It is believed that the Madikwe facies developed into the Buispoort facies. The Buispoort facies is associated with sites such as Boschhoek, Buffelshoek, Kaditshwene, Molokwane and Olifantspoort (Huffman, 2007).

7.9.3 Previous Archaeological and Heritage Studies in and around the Study Area

A scan of the South African Heritage Resources Information System (SAHRIS) database has revealed the following studies conducted in and around the study area of this report, including a previous heritage impact assessment study for the proposed Reclamation of the Soweto Cluster Dumps (du Piesanie 2014). These studies are summarised below in ascending date order:

- Application for Permit: Archaeological and Palaeontological Sites and Meteorites – Old Crown Mines Cemetery,
- Fourie, M. 2010. Heritage Scoping Assessment and Notice of Intent to Develop for the Proposed Pipeline Project. For Crown Gold Recoveries (Pty) Ltd by Digby Wells & Associates. No potential heritage resources were observed in the project area.

- Van der Walt, J. 2013. Archaeological Impact Assessment for the Proposed Filling Station on Erf 330 Crown Extension 18, Crown Mines, Gauteng Prepared for Marinda le Roux. Apart from an avenue of Plane trees on the northern periphery of the site no other sites of heritage significance were identified on Erf 330. However, the site is adjacent to the Provincial Heritage site of Langlaagte Deep Mining village also known as Crown Village
- Van Schalkwyk, 2016. Heritage Impact Assessment for the Proposed Installation of Turffontein Corridor Conduits and Outfalls Storm Water Management Systems, City of Johannesburg District Municipality, Gauteng Province. For Envirolution Consulting. A very large number of features, mostly houses and infrastructure related features occur in the region. All of these are very formal and clearly visible. Due to the fact that the development will take place inside the road reserve, it was considered unlikely that any such features would be impacted by the construction of the storm water corridor conduits and outfalls.

7.9.4 Historical Background of Johannesburg, including Riverlea, Booysens, Ophirton

7.9.4.1 Johannesburg,

The City of Johannesburg developed from a mining camp after gold-bearing conglomerate was discovered on the farm Langlaagte in 1886 by George Harrison and George Walker, more or less at the same time as discoveries in the Krugersdorp/Roodepoort area by JG Bantjies and the Struben brothers. By September 1886, around 2500 people were living in the general area and 1300 diggers licenses had been issued (Erasmus, 2014). Due to the discovery of the reef and the sudden influx of miners, a special proclamation was issued by the ZAR government, also in September 1886, listing nine farms that were proclaimed as public diggings. The southern portion of the farm Doornfontein was one of these farms. Another of the farms, Randjieslaagte, was owned by the State and was chosen as the site for the new mining town in order to provide revenue for the Government (Erasmus, 2014).

The town was accordingly surveyed and named Johannesburg (apparently, since both the vice-president, Joubert and the survey clerk Rissik were named Johannes – Erasmus 2014). A health committee was elected in November 1887. On 1 October 1897, the fledging town was granted a town council followed by municipal status. However, ongoing issues with the so-called uitlander population of the town and the British government, which were realised to be due to the rich gold resources, ultimately resulted in the Second South African Wars. Notwithstanding this, Johannesburg was relatively unaffected by the conflict until it was occupied by the British forces on 31 May 1900 with virtually no resistance. The mines which had been closed reopened almost immediately after the end of the war in 1902. After this Johannesburg and its suburbs grew very rapidly (Erasmus, 2014).

7.9.4.2 Booysens and Booysens Reserve

Smith (1977) states several sources as indicating that the original property was owned by a man called Boysen (Johannes or Jan or JA Booysen). She further states that the township was laid out by the Booysen Farm syndicate on the farm Turffontein in 1887. The first stands were apparently sold in May and June 1887.

Booysens Reserve was surveyed in 1896 and the first stands were auctioned the same year. The “mynpacht” on which the township was established was used as agricultural holdings at the time as it was one of the few properties that were unproclaimed.

7.9.4.3 Riverlea

This township was laid out on the farm Langlaagte No.13 on 25 May 1965 as a township for coloureds. The establishment of the township Riverlea (or riverly) had been recommended by the Johannesburg Council in August 1960. The street names were all based on rivers. By 1965 three extensions had been established. The name apparently indicates an area where there is a river (Smith 1977).

7.9.4.4 Ophirton

Smith (1977) notes that this suburb was one of the earliest residential areas in Johannesburg. The township was laid out in 1887 on the farm Turffontein No. 21, although the name of the area seems to have changed several times during the late 1800s. However, the present-day township dates from 1903 when the plan was confirmed by the Surveyor-General. By that date, the property belonged to the Robinson Deep Gold Mining Company although the name of the suburb probably derives from one of the previous land-owners, the Paarl-Ophir Gold Mining Co. Ltd. Smith (1977) also notes that the land changed ownership several times and was owned by CL Liebenberg before being purchased for the establishment of the township.

7.9.5 Conclusions of the desktop study

The archival and historical research has revealed that the entire area 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 Crown Mines. 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).

7.9.6 Field Work and Finding

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 14 October 2019.

The two heritage resources were identified during the fieldwork component of this HIA. One site is a historical structure or the remains of such structures (VS1). The other site identified is a burial ground (VS2).

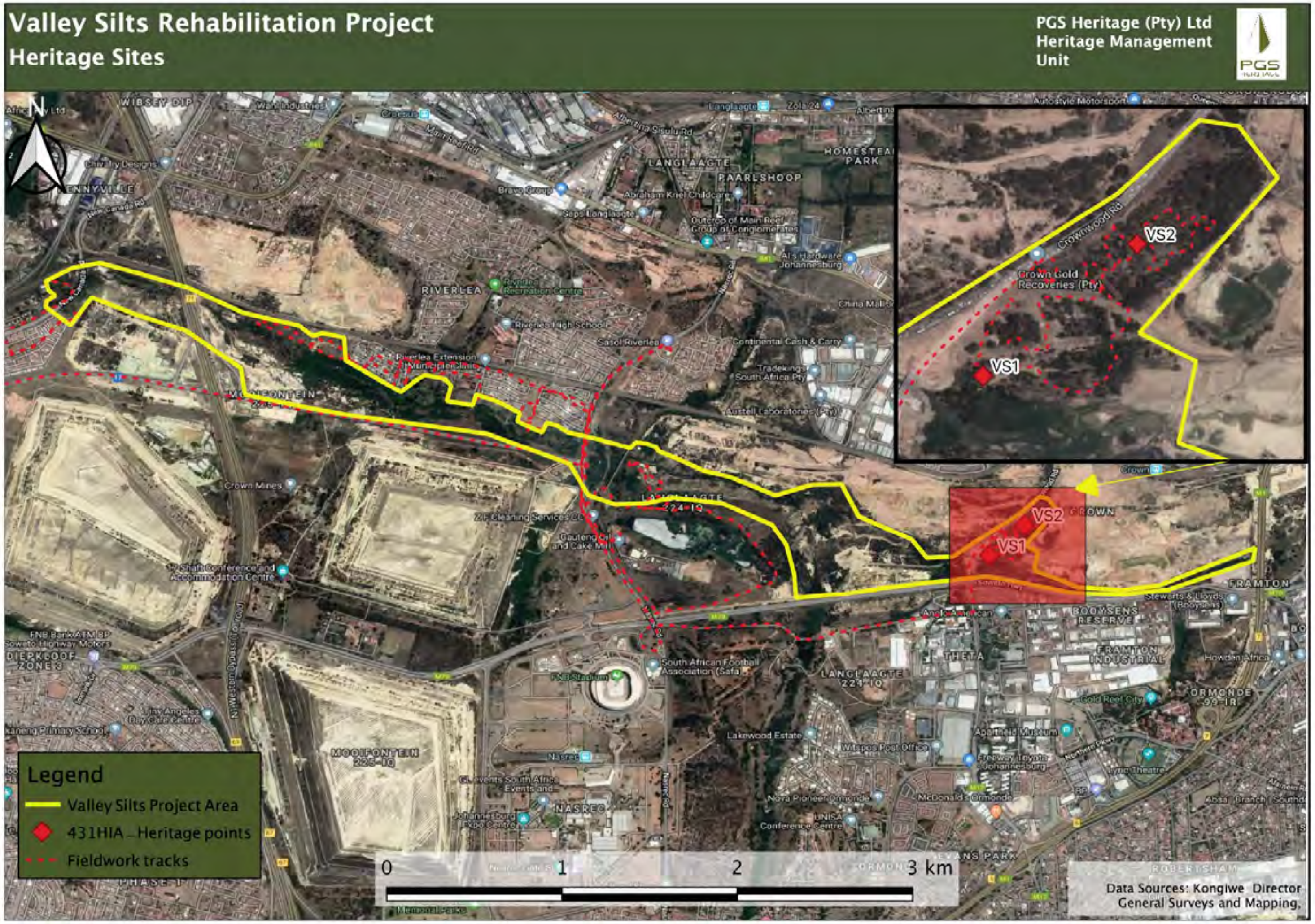


Figure 7-66: Locality of the heritage resource in the study area

Table 7-26: Sites identified during heritage survey

SITE[9] NUMBER	LATITUDE	LONGITUDE	DESCRIPTION	HERITAGE SIGNIFICANCE	HERITAGE RATING
VS1	S 26,227	E 28,0040	The site consists of a semi exposed stone walled structure (partly covered with soil). The stone worked exposed consist of masoned stone blocks used to construct a stone wall. The structure is however not entirely exposed and determining the extent was impossible. Historical maps show no structures present in the area. It is evident that the wall is part of a larger subsurface structure and in all probability associated with early mining activities. The exposed section of the wall is approximately 10m in length. With the sparse information on the structure and the fact that very little has remained of structures related to the early mining history of the Witwatersrand this site can potentially hold further information on the history of the area. The site is provisionally rated as having a medium heritage significance with a heritage rating of IIIC. In the event that the site cannot be excluded from the planned mining activities, further research into the site must include: ❖ Exposing the structure through archaeological excavation	Medium	Grade IIIC

[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.*

			❖ Archival research on the structure ❖ Analysis of any artefacts recovered during the excavations ❖ If it is found that after mitigation the site is not conservation worthy an application for destruction must be lodged under s35 of the NHRA. ❖ If the site is to be retained after mitigation a site-specific heritage management plan for the site must be developed and submitted for approval to the SAHRA.		

Figure 7-67 – Exposed stone walling at VS1

VS2	S 26,226	E 28,0060	The cemetery is situated between Crownwood road and the reclaimed Crown Mine dump. Numerous stone packed graves were identified during the fieldwork. Due to the vegetation growth it was impossible to do an accurate grave count, but an estimated 50-100 graves are located in the area. My discussions with the archaeologist, Anton Pelser, who was responsible for the grave relocations at Crown Mines, indicated that the cemetery may be related to Indian labourers. This is however hearsay. **The extent is approx. 1ha** The age of the cemetery is difficult to estimate. Some of the graves do have large eucalyptus trees growing on them. The locality in relation to the grave relocated just to the east of this cemetery as well as the possibility of the graves linked to indentured labour indicates the site is of high heritage significance and a grading of IIIA. It is recommended that the area is avoided and demarcated as a cemetery with a 50 meter buffer	High	IIIA

Figure 7-68 – Stone packed graves in the cemetery

Figure 7-69 – Trees growing on some graves

7.10 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.

7.10.1 Project Area Demographics and Population characteristics

The project area falls under the jurisdiction of CoJ, this section will provide an overview of the socio-economic baseline information for both affected wards. The aim of this section is to contextualise the study by developing a socio-economic demographic profile that captures the relevant characteristics of the study area.

7.10.2 Key Challenges with the CoJ

According to the IDP review 2018/2019, the city conducts a public participation process to facilitate community consultation sessions. The purpose of the community consultation sessions is to provide feedback and afford community members to raise issues of concern. Based on the overview of issues/concerns from community members it seems the issue of access to sustainable human settlements is a common concern in all the regions. Other challenges that the CoJ is experiencing include:

- An uncontrolled influx of people in the Inner City - increased scale of urban growth;
- Housing backlogs contributing to the increased rise in illegal occupation in key residential areas;
- Service delivery breakouts- due to a lack of infrastructure maintenance and infrastructure backlogs are increased by a continual influx of migrants;
- High unemployment rate;

- Income inequality and poverty;
- Housing backlogs contributing to the increased rise in illegal occupation in key residential areas.

The abovementioned issues have a bearing on how the proposed project may bring about social change within the affected local area

7.10.3 Demographics

Ward 68: According to Statistics South Africa - Census 2011 (RSA, 2011) Riverlea's population stood at 16 226 spread over 4 208 households.

Ward 124: According to (Census, 2011) the population in Booysens was estimated to be 3 926 (2,353.75 per km²).

7.10.4 Dependency ratio

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.

7.10.5 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.

7.10.6 Educational Level

Ward 68: 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 (ibid.) further adds that it is documented in the literature that education and poverty are inversely related.

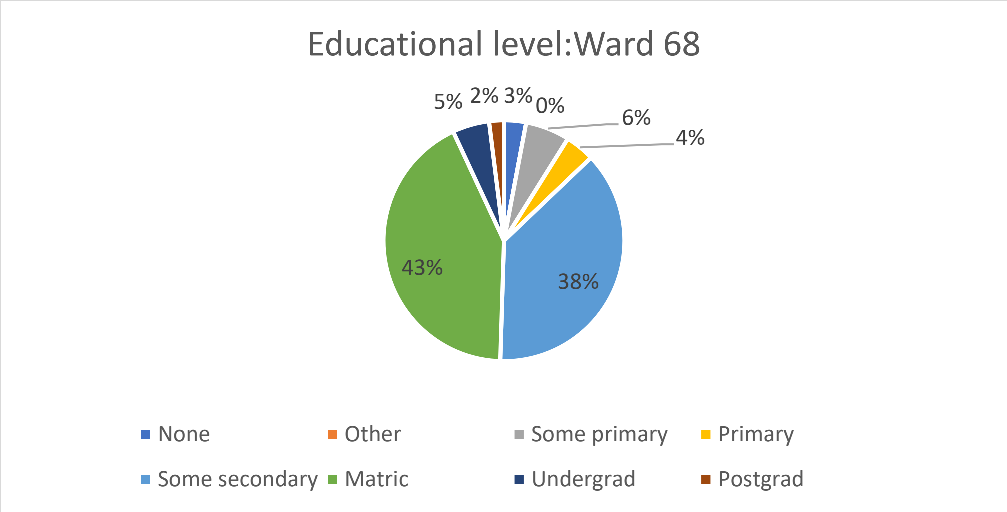


Figure 7-71: Educational level- Ward 68 (Source: Census 2011)

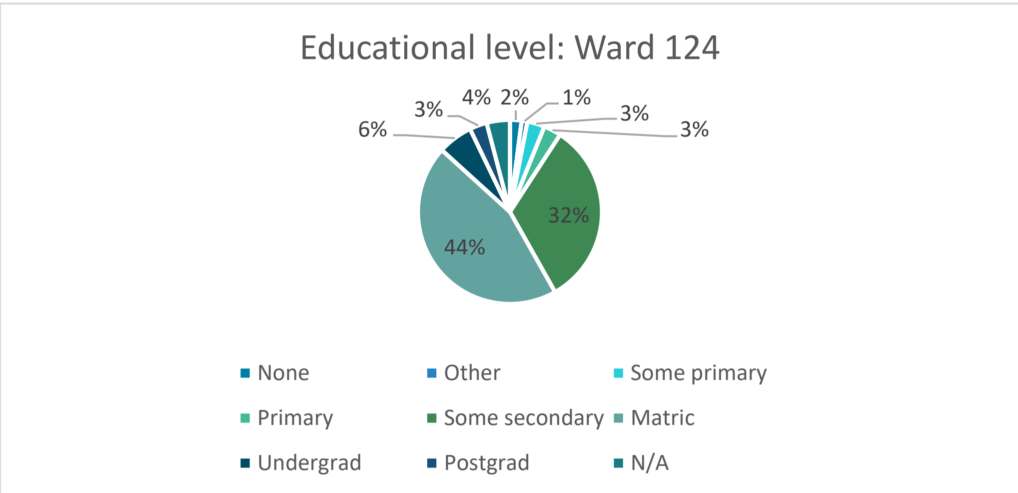


Figure 7-72: Educational Level-Ward 124 (Source: Census 2011)

7.10.7 Economy and Livelihoods

About 49% of the population in ward 68 is employed which is slightly higher compared to Gauteng and about 61% of the population in ward 124 is employed (Census, 2011). According to CoJ's 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 (among other factors) 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 and from both Ward Councillors. Young men were observed hanging around the street corners particularly in Riverlea. It was also reported that most of the youngsters have formal education but there are no employment opportunities. The lack of employment opportunities has made some youngsters to resort substance abuse. (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- which is prevalent in Riverlea.

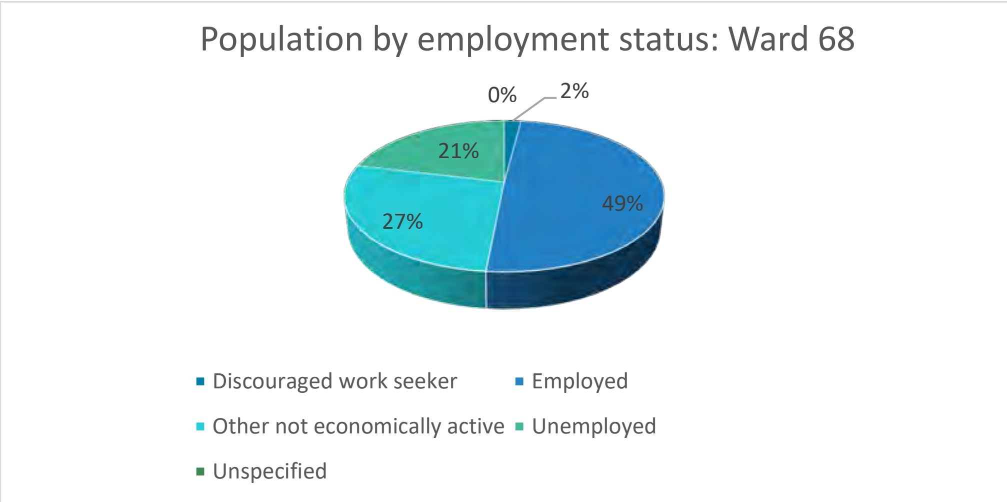


Figure 7-73: Population by employment status - Ward 68 (Source: Census 2011)

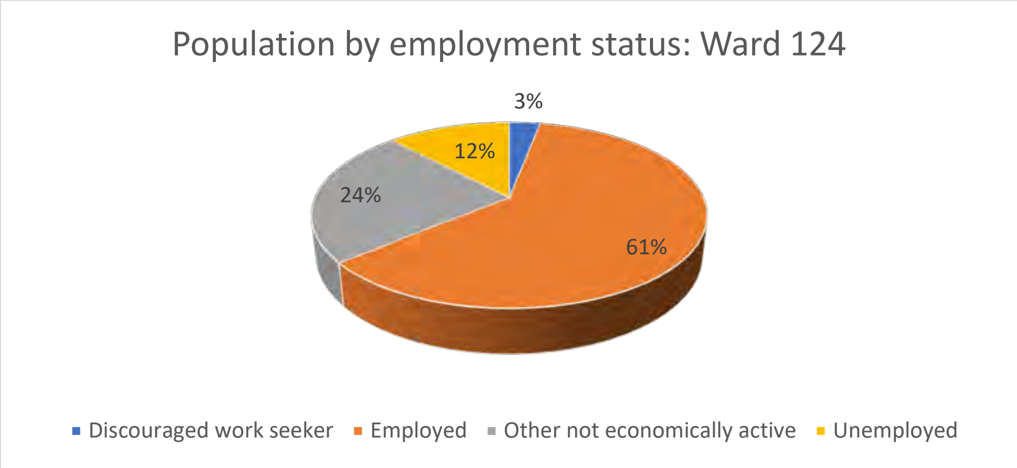


Figure 7-74: Population by employment status - Ward 124

Source: Census 2011

During the site visit, artisanal mining was observed in Ward 68. 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. In Ward 124 there are street vendors selling food to employees working within the area, please refer to Figure 7-75 for forms of informal trading taking place in the area.

Zama-zama's adit - Ward 68

Zama-zama's bags containg materials they got underground - Ward 68

Street vendor - Ward 124

Figure 7-75: Types of informal trading observed in the affected wards

7.10.7.1 Annual Income

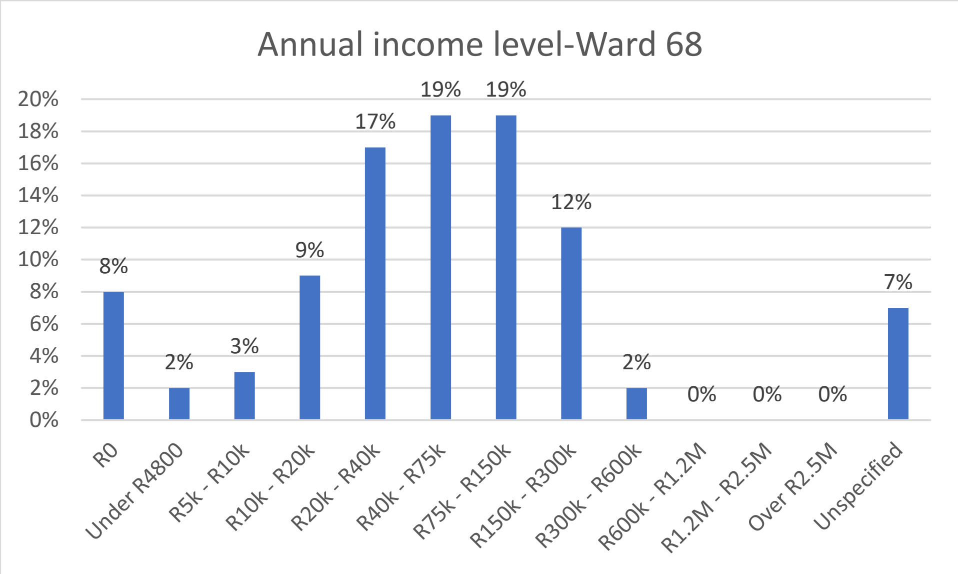


Figure 7-76: Employees by annual income - Ward 68 (Source: Census 2011)

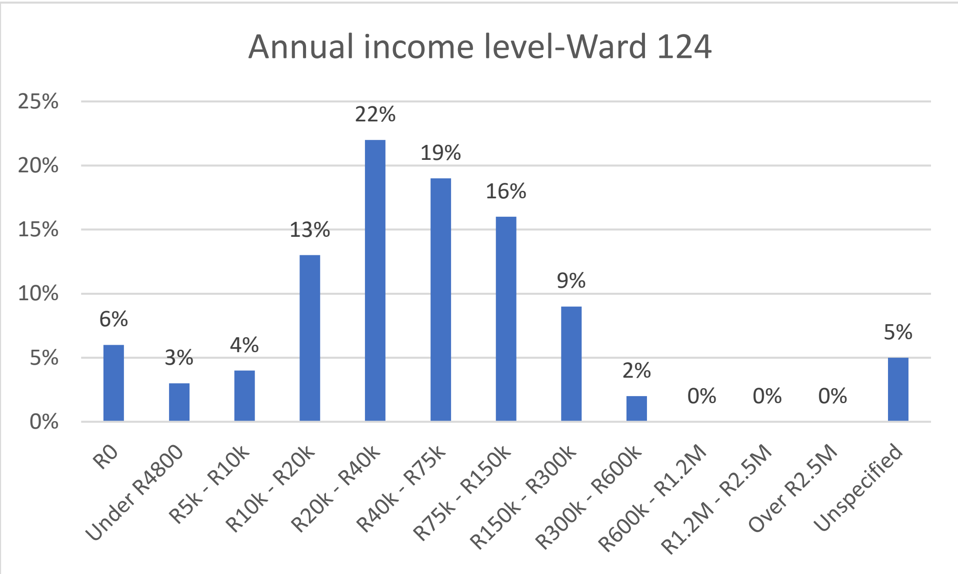


Figure 7-77: Employees by annual income - Ward 68 (Source: Census 2011)

Both Figure 7-76 and Figure 7-77 indicate that both wards have a low income , thus are regarded as vulnerable due to the high levels of poverty.

7.10.8 Anticipated Social Impacts

The following social impacts are anticipated:

Table 7-27: 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;
Job security and skills development (for current personnel)	Exposure to increased dust levels
	Impact on settlements
	Impact on spatial development- future land use
	Increased nuisance factors

7.10.8.1 Job Security

It is understood that the proposed project will not create additional job opportunities 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.

It should be noted that the number of opportunities offered is subject to the company's financial situation and employment need. According to the company's existing SLP (2018-2022), Ergo intends to implement the following strategic actions with regards to bursaries and experiential work:

- Allowing individuals to work as apprentices to skilled people on the mine;
- Providing equitable access to bursary and internship opportunities; and
- Integrating in the internship candidate or the bursar as operating member of the company should suitable vacancies exist.

The company as a subsidiary of DRDGold, has access to the Ergo Business Development Academy (EBDA).The academy is a facility that has been launched by Ergo Mining (Pty) Ltd to address the critical shortage of skills in the country, create jobs, empower people and uplift the quality of life of all South Africans (http://www.ebda.co.za/).

7.10.8.2 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.

7.10.8.3 Potential to Ameliorate the Current Flooding Issues

The residential area (Mogol Street) adjacent to the project area currently experiences floods during the rainy season. The street lies at the bottom of a slope and when it rains, the households and street gets flooded https://westside-eldos.co.za/50222/heavy-downpours-flood-riverlea-homes-residents-demand-restitution/ <Date accessed: 23 October 2019>. This statement was also supported by residents interviewed during the SIA interviews, respondents indicated that the stormwater drains are currently blocked by the silts and when it rains the area gets flooded. One respondent indicated that she struggles to keep the flooding under control and the water damages their properties and belongings.

The silt has not only blocked the storm water drains; the sewer system is blocked which affects the ablution facilities. One respondent indicated that her toilet has been blocked and out of use as a result of the blocked sewage system. She mentioned that she uses her neighbour ablution facilities.

It is anticipated that the removal of the silt should improve the water flow dynamics and assist in ameliorating current flooding issues experienced in the area of Riverlea. After removal of the silt from the target areas, Ergo intends to rehabilitate the target area by shaping the area where silt was removed and making the area free draining. The target area should provide attenuation in the future thus reduce the risk of flooding.

7.10.8.4 Safety Impacts for Employees

According to DRDGold's Annual Integrated Report (2018:30), has reported that the highest risk of theft is during the final stages of production, in the gold rooms where extracted gold is visible and a target area.

It is reported by the company (DRDGold Form 20f, 2015:14) that its operations often experience high incidents of copper cable theft, this is a risk to the employees' lives. The company might suffer production losses and incur additional costs as a result of power interruptions caused by cable theft and theft of bolts used for the pipeline.

The abovementioned incidents have a likelihood of creating a sense of feeling unsafe for current employees. The company (DRDGold Limited's Annual Integrated Report 2018: 18) is aware of the safety aspects associated with its operation and has initiated health and safety awareness campaigns to raise awareness and educate about the importance of health safety in the workplace, such as:

- Managerial procedural training;

- Workplace safety pledge (for both managers and employees;
- Silicosis dust awareness campaign.

7.10.8.5 Safety Impacts for Community Members

As discussed in Section 6, there are households living in the close proximity to the project area and their safety during the construction and operational phase should be taken into consideration. Children were observed playing and dumping household waste near the project area in Riverlea. The community needs to be informed that children will need to stay from the designated project area to avoid incidents.

7.10.8.6 Increased Traffic from Hauling

It is expected that construction vehicles will be driven to the project site to deliver construction material, and to transport construction rubble. Construction vehicles during the construction phase and hauling of the dried silts to the Ezekiel dump is not an impact but a social change that may pose a health and safety risk to surrounding communities. A detailed Traffic Impact Assessment has been undertaken as part of the EIA for the proposed project. For the purpose of the SIA, the potential health and safety impacts associated to the increased traffic in the project site will be assessed. There is a school (Wilhemina Hoskins Primary School) is close to the project site, children might be wandering onto site and being exposed to the project area, this might affect their safety.

7.10.8.7 Disruption in Movement Patterns

It is understood that the reclamation of gold bearing silts will be conducted at targeted areas, as such it is not anticipated that the roads will be closed as a result of the proposed project, however project infrastructure, the proximity of the project and increased traffic from hauling might slightly disrupt the daily movement patterns of residents. This impact will likely affect people who use the soccer field close to the project site.

7.10.8.8 Exposure Increased dust levels and rise in associated health impacts

During stakeholder consultations concerns regarding increased levels of dust were recorded- this concern was linked to the current dust impacts from the Mooifontein dump that affects Riverlea residents. The increase in dust can have adverse impacts on the health of the communities, and adversely impact road safety conditions along the gravel surfaced roads where visibility may be reduced.

Dust particles vary in size from coarse (non-inhalable), to fine (inhalable), to very fine (respirable). According to the (State of Victoria, Department of Health and Human Services, 2015) particles in airborne dust tend to be coarse or non-respirable and do not pose a serious health threat to the general public. However, people with respiratory conditions, may experience difficulties. This statement is important given the health status quo of residents living in Riverlea. It should be noted that effects of dust as a result of any mining activity (historical and current) on residents living in Riverlea is a sensitive issue that was reported by in the (CGRO report) that human exposure to contaminated mining waste along the Witwatersrand has resulted in significant health concerns, such as asthma, bronchitis and pneumonia.

The Air Quality Impact Assessment (AQIA) Report Valley Silts EIA (2019:57) indicates that it is expected that hauling of silt, turning of silt in the drying process and loading of dried silt onto haul trucks 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. Exposure of increased dust levels as a result of the proposed project is detailed in the AQIA report, 2019. The air quality in South Africa is governed under the National Environmental Management: Air Quality Act, Act 39 of 2004 (NEM:AQA) (Act No. 39, 2004). The main objective of the act is to ensure the protection of the environment and human health through reasonable measures of air pollution control within the sustainable (economic, social and ecological) development framework.

For the purpose of this report, the SIA worked from the premise that increased dust levels might exacerbate health impact related to dust. It should be noted that a Health Impact Assessment has been undertaken as part of the EIA for the proposed project which provides a detailed assessment of the health impacts associated with the proposed project.

7.10.9 Identified Social Risks

7.10.9.1 Attitude/Perception 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 and could result in interest group activity. An interest group has been identified within the project area – the Riverlea Mining Forum.

Due to historical mining operations in the area, some stakeholders seemed quiet negative regarding the proposed project and the applicant. Based on stakeholder engagements it was evident that the negative attitudes/perceptions towards the project were rooted from previous mining activities undertaken in the area. In addition, the limited job opportunities (considering the high unemployment rate in the area) may also contribute to the formation of a negative attitude towards the project.

During the SIA interviews it was evident that the attitude/perceptions regarding the proposed project was twofold, residents living Mogol street (a residential area close to the project area) were interested in the proposed project. They perceive the proposed project as an initiative that could possible assist with ameliorating the floods issues. Whilst on the other stakeholders seemed to have issues with the proposed project. This is influenced by their experiences with previous mining operations in the area. Some stakeholders indicated that the area in which the applicant previously undertaken the reclamation process should be adequately rehabilitated. According to these stakeholders the lack of adequate rehabilitation has created trust issues thus they are concerned that the applicant will reclaim the gold bearing slits and leave the area unrehabilitated and they will have to bear the brunt of an environment that is damaged.

It is evident that there is a trust deficit between the Riverlea residents and the applicant. It is important that the trust between the community members and the applicant be re-established to ensure that the project is accepted, and that the applicant has the "social licence to operate in the area and also to ensure that the positive aspects of the project materialise. 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.

The company is familiar with concept of "social licence to operate", according to the(DRDGold Integrated Annual Report, 2018: 28)'s statement in relation to the mitigation action associated with the risk of 'social licence to operate' is detailed as follows: "*Our ongoing commitment to improving engagement with our employees and surrounding communities, and our strategic objective to support our neighbouring communities by improving quality of life, poverty alleviation and youth education helps mitigate the risk"*.

Recommendation: From a social perspective, it is recommended that a community forum is established to provide the stakeholders-including the applicant with a platform to discuss issues of concern, identify risks and opportunities. By listening and engaging, the community and the applicant will also be better placed to identify emerging community issues at an early stage and deal with them proactively. A Social Management framework is required to assist with addressing stakeholders' grievances and assist the applicant to ensure ongoing-stakeholder engagement. Effective stakeholder engagement develops a "social licence" to operate and depends on mutual trust, respect and transparent communication between the applicant and stakeholders. It thereby improves a company's decision-making and performance by :

- **Cutting costs**: Effective engagement can help the applicant to avoid costs, while its absence can be costly both in terms of money and reputation;
- **Managing risk**: Engagement helps the applicant and communities to identify, prevent, and mitigate environmental and social impacts that can threaten project viability; and
- **Managing stakeholder expectations**: Consultation also provides the opportunity for the applicant to become aware of and manage stakeholder attitudes and expectations.

7.10.9.2 Lack of Service Delivery-Social Unrest

Riverlea is a an area where the lack of service delivery has been demonstrated by means of a protest-these protests have been reported in the national newspapers such as the Citizen https://citizen.co.za/news/south-africa/1629939/protesters-in-running-battles-with-police-riverlea-roads-closed/ and the ENCA : https://www.enca.com/south-africa/protesters-engage-police-in-running-battles. According to (Mbanyele, 2018: 5) the sections of the population that are poor and lack stable employment and other opportunities for financial stability are the most prone to protesting. Service delivery can be triggered by various aspects such as governance deficits, failed infrastructures and environmental degradation (Renn *et al*, 2011: 36). Given the area's history with service delivery protests, high unemployment rate and lack of better service delivery increased the likelihood of potential social unrest that might occur in the future which could affect the progress of the project.

Recommendation: Solutions to address service delivery require interventions from the local authorities. However, the applicant can address potential issues that could lead to unrest by ensuring that an effective grievance mechanism is put in place to ensure that stakeholders are provided with a platform to raise their concerns/complaints. Ongoing- stakeholder engagement (as mentioned above) is recommeded to ameliorate any potential issues that could lead to social unrest.

7.11 Community Health

Refer to Appendix D8 of this EIA report for a review of the Community Health Impact Assessment (cHIA)

7.11.1 Methodology

7.11.1.1 Baseline Data Collection

A standardised approach was considered for the rapid/desktop cHIA to ensure that evidence-based recommendations supported the impact assessment and community health management plan. The rapid/desktop cHIA activities included a desktop literature review and analysis of existing and accessible data.

Community engagement with nearby communities, clinics or health officials was not directly conducted as part of the cHIA.

7.11.1.2 Desktop Review

The desktop literature review:

- ❖ Outlines the City of Johannesburg's community health profile;
- ❖ Includes of specific health regulations; and
- ❖ Analysis of specialist studies (with specific reference to air quality, surface water and groundwater).

7.11.2 Determinants of Health

Community health comprises aspects relating to human health, including quality of life, that are determined by physical, biological, social and psychosocial factors in the environment. Community health is influenced by a broad range of determinants, as illustrated in Table 7-28.

Table 7-28: Key factors that determine Community/Human Health (Determinants)

FIXED	SOCIAL AND ECONOMIC	LIFESTYLE AND BEHAVIOURS	ACCESS TO SERVICES	ENVIRONMENTAL	
❖ Genes ❖ Sex ❖ Ageing ❖ Race	❖ Poverty ❖ Employment ❖ Social ills ❖ Communal life ❖ Crime	❖ Diet ❖ Physical activity ❖ Smoking ❖ Alcohol ❖ Sexual conduct ❖ Drugs ❖ Coping skills ❖ Culture	❖ Education ❖ Health services ❖ Social services ❖ Transport ❖ Leisure ❖ Basic services	❖ Air quality ❖ Noise ❖ Housing ❖ Water quality ❖ Water quantity ❖ Waste management ❖ Social environment ❖ Risk of injury	❖ Sun exposure ❖ Disease vectors & pests ❖ Communicable diseases ❖ Climate change ❖ Food safety ❖ Environmental pollution ❖ Occupational hazards

					❖ Hazardous substance

To ensure health determinants are evaluated in a systematic manner, the standard Environmental Health Areas (EHAs), as stipulated by international agencies, have been considered (www.ifc.org/sustainability). The EHA framework defines the type of health impacts and provides a structure for organising and analysing potential project impacts on the community. The table below defines the various EHAs (Table 7-29).

Taking into consideration the nature of this cHIA, **EHA 5 and 8 formed the basis of this report.**

Table 7-29: The 12 Environmental Health Areas as part of the EHA Framework

ENVIRONMENTAL HEALTH AREAS (EHAS)	
1.	**Vector-Related Diseases -** Malaria, schistosomiasis, dengue, onchocerciasis, lymphatic filariasis, yellow fever, etc.
2.	**Respiratory and Housing Issues -** Acute respiratory infections (bacterial and viral), pneumonias, tuberculosis; respiratory effects from housing, overcrowding, housing inflation, etc.
3.	**Veterinary Medicine and Zoonotic Issues** - Diseases affecting animals (e.g. bovine tuberculosis, swinepox, avian influenza) or that can be transmitted from animal to human (e.g. rabies, brucellosis, Rift Valley fever, Lassa fever, leptospirosis, etc.).
4.	**Sexually Transmitted Infections -** HIV/AIDS, syphilis, gonorrhea, chlamydia, hepatitis B; etc.
5.	**Soil- and Water-Sanitation Related Diseases -** Giardiasis, worms, water access and quality, excrement management
6.	**Food- and Nutrition- Related Issues** - Stunting, wasting, anemia, micronutrient diseases (including deficiencies of folate, Vitamin A, iron, iodine); changes in agricultural and subsistence hunting, fishing, and gathering practices; gastroenteritis (bacterial and viral); food inflation
7.	**Accidents and Injuries** - Road-traffic related, spills and releases, construction (home- and project-related) and drowning
8.	**Exposure to Potentially Hazardous Materials** - Pesticides, fertilizers, road dust, air pollution (indoor and outdoor, related to vehicles, cooking, heating, or other forms of combustion or incineration), landfill refuse or incineration ash, and any other project-related solvents, paints, oils or cleaning agents, by-products, or release events
9.	**Social Determinants of Health (SDH)** - Including psychosocial, social production of disease, political economy of health, and ecosocial issues such as resettlement or relocation, violence, gender issues, education, income, occupation, social class, race or ethnicity, security concerns, substance misuse (drug, alcohol, smoking), depression and changes to social cohesion, etc.
10.	**Cultural Health Practices** - Role of traditional medical providers, indigenous medicines, and unique cultural health practices
11.	**Health Services Infrastructure and Capacity** - Physical infrastructure, staffing levels and competencies, technical capabilities of health care facilities at district levels; program management delivery systems; coordination and alignment of the project to existing national- and provincial-level health programs (for example, TB, HIV/AIDS), and future development plans

ENVIRONMENTAL HEALTH AREAS (EHAS)	
12.	**Noncommunicable Diseases (NCDs) -** Hypertension, diabetes, stroke, cardiovascular disorders, cancer, and mental health

7.11.3 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.

The closest residential area to the Project is the township of Riverlea, the outskirts of the township is situated approximately 700m from the Project area. Riverlea is a housing area, constructed in the early 1960's with a population of approximately 24 000 people.

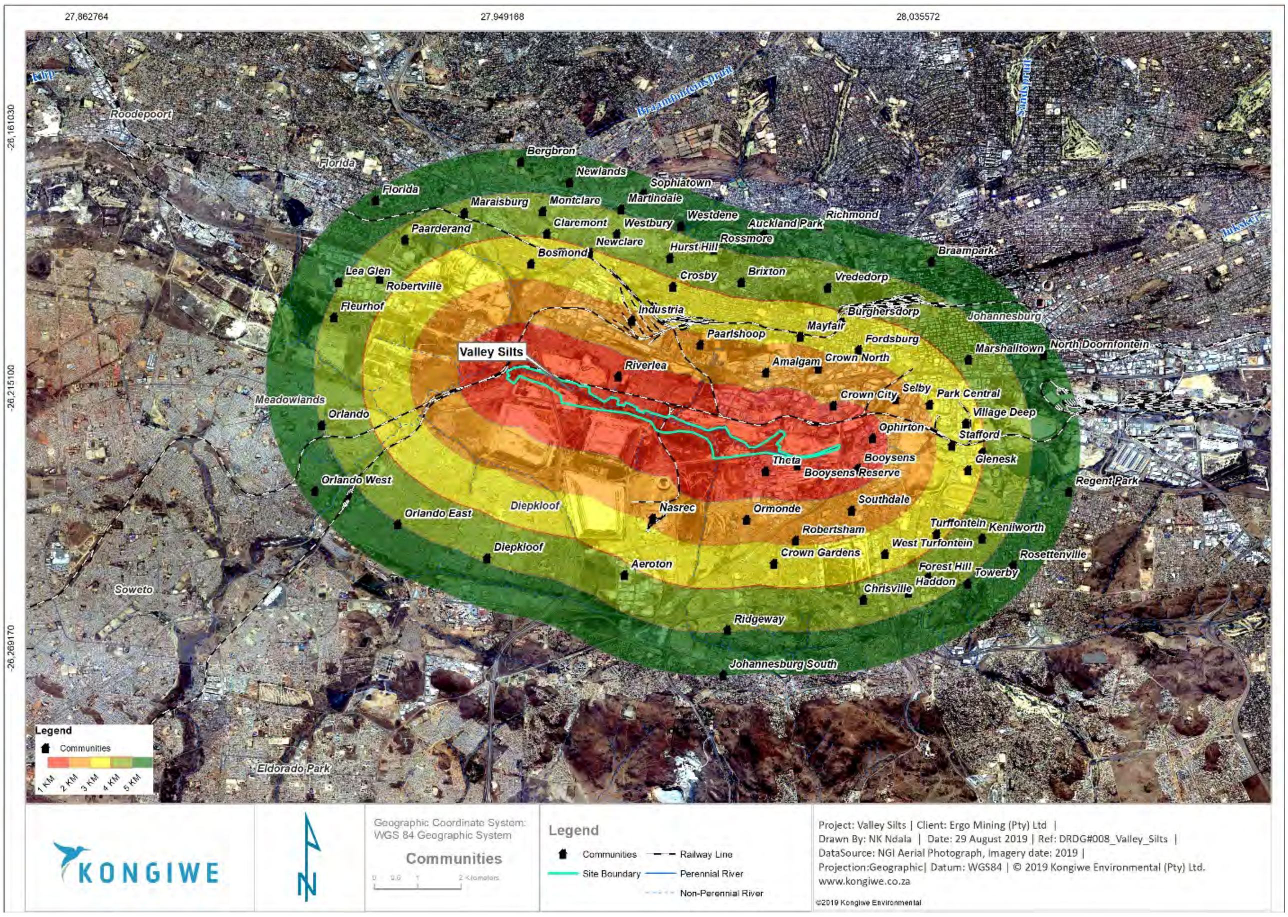


Figure 7-78: Sensitive receptors (Communities) within a 5km radius from the Project area

7.11.4 Baseline Health

This section describes the health characteristics of the potentially affected area thereby defining the broad health 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 health baseline conditions are understood to ensure accurate identification and assessment of potential impacts associated with the proposed Project

7.11.4.1 Health Status: City of Johannesburg Metropolitain Municipality (CoJMM)

The Gauteng province is the most densely populated province in the country and comparatively the smallest in area. The province's population of approximately ten million people makes up over 20% of the total population of South Africa.

Johannesburg metropolitan municipality (JMM) in Gauteng province has a total population of 3 461 050, the highest of the province's six districts. The population density of 3 018.4 people per km^2 ranks the metro as having the highest population density in the country. It is one of the fastest growing urban areas nationally and globally. It is a rapidly growing and changing city faced with significant urban development challenges and, in particular, the ongoing problem of urban poverty and increasing social inequality and social exclusion. The municipality is divided into eight Regions (A (Ward 77), A (Ward 95), B (Ward 68), C (Ward 50), D (Ward 15), E (Ward 75), F (Ward 61) and G (Ward 3)) consisting of 109 wards that form part of a total of 420 wards in the Gauteng province (www.uj.ac.za/csda).

A common vision for the CoJ has been established as "One City One Health System". Previously health care service delivery has been characterised by fragmentation and poor-quality care to communities. The emphasis is now on primary health care through the district health system with a strong focus on preventative health service delivery that is accessible and effective.

Rapid urbanisation, high levels of poverty and unemployment, poor social conditions and physical conditions (lack of access to safe drinking water, sanitation and poor housing, as well as the rising HIV/AIDS epidemic) have direct, but negative, impacts on the health status of communities. Critical in improving upon the health of Johannesburg citizens is reducing the number of HIV/AIDS cases, managing tuberculosis (TB) infections, and ensuring healthy lifestyles. Of relevance to the health sector is the amplified risk of communicable diseases outbreaks and the social problems that come with unemployment: trauma and violence (xenophobia) and alcohol related illnesses. It is difficult for mobile populations who are also at risk of acquiring diseases such as TB, to comply with the long-term treatment it requires. Poor treatment compliance contributes to the problems of emerging and re-emerging diseases such as multidrug resistant TB (CoJ IDP 2019/2020) (https://www.joburg.org.za/services_/JoburgCares/Pages/Health.aspx).

An amount of R178-million has been budgeted for health services, with this amount increasing in the medium term, reflecting larger allocations to the HIV/AIDS programme.

The JMM has a total of 108 clinics, 11 community health centres, two district hospitals, two regional hospitals, three tertiary hospitals and 36 other hospitals. Johannesburg's low ratio of district hospital beds at 0.1 beds per 1 000 population is to be expected. The bed utilisation rate was 57.4%, a decrease of 7.3 percentage points from 2010/11. The average length of stay was 3.8 days, which is higher than the provincial average of 3.5 days.

The top three major causes of death in the various age categories are shown in the table below (JHB DHP 20172018) (

Table 7-30).

Table 7-30: Leading causes of death in CoJMM

AGE	CAUSE OF DEATH
< 5 years	Preterm birth complication (17.4%)
	Lower respiratory infections (12.1%)
	Diarrhoeal diseases (9.6%)
5 – 14 years	Fires, hot substances (8.1%)
	Lower respiratory infections (7.7%)
	HIV/AIDS (7.7%)
15 -24 years	Mechanical forces (14.2)
	Accidental threats to breathing (11.3%)
	HIV/AIDS (7.7%)
25 – 64 years	HIV/AIDS (16.9%)
	Tuberculosis (12.4%)
	Lower respiratory infections (7.2%)
65+ years	Ischaemic heart disease (11.8%)
	Cerebrovascular disease (10.1%)
	Lower respiratory infections (6.3%)

Within Johannesburg there are 421 ward-based outreach teams, 107 clinics, 10 community health centres, two district hospitals and three tertiary hospitals. Challenges which exist at these facilities, include waiting time to see a health care professional, cleanliness and availability of medicine (JHB DHP 2018).

7.11.4.2 Health Status: Riverlea

The Project is located in one of Johannesburg's most diverse regions, Region B, Ward 68, in the centre of the CoJ. It covers an area of 3.40km2 and was constructed in the early 1960's with a population of approximately 29 696 people living in roughly 4,208 households. The region comprises some of the wealthiest suburbs of Johannesburg, including Northcliff, Westcliff, Parktown, and Hyde Park. At the same time, it encompasses several poorer areas such as Vrededorp, Sophiatown, Brixton and Riverlea. This community is currently the closest residential area to Soccer City (www.uj.ac.za/csda). The residents of Riverlea are majority South African, with Afrikaans being their first language spoken.

According to a Health Environment and Development Study (HEAD), conducted over a five year period, by a collaboration between the Medical research Council (MRC), the University of Johannesburg (UJ), the University of the Witwatersrand, and the CoJ, result indicate that Riverlea already has a wide range of social, environmental and health problems (www.uj.ac.za). In particular is high blood pressure, asthma and diabetes.

7.11.5 Environmental Health Status

7.11.5.1 Surface Water

Refer to Section 7.7.

The water quality results are summarised below:

- pH was within limits at all monitoring locations over the monitoring period;
- Electrical Conductivity (EC) and Total Dissolved Solids (TDS), which provides an indication of the dissolved salts, was within limits at all monitoring locations over the monitoring period;
- Elevated levels of iron, manganese and nickel occurred at all monitoring locations over the monitoring period, all indicative of a chronic health risk. In 2019, lead (Pb) levels were elevated, indicating a chronic health risk; and
- Based on surface water monitoring data available on the Klip River Forum website, elevated ammonia, phosphate, Chemical Oxygen Demand (COD) and E.Coli counts were recorded from monitoring sites along the Russell Steam at New Canada Road and east of Valley Silts and are elements of concern.

The table below details the effects of water variables on the environment and humans (Table 7-31).

Table 7-31: Water variables on the Environment and Human Health

PARAMETER	HEALTH IMPACT
Heavy metals typical of AMD	If ingested, heavy metal toxicity can have several consequences in the human body. It can affect the central nervous function leading to mental disorder, damage the blood constituents and may damage the lungs, liver, kidneys and other vital organs promoting several disease conditions. Also, long term accumulation of heavy metals in the body may result in slowing the progression of physical, muscular and neurological degenerative processes that mimic certain diseases such as Parkinson's disease and Alzheimer's disease. More so, repeated long-term contact with some heavy metals or their compounds may even damage nucleic acids, cause mutation, mimic hormones thereby disrupting the endocrine and reproductive system and eventually lead to cancer (Godwill, 2019).
Elevated levels of iron	If ingested, 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.
E. Coli	E. Coli is a faecal coliform bacteria, which is found in water contaminated with faeces from infected humans and or animals. The waste can enter water through sewage overflows, sewage systems not operating correctly and polluted stormwater runoff. People who contract gastroenteritis from drinking water contaminated with E. coli develop diarrhoea, which causes the body to lose more water than usual, which can lead to dehydration, especially dangerous to babies and older adults. Long term infection with E. Coli can result in an increased risk of developing high blood pressure, kidney problems and heart disease in later life.

7.11.5.2 Groundwater

Refer to Section 7.8.

7.11.5.3 Uranium Contamination

The environment around us always contains small amounts of Natural Occurring Radioactive Materials (NORMs), which have existed since the formation of the earth. Their availability in the environment is generally at levels that are not potentially harmful to human health. A major concern comes when the levels are elevated as a result of human practices like mining (Nour et al, 2005). In nature, mining involves the production of large quantities of waste, which may contaminate soils over a large area, thereby negatively impacting the environment and human health. Mining is one of the major causes of elevation of NORMs concentrations on the earth’s surface causing health risks to humans, especially when inhaled or ingested. Gold mining operations result not only in the extraction of gold but also considerable amounts of Uranium (U), deposited within the gold tailings. In South Africa, the gold mining industry has existed for over a century. As a result, mine tailings are littered everywhere, posing a threat to local communities. The communities living around these areas are threatened by radioactive pollution mainly caused by uranium (Winde et al., 2019). Gauteng Province has approximately 1.6 million people living near TSFs, and a large number of informal settlements reside, if not next to the TSFs, in very close proximity to them.

A site survey which sampled 50 readings within the Valley Silts project area closest to the highway found that the highest measurements were for 0.349 Bq/g for Uranium (U) and 0,281 Bq/g for Thorium (Th). Therefore, this material is below the 0.5 Bq/g limit and currently not regarded as radioactive.

7.11.5.4 Air Quality

Refer to Section 7.9.

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.

PM can be classified by their aerodynamic properties into coarse particles, PM_{10} and fine particles, $PM_{2.5}$ (Harrison & Van Grieken, 1998). The coarse particles contain earth crust materials and fugitive dust from roads and industries (Fenger, 2002). The fine particles contain the secondarily formed aerosols such as sulphates and nitrates, combustion particles and re-condensed organic and metal vapours. 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 7-32).

Table 7-32: 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

7.11.5.4.1 Sensitive Receptors surrounding Project

The information below has been extracted from the Air Quality Impact Assessment (AQIA) as compiled by Gondwana Environmental Solutions International for Kongiwe Environmental (Pty) Ltd.

The closest sensitive receptors are the Riverlea development, Wilhelmina Hoskins Primary School and the Riverlea Primary and High Schools which lie immediately to the north of the Project area. There are many schools, clinics and hospitals within a 10 km radius (Figure 7-79).

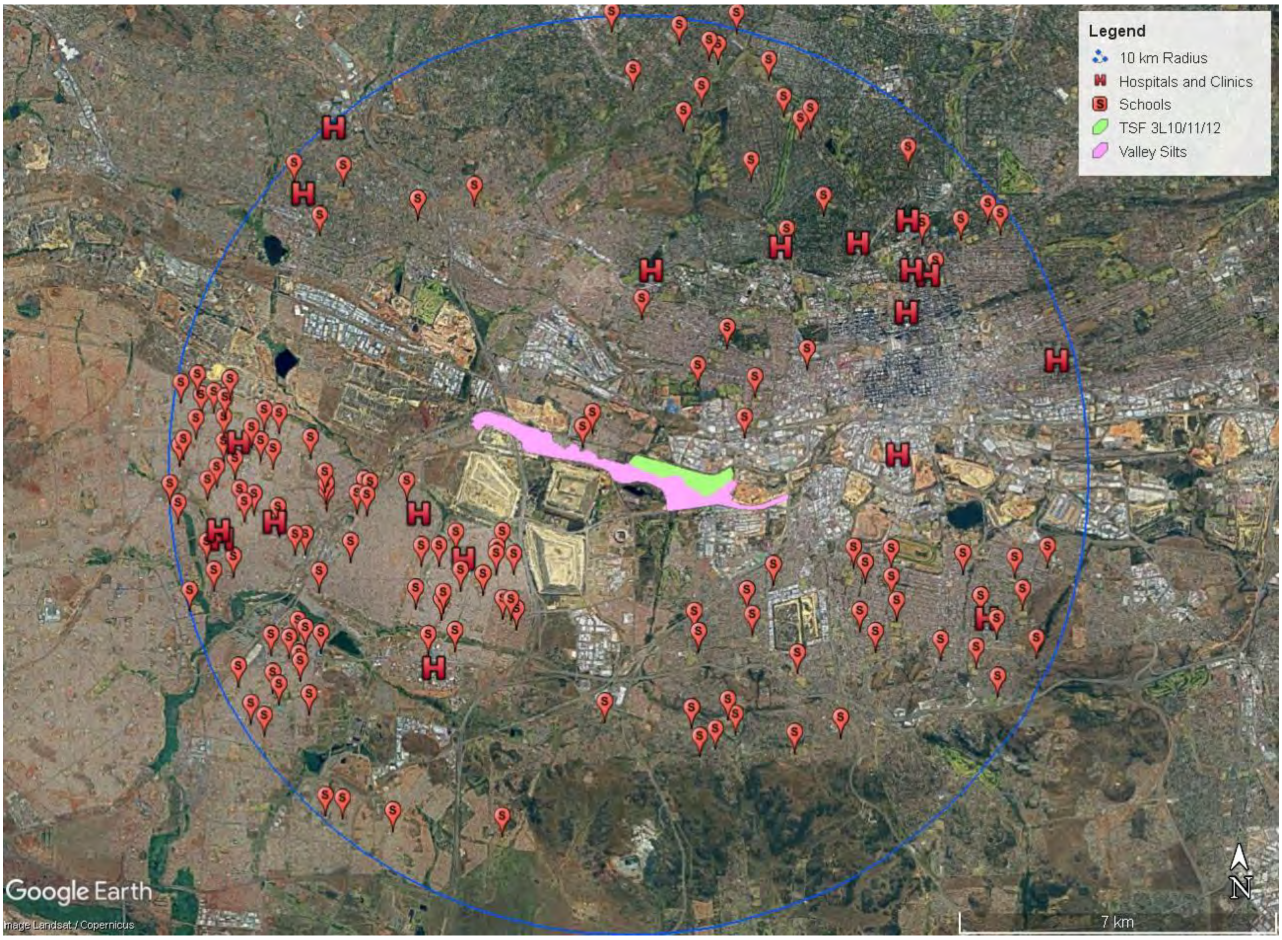


Figure 7-79: Sensitive receptors within a 10km radius from the Project area.

7.11.5.4.2 Seasonal Impacts and Wind Direction

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

The predominant winds at the Valley Silts Project area (as given by the WRF data for the period from 2016 to 2018) are from the north-north-westerly direction for approximately 11% of the time (this holds for summer and during daytime), followed by the east-south-easterly and south-easterly directions (during winter and night time).

7.11.5.4.3 Background Concentrations

There are many dust fallout monitoring stations and one air quality monitoring station within a 5 km radius of the Project area, four of these stations lie within 250m of the Project area: Wilhelmina L.P. School, Stockwell, Sand Street and Gabiebula. The graph of the measured average dust deposition rates at these monitoring stations (Figure 7-36) illustrates that there have been no exceedances of the National Dustfall Standard of 600 mg/m2/day for these residential areas in the period from July 2016 to June 2019.

Figure 7-37 and Figure 7-38 are graphs, compiled on the South African Air Quality Information System (SAAQIS) website, of the measured average daily PM_{10} and $PM_{2.5}$ ambient concentrations at the Diepkloof air quality monitoring station. They indicate high ambient concentrations of these criteria pollutants, with several exceedances of the NAAQS. Although the Diepkloof air quality monitoring station lies approximately 3.5km away from the Valley Silts Project area, it does highlight and confirm the concern about air quality in this area.

These current exceedances can be attributed to several sectors that emit pollutants which affect the ambient air quality of the city, including but not limited to: Volatile Organic Compounds (VOC) biomass burning; aircraft emissions; household fuel combustion for cooking and heating; windblown dust from the surrounding TSFs; industrial sources; on-road vehicles; and waste treatment.

7.11.6 Conclusions of the cHIA

Current sources of pollution associated with the Valley Silts area include surface- and groundwater contamination and air quality impacts.

Based on the cHIA and the contributing specialist studies, it is apparent there is a larger cumulative impact resulting from operations in the greater area (TSFs, Robinson landfill site, industry, etc.), whose impacts already have and will continue to contribute to a polluted environment. The Project area is located within this greater area and is negatively contributing to this compounding impact, but not substantially, and impacts can be managed and mitigated. The remediation of Valley Silts will assist in the direct amelioration of varying pollutants.

During the excavation of the silts and the drying of the silts, localised air quality and surface water will be impacted upon. In the long term, the excavation of the silt will have a positive impact on the groundwater environment, but only if surface and groundwater discharge from the slimes dams and sand dumps along the Russell Stream is effectively managed and kept out of the Russell Stream.

Stakeholders must be informed that only portions of Russell Stream will be remediated and that it will be a collaborative effort between Government Departments, Municipalities and Ergo, and therefore changes may not happen immediately. Expectations should be managed; this can be achieved through the establishment of a community forum where issues/risks/opportunities regarding the proposed Project are discussed and addressed.

It is recommended that the remediation of Valley Silts proceeds, as it will have a positive impact on the community of concern, provided the recommended mitigation measures are implemented, and adhered to, to manage the impacts thus ensuring compliance with current legislative requirements

7.12 Traffic Statement

Refer to Appendix D9 of this EIA report for a review of the Traffic Statement.

7.12.1 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 7-33.

Table 7-33: Surrounding Road Network

ROAD NAME	ROAD CLASS	MANAGING AUTHORITY	ROAD FUNCTION	GENERAL
Francois Oberholzer Freeway (M2)	1	Gauteng Department of Roads and Transport (GAUTRANS)	Major Highway south of the Johannesburg CBD, connecting the CBD with the N3 highway and N1 highway.	This road is to the north of the site and will form part of the main transit route for the Heavy Vehicles between the site and the processing area.
Main Reef Road (R41)	2	Johannesburg Roads Agency (JRA)	Main corridor connecting Roodepoort to the Johannesburg CBD and the M2 highway.	This road is to the north of the site and will form part of the main transit route for the Heavy Vehicles between the site and the processing area.
Crownwood Road (M17)	2	Johannesburg Roads Agency (JRA)	Functions as a connecting road between the N12 Southern Bypass Freeway, Main Reef Road and the area of Mayfair.	This road has been recently realigned. This road will provide access to the planned operations

7.12.2 Existing Traffic Demand

The Traffic specialist concluded the traffic generated by the site does not warrant traffic surveys as the distribution and 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 30vph, even during the construction phase.

7.12.3 Future Traffic Demand

Considering the existing and future planned surrounding road network, as well as the fact that the s urrounding area is already mostly developed, with large portions reserved for mining activities, traffic growth at the proposed access position to the site will be average (2.0% - 3.0%). There are no future roads planned near the access position, according to the JRA Road Master Planning and Gautrans Master Planning.

7.12.4 Trip Generation Conclusions

The expected trips to be generated by the proposed activities were based the maximum processing capacity of the Knights Plant and COTO TMH17. The document recommends the following splits for Heavy Industry (silt reclamation and rehabilitation) and trips are based on details provided by the client for the construction period:

- Weekday AM peak hour – 22 trips, with a 75:25 (in/out) directional split;
- Weekday PM peak hour – 22 trips, with a 25:75 (in/out) directional split.

As previously mentioned, the activities will include the rehabilitation and reclamation of the Valley Silts area surrounding the Russell Stream. 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 7-34 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.

Table 7-34: Development Peak Hour Generated Trips

TMH17 CODE	LAND USE	EXTENT	AM PEAK			PM PEAK		
			In	Out	Total	In	Out	Total
120	Heavy Industry	Silt Reclamation and rehabilitation	17	5	22	5	17	22

7.12.5 Proposed Sites Access

The following access positions is proposed:

- **One (1) access to the site** is proposed directly off Crownwood Street, as indicated on Drawing 19054/AL/01 in the TIA Appendix D9. This access to the site is proposed approx. 440m to the south of the intersection with Jupiter Road. The access must be 10m wide, with one (1) lane 'IN' and one (1) lane 'OUT'. Traffic from Crownwood Road (M17) will have the right of way and a 'STOP' condition will be implemented for the proposed access. Proposed access details are shown on Drawing 19054/AL/01 in the TIA Appendix D9.

7.12.6 Access Safety (For all Sites)

The following safety measures are proposed by the Traffic impact specialists:

- The current Speed limit of 60 km/h will be maintained, and the proposed Speed Limit Signs are to be erected on both sides within 200 m from the proposed access position.
- The proposed Heavy Vehicles Turning Signs is to be erected on both sides of the proposed accesses at least 100 m from the proposed.
- The Sight Distance from the proposed access positions are 180 m in both directions, this is more than the required sight distance for a 60 km/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 the site to avoid dangerous movements within the traffic.
- A minimum stacking space of 24 m (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, as shown in the Queueing Analysis on next page.
- We propose a separate short right turn lane for the northern approach to allow heavy vehicles to stop safely when waiting to enter the site.

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.

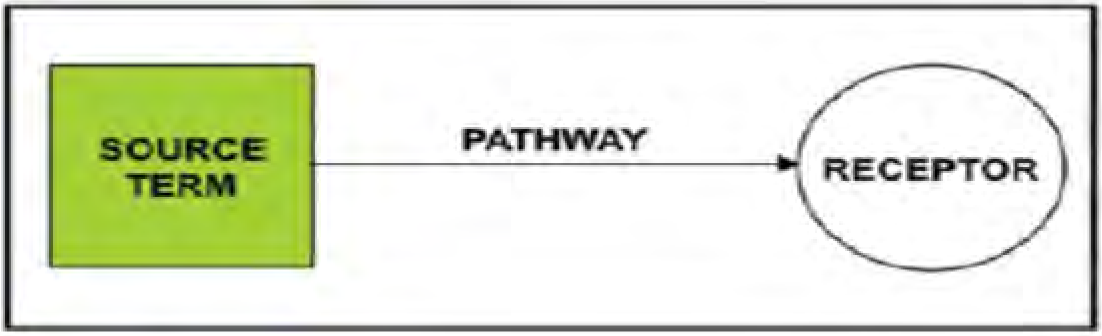


Figure 8-1:Impact prediction model.

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 Valley Silts Project. The potential impacts are discussed per environmental feature/ aspect. For more detail please refer to the specialist study contained in the appendices.

8.2.1 Construction Phase

Ergo 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 a pre-construction Radiation walk-over survey
2	Removal of vegetation and site clearance
3	Preparation of access roads should this be required
4	Initiation of a community forum for engagement throughout the project life cycle
Construction Phase	
5	Employment of workers (minimal)
6	Operation of construction machinery and vehicles
7	Temporary storage of construction materials and hazardous material such as contaminated soil
8	Instatement of waste management and dust control measures on site
9	Desilting of existing facilities
10	Instatement of traffic signage, access, parking bays

8.2.1.1 Biodiversity (Fauna, Flora and Herpetology)

The impacts identified during the wetland and terrestrial surveys that are having a negative ecological impact in the project area were identified and 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 leading to the degradation of the environment;
- Dumping of builder's rubble and general waste;
- Hunting with dogs reducing the likelihood of species being present in the area;
- Urban infrastructure, resulting in the removal of natural vegetation;
- Unregulated burning leading to loss of habitat and increased air pollution;
- Fencing that is responsible for separating the various habitats;
- Habitat fragmentation and degradation; specifically of the CBA, ESA, CR and VU ecosystems; and
- Telephone lines and power lines within the vicinity of the project area that could lead to bird strikes and electrocutions

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;
- Disturbances due to excavation works in CBA: Important and ESA watercourse;
- Habitat disturbance;
- Introduction of alien species, especially plants;
- Erosion;
- Oil spills from the construction vehicles; 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 on Biodiversity

NATURE OF IMPACT 1: Excavation of Silt : Loss of areas classified as CBA and ESA; Site clearance, compaction of soil with heavy machinery, noise, displacement of fauna and endemic plant species, erosion, loss of animal corridors; Habitat disturbance.		
	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)*	Medium term	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Storm water flooding ❖ Change of hydrology of the Russel Spruit	
Mitigation measures ❖ Demarcate the project area and avoid surrounding areas; ❖ Limit the work to daytime activities; ❖ Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces; ❖ An erosion control plan must be compiled and implemented; ❖ Faunal species must be allowed to move out of the area unharmed.	

Table 8-6: Assessment of significance of potential construction impacts on Biodiversity

NATURE OF IMPACT 2: Storing and Drying of Silt: Clearance of vegetation, dust, encroachment by alien vegetation, displacement of fauna and endemic plant species		
	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)*	Medium term	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Drainage of the polluted water into the surrounding area		
Mitigation measures ❖ Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive on cleared areas; ❖ Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces; ❖ An erosion control plan must be compiled and implemented; ❖ Allow species to move out of the area safely, if they do not move on their own get a qualified person to assist with the relocation of the species.		

Table 8-7: Assessment of significance of potential construction impacts on Biodiversity

NATURE OF IMPACT 3: Hauling of silt on existing and new roads: Loss of areas classified as CBA and ESA; Site clearance, compression of soil with heavy machinery, noise, displacement of fauna and endemic plant species; deaths due to vehicle collisions; erosion due to roads, chemical and oil spills for the vehicles, loss of animal corridors		
	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)*	Medium term	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Spreading of alien invasive plant species seeds		
Mitigation measures ❖ Demarcate the roads using tape, as far as possible restrict the movement into adjacent areas. ❖ Install signs restricting the speeds of the vehicles. ❖ Compile and implement a spill management plan. ❖ Install culverts below the roads to assist with erosion control, leave green corridors for species to move along.		

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 namely the reclamation of gold bearing tailings sediments from the project area. Table 8-8 lists the potential risks posed by the project to wetlands within the project area as well as those within the 500 m 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, most construction-related activities are expected to centre on site clearing.

Of greater significance will be the operational risks associated with the reclamation of the site as it is situated within a channelled valley-bottom wetland which will be directly impacted by the reclamation process. As such, a severity rating of 5 is mandatory following the DHSWS risk assessment protocol. Three highly probable and potentially significant impacts were identified for which mitigation is limited and the residual impact considered Moderate. These include loss of wetland and hydromorphic vegetation habitat through site excavation, exacerbated contamination of downstream watercourses through the upheaval and liberation of accumulated toxins trapped in the sediments and sedimentation and increased turbidity in downstream watercourses. 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 to rehabilitation.

The specialist has made the following recommendations with regards to the removal of silts from the Russell Stream (operational phase):

- Mitigation is limited and rehabilitation is critical. Commission and implement a wetland rehabilitation and monitoring plan.
- The plan must be presented to and approved by the relevant authorities (i.e. DHSWS head office Pretoria).
- It is imperative that a budget be allocated for the planned rehabilitation 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 rehabilitation, should ultimately result in the removal / reduction of an existing source of wetland contamination.
- Excavate a temporary cut-off trench around the active reclamation area to help contain contaminants that are mobilised during the reclamation process from ending up in the downstream watercourses.
- Stay within the proposed reclamation areas and avoid extending earthmoving activities outside of these areas.
- Work systematically targeting one area at a time while rehabilitating the recently completed area as the operation progresses. Rehabilitating in this manner will allow for problems or inadequacies to be identified and rectified in the successive rehabilitation phases.
- Monitor water quality upstream and downstream of the site along the Russel Stream. 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 8-8: DWS Risk Impact Matrix for the Valley Silts Project During Construction

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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											
CONSTRUCTION																			
Excavation	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 should be a temporary impact that will only last the lifetime of the reclamation activities. However, this is entirely contingent on the Ergo to rehabilitation as, due to the nature of the project, mitigation during operation is limited in this regard. ❖ A wetland rehabilitation and monitoring plan must be commissioned. The study must make use of independent and appropriately qualified professionals. ❖ The plan must be presented to and approved by the relevant authorities (i.e. DHSWS head office Pretoria). ❖ It is imperative that a budget be allocated for the planned rehabilitation efforts and likewise that it be approved by the relevant authorities. ❖ 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.	Increased 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 rehabilitation should ultimately result in the removal / reduction of an existing source of wetland contamination. ❖ Excavate a temporary cut-off trench around the active reclamation area to help contain contaminants that are mobilised during the reclamation process from ending up in the downstream watercourses.

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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											
			With	3	3	3	3	5	3	4	12	2	2	5	3	12	144	M	❖ Stay within the active reclamation area and avoid extending earthmoving activities outside of these areas. ❖ Attempt to limit / control the wetting of sediments with water 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 conveyed through pipelines to the processing facility) ❖ Work systematically targeting one area at a time while rehabilitating the recently completed area as the operation progresses. Rehabilitating in this manner will allow for problems or inadequacies to be identified and rectified in the successive rehabilitation phases. ❖ Monitor water quality upstream and downstream of the site along the Russel Stream. 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	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.

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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
		reclamation activities	**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 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	4	3	2	2	2.8	2	3	7.8	1	1	5	2	9	69.75	M	
Drying and hauling	Direct wetland degradation	Potential loss / disturbance of wetland soil and vegetation	Without	2	2	2	2	2	2	3	7	1	1	1	2	5	35	L	❖ The proposed drying area (3L12/11/10 directly north of the FNB stadium and Valley Silts project area) is situated on an existing "dirty site" that has already been completely transformed by tailings. ❖ No functional wetlands exist within the proposed drying area and as such the risk of direct wetland degradation or loss is unlikely. ❖ Restrict drying activities to within the proposed drying footprint area
			With	1	1	1	1	1	2	3	6	1	1	1	2	5	30	L	
	Contamination and sedimentation	Contamination and sedimentation of the Russel Stream with leachate from the drying area	Without	4	3	2	2	2.8	2	3	7.8	1	1	5	2	9	69.75	M	❖ Construct a cut-off trench around the proposed drying area. ❖ Remove all dried material before closure. ❖ Attempt wherever possible to use the same access point and limit truck movement to the assigned haul routes. ❖ Haul trucks should have covered loads. ❖ Keep haul roads wet or use environmentally friendly dust suppressants.
			With	4	3	2	2	2.8	2	3	7.8	1	1	5	2	9	69.75	M	

8.2.1.3 Surface Water

During the construction phase vegetation will be cleared and temporary infrastructure will be erected. The construction phase will be less than a year. The activities and impacts that are likely to occur during the construction phase are summarised in Table 8-9.

Table 8-9: Summary of activities and impacts for the construction phase

ACTIVITY	IMPACT DESCRIPTION
Removal of vegetation and alteration to the topography.	Erosion of silt and consequent deterioration of water quality in the Russell Stream.

Table 8-10: 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 the Russell Stream		
	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 ❖ Clearance of vegetation must be limited as far as possible; ❖ The SWMP must be implemented as a first step during the construction phase; and ❖ Water quality sampling must be implemented upstream and downstream of construction sites. It is recommended that Total Suspended Solids (TSS) and turbidity are included in the current water quality monitoring programme.		

8.2.1.4 Groundwater

During the construction phase, the sediments and silt in the area, earmarked for excavation, will be disturbed. The introduction of oxygen during this phase of the project is expected to result in a deterioration in groundwater quality. Due to the short duration of the construction phase, this impact is not expected to have an additional negative impact in terms of salt and heavy metal concentration increases, nor be laterally extensive.

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.	

Residual Impacts

- The slimes dams and sand dumps along the Russell Stream are all potential sources of pollution and silt. In the current state of the stream (with silt) and after removal of the silt, these pollution sources next to the stream must be managed more effectively to ensure no contaminated silt, surface or groundwater enters the rehabilitated Russell Stream. Current water qualities indicate high salt and metal concentrations, with a low pH water found in the drains along the TSF footprint areas

Mitigation measures

- Implement a groundwater monitoring programme before excavation starts. Dedicated groundwater monitoring boreholes are required along the Russell Stream and downstream to effectively measure the current groundwater status, impact of the activities on the groundwater environment and changes in groundwater qualities and levels post closure. Refer to Section 13.1 of the Groundwater Impact Assessment
- Develop sound surface runoff management plans to ensure that all dirty runoff from the stockpile areas, but also from the adjacent slimes dams and sand dumps are contained and diverted to the cut-off trenches and sumps. No pooling of water on surface allowed.
- Ensure that cut-off trenches and sumps are designed to contain all dirty water generated during the process, to prevent overflows and spillages.

8.2.1.5 Air Quality.

An air quality impact assessment was undertaken to evaluate the impact on ambient air quality caused by the mechanical removal of silt from the Russell Stream and associated haulage, silt turning for drying and truck loading processes for haulage to the processing plant. $PM_{2.5}$ and PM_{10} represent the main criteria pollutants of concern.

The most significant pollutant that is generated from construction activities, loading and unloading silt, hauling of silt and turning of the silt in the drying process is particulate matter (PM). Particulate matter with an aerodynamic diameter of less than 2.5 micrometres (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. Ambient concentrations of criteria pollutants are of significance in terms of their potential to impact human health and the broader environment. To estimate ambient concentrations of $PM_{2.5}$ and PM_{10}, air dispersion modelling was undertaken using AERMOD, the United States Environmental Protection Agency's preferred regulatory model for both simple and complex terrain. Emissions from construction of basic facilities for the project were deemed to be short term and of low significance. Should all mitigation measures be adhered to, the impacts of dust fallout will be significantly reduced.

Table 8-12: All project Phases - Air Quality impacts.

IMPACT ASSESSMENT MATRIX		
Impact Description	Hauling of silt, turning of silt in the drying process and loading of dried silt onto haul trucks 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.	
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	
Activity	**Without Mitigation**	**With Mitigation**
Magnitude	**Major negative:** Worst-case conditions are expected to lead to the 24-hour NAAQS being exceeded over parts of the residential area of Riverlea and over the industrial areas to the north of 3L10/11/12 and to the south of the eastern project area. This is a health risk to people living in those areas.	**Moderate negative:** Because of the proximity to the project boundary, even with mitigation measures in place, cumulative concentrations and worst-case conditions may lead to the NAAQS being exceeded over parts of the residential area of Riverlea and over the industrial areas to the north of 3L10/11/12 and to the south of the eastern project area.
Duration	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of reclamation activities taking place (6 years).	**Long Term:** There is a possibility of the ambient air concentrations exceeding the NAAQS for the duration of reclamation activities taking place (6 years).
Spatial Scale	**Local:** Dispersion of emissions from the project are expected to extend over approximately 2 km from the project boundary.	**Local:** Dispersion of emissions from the project are expected to extend over approximately 1.8 km from the project boundary.
Consequence	High	**Medium**
Probability	**Definite:** Parts of the industrial area to the north of 3L10/11/12 are predicted to experience exceedances of the annual average NAAQS (No exceedances are permissible).	**Possible:** Although mitigation measures will reduce the probability of exceedances of the NAAQS caused by the reclamation activities, cumulative ambient concentrations may still lead to exceedances.
Significance	High	**Medium**
Mitigation	Either keeping all unpaved haul roads at least 175 m from residential areas and 320 m from the northern boundary of the 3L10/11/12 footprint; or wet suppression/chemical stabilization of unpaved haul roads. Regular sweeping/vacuuming of paved haul roads. Keeping drop height for	

	loading of dried silt onto haul trucks to a minimum. Keeping loading and drying areas as far from the northern boundary of the 3L10/11/12 footprint as possible.
Cumulative Impact	Emissions from the reclamation of the Valley Silts Reclamation Project are expected to temporarily increase ambient concentrations of PM_{10} and $PM_{2.5}$ up to 2 km from the project boundary. Concentrations of these criteria pollutants are already high in the City of Johannesburg metropolitan area.

8.2.1.6 Heritage and Palaeontology

The impacts occur during the Construction and Operation phases only.

The fieldwork identified two heritage features (VS1 and VS2). VS1 is a partly exposed stone structure probably related to early mining history, while VS2 is a cemetery with approximately 50-100 visible graves, although several of the slimes dams/ sand Project 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 Project.

- VS1 has a medium heritage significance with a heritage grading of IIIB. The impact significance before mitigation on the historical structures will be Medium negative before mitigation. Implementation of the recommended mitigation measures will modify this impact rating to an acceptable **Low negative**.
- The cemetery at VS2 has a high heritage rating and a heritage grading of IIIA. The impact significance before mitigation on the cemetery and graves sites will be High negative before mitigation. Implementation of the recommended mitigation measures will modify this impact rating to an acceptable Medium to **Low negative**.

It should be noted that, in addition to the large informal burial ground (VS2) identified during the fieldwork for this project, several unmarked burial grounds have been identified and uncovered by previous development and construction projects in the surrounding area (i.e. two at Fleurfhof and one at Stormill in the West Rand). In addition, an example of a burial ground that had been covered by a slimes dam/sand dump and was exposed after the dump had been reclaimed is known from the Crown Mines/ Langlaagte area in Johannesburg (Anton Pelser 2012 and pers.comm.; Esterhuysen et al 2018). The communities of Riverlea have also indicated that the possibility of graves in the areas just below Riverlea does exist even though fieldwork has revealed no evidence of this

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. Management Measures, including a chance find protocol has been included into the EMPr.

Table 8-13: Impacts on possible heritage resources during the construction and operation phase

No.	Affected Environment	Activity	Impact Description	BEFORE MITIGATION						Cumulative Impact	Mitigation measures / Recommendations	AFTER MITIGATION					
				Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE			Magnitude	Duration	Spatial Scale	Consequence	Probability	SIGNIFICANCE
CONSTRUCTION AND OPERATION																	
1	Historical structure - VS1	Desilting, excavation, drying, hauling	Destruction of stone structure	*Moderate -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium	No	Demarcate as no-go	Minor +	Short Term < 18 months	Site or Local	Low	Minor +	Medium
2	Cemetery - VS2	Desilting, excavation, drying, hauling	Destruction of graves	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	Demarcate as no-go	Minor +	Short Term < 18 months	Site or Local	Low	Minor +	Medium
3	Possible burials	Desilting, excavation, drying, hauling	Destruction of graves	*Major -*	*Long Term > 5 years*	*Site or Local*	High	*Possible*	High	No	Implement chance finds procedures	*Minor -*	*Long Term > 5 years*	*Site or Local*	Medium	*Possible*	Medium

8.2.1.7 Social Impact

Refer to Chapter 7, section 7.10.8 for a description of the anticipated social impacts of the proposed project.

Table 8-14: Impacts on Job security and skills development

NATURE OF THE IMPACT: JOB SECURITY AND SKILLS DEVELOPMENT		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Moderate +	Major +
Probability	Definite	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
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 as per the Social and Labour Plan (SLP) ❖ 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 8-15: Impacts of stimulating economic growth.

NATURE OF THE IMPACT: STIMULATION OF ECONOMIC GROWTH		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Low +	Major +
Probability	Definite	Definite
Calculated Significance Rating	Medium	High
Impact Status: (positive or negative)	Positive	Positive
Reversibility: (Reversible or Irreversible)	N/A	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
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; ❖ The applicant is advised to source local suppliers, HDSAs and Small, Medium and Micro-sized Enterprises (SMME's) ❖ 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 SMME's.

Table 8-16: Safety Impacts for employees and communities

NATURE OF THE IMPACT: SAFETY IMPACTS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Moderate-
Probability	Possible	Definite
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
Residual impacts ❖ Residual impacts are expected only if accidents occur during the construction and operational phases- Compromised quality of life is expected due to accidents that could possibly occur; ❖ Increased perception of unsafety		
Mitigation measures ❖ Security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ All project infrastructure should be contained in a secured area to prevent unauthorized access and therefore potential health and safety risks; ❖ A grievance management mechanism should be in place to receive incident related queries; ❖ Appoint competent safety personnel to ensure construction site personnel to comply with their responsibilities for health and safety and to achieve progressive improvement in safety performance; ❖ Comply with the Mine Health and Safety Act; ❖ Safety warning and informative signs should be placed in area with potential hazards and risk of accident.		

Table 8-17: Increased traffic due to hauling of silts

NATURE OF THE IMPACT: INCREASED TRAFFIC FROM HAULING		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Short term

Magnitude	Major -	Medium-
Probability	Possible	Definite
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
Residual impacts ❖ Residual impacts are expected only if accidents occur during the construction and operational phases- Compromised quality of life is expected due to accidents that could possibly occur; ❖ Increased perception of unsafety		
Mitigation measures ❖ Adhere to the mitigation measures as recommended in the Traffic Impact Assessment; ❖ Consider the use of traffic signs to warn construction vehicles of the presence of pedestrians; ❖ A grievance management mechanism should be in place to receive incident related queries		

Table 8-18: Disruption of movement patterns

NATURE OF THE IMPACT: DISRUPTION IN DAILY MOVEMENT PATTERNS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Short term	Short term
Magnitude	Medium -	Minor-
Probability	Possible	Definite
Calculated Significance Rating	Medium	Low
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
Residual impacts ❖ Restricted access which might disrupt daily movement patterns		
Mitigation measures ❖ A grievance management mechanism should be in place to receive incident related queries; ❖ The applicant should keep the residents informed on a day-to-day basis regarding construction progress and when to expect the site to be blocked.		

Table 8-19: Exposure to dust fallout and health impacts

NATURE OF IMPACT: INCREASED DUST LEVELS AND RISE IN ASSOCIATED HEALTH IMPACTS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local

Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Definite	Definite
Calculated Significance Rating	High	**Medium**
Impact Status: (positive or negative)	Negative	Negative
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes	
Can impacts be enhanced: (Yes or No)	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 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;
- Consider mitigation measures indicated in the AQIA, 2019:58:" *Either keeping all unpaved haul roads at least 175 m from residential areas and 320 m from the northern boundary of the 3L10/11/12 footprint; Or wet suppression/chemical stabilization of unpaved haul roads. Regular sweeping/vacuuming of paved haul roads. Keeping drop height for loading of dried silt onto haul trucks to a minimum. Keeping loading and drying areas as far from the northern boundary of the 3L10/11/12 footprint as possible*".

8.2.1.8 Community Health

8.2.1.8.1 EHA #5: Surface Water

Table 8-20: Impact Evaluation – Water Pollution

NATURE OF IMPACT: Ingestion of contaminated surface water due to potential of silt contaminating Russell Stream. The stockpiling of silt is in close proximity of the flood plain, during high rainfall potential flooding may arise and impact the water quality. Poor maintenance of stormwater infrastructure could result in spillages and resultant impacts on water quality.

	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 -	Moderate +
Probability (Definite, Possible, Unlikely)	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	High	Medium
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	

NATURE OF IMPACT: Ingestion of contaminated surface water due to potential of silt contaminating Russell Stream. The stockpiling of silt is in close proximity of the flood plain, during high rainfall potential flooding may arise and impact the water quality. Poor maintenance of stormwater infrastructure could result in spillages and resultant impacts on water quality.
Residual impacts ❖ The slimes dams and sand dumps along the Russell Stream are all potential sources of pollution. In the current state of the stream (with silt) and after removal of the silt these pollution sources next to the stream must be managed more effectively to ensure no contaminated silt, surface or groundwater enters the rehabilitated Russell Stream. Current water qualities indicate high salt and metal concentrations, with a low pH water found in the drains along the TSF footprint areas.
Mitigation measures ❖ Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted to paddocks. No pooling of water on the surface allowed. ❖ Implementation of the proposed Storm Water Management Plan (SWMP). The SWMP will ensure that "dirty" footprints and runoff is contained (As per Surface Water Report and the EIA/EMPr). ❖ It is recommended that the proposed paddock walls and berms be reinstated to a height above the floodline. ❖ The excavated silt and any water must be removed from open and exposed formation surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper fractured aquifers. ❖ If rainwater 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 remediation process to prevent overflows and spillages. ❖ Ensure that sufficient cut-off trenches and berms are implemented to avoid future wash of silt. ❖ Regular monitoring reports must be prepared for internal use, as well as for submission to the authorities.

8.2.1.8.2 EHA #5: Groundwater

Groundwater quality will be negatively affected with potential increase in salt loads, especially sulphate concentrations during the excavation activities. The silt will potentially contain pyrite minerals and when exposed to oxygen and water during excavation it will result in the formation of acidic conditions. The risk of groundwater contamination during the hydraulic mining will be higher compared to the existing impacts, as chemical reactions and leaching from the silt will increase. Surface water management and containment guidelines must be followed carefully during the rehabilitation process.

In addition, the gold containing silt and the adjacent TSF and sand dump facilities can potentially add chloride, calcium, magnesium, manganese and aluminium to the local groundwater system, if the management of contaminated water on site is not effective, but also through seepage from the dumps. This has been confirmed by the 2019 water sampling results. Metals like cobalt, copper, nickel and zinc can also be elevated.

The current understanding of the aquifers present and the potential sources to groundwater contamination suggests that the impact on groundwater quality during the operational phase will mainly be limited to the disturbed areas. Within the disturbed areas, both the simulated sulphate and iron concentrations are expected to exceed the Klip River catchment unacceptable water quality guidelines. This impact may extend between 200 and 500 m from the excavations, depending on aquifer conditions.

It is furthermore likely that a small portion of the wetland situated to the east of the Valley Silts project may experience groundwater quality in terms of sulphate and iron concentrations that exceed tolerable interim target water qualities. In the long-term groundwater qualities are expected to improve to within acceptable management targets in this wetland. There is currently insufficient information available to estimate the salt load on this wetland as a result of potentially contamination groundwater baseflow components.

Table 8-21: Impact Evaluation – Water Pollution

NATURE OF IMPACT: Ingestion of contaminated surface and groundwater. Surface water and groundwater pollution during remediation as a result of AMD water seeping into the aquifers and rivers.		
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 -	Moderate +
Probability (Definite, Possible, Unlikely)	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Reversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ The slimes dams and sand dumps along the Russell Stream are all potential sources of pollution. In the current state of the stream (with silt) and after removal of the silt these pollution sources next to the stream must be managed more effectively to ensure no contaminated silt, surface or groundwater enters the rehabilitated Russell Stream. Current water qualities indicate high salt and metal concentrations, with a low pH water found in the drains along the TSF footprint areas.		
Mitigation measures ❖ 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. The groundwater monitoring network efficiency must be assessed, and new monitoring boreholes drilled, if required. ❖ The excavated silt and any water must be removed from open and exposed formation surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper fractured aquifers. ❖ If rainwater is present and does not evaporate within a few weeks, then the paddocks are to be pumped prior to AMD forming. ❖ Ensure that the existing paddocks can contain all dirty water generated during the removal and drying process to prevent overflows and spillages.		

NATURE OF IMPACT: Ingestion of contaminated surface and groundwater. Surface water and groundwater pollution during remediation as a result of AMD water seeping into the aquifers and rivers.
❖ Ensure that sufficient cut-off trenches and berms are implemented to avoid future wash of silt and slimes from the historical TSF situated adjacent to the Project. ❖ Ensure a stormwater management plan is implemented to contain "dirty" footprint runoff (As per Surface Water Report and the EIA/EMPr). ❖ Regular monitoring reports must be prepared for internal use, as well as for submission to the authorities.

8.2.1.8.3 EHA #8: Air Quality

Table 8-22: Impact Evaluation - PM

NATURE OF IMPACT 1: Respiratory and other health issues as a result of PM inhalation. Hauling of silt, turning of silt in the drying process and loading of dried silt onto haul trucks causes the emission of PM 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**
Impact Status: (Positive or Negative)	**Negative**	**Negative**
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)*	Major -	Moderate -
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
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 ❖ Monitor dust fallout rates during the removal and drying phase of the Project. ❖ Continue with dust suppression measures or binders on the exposed areas. ❖ Keep haul roads as far from the residential areas as possible, preferable more than 175m away. ❖ Wet/chemical suppress unpaved roads. ❖ Where possible, existing tarred roads should be used. ❖ Areas for drying and loading the silt should also be kept within the "dirty" footprint area. ❖ Temporary storage piles for the removed vegetation to be kept to a minimum. ❖ The drop height for loading haul trucks, after the silt has been dried, should be kept to a minimum. ❖ Strict speed control of all vehicles on site to 40 km/hr. ❖ If reducing speeds to 40 km/hr does not reduce emissions sufficiently, either chemical stabilisation or wet suppression mitigation methods should be used on all on-site roads or alternatively, the speed of all on-site vehicles must be limited to 20 km/hr (reducing speeds from 40 km/hr to 24 km/hr results in a 42% reduction in PM10 emissions (Watson, et al., 1996)). ❖ Trucks transporting the dried silt should be covered with a tarpaulin, minimising dust plumes. ❖ Establish a quarterly reporting structure to appraise performance, compliance and complaints.		

8.2.1.9 Traffic Statement

Table 8-23: Construction and Operation Traffic Impacts

NATURE OF IMPACT 1: Extra Heavy Vehicle Traffic		
	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)	Reversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None		
Mitigation measures ❖ None		

Table 8-24: Construction and Operation Traffic Impacts

NATURE OF IMPACT 1: Increased Congestion		
	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)	Reversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None		
Mitigation measures ❖ None		

Table 8-25: Construction and Operation Traffic Impacts

NATURE OF IMPACT 1: Vehicle Impact and Damage		
	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)	Reversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ Extended congestion and delays on the road		
Mitigation measures ❖ Sufficient sight distance at access position ❖ Warning and speed restrictions to be adhered to		

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 8-26: Summary table of the Activities associated with the operational phase of the project

ACTIVITY	DESCRIPTION
	Operational Phase
1	Excavation of Silts
2	Stockpiling and drying of silts
3	Hauling of silts to the Ezekiel Dump for Pre-Processing

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;
- ❖ Habitat disturbance;
- ❖ Disturbances due to excavation works in CBA: Important and ESA watercourse;
- ❖ Erosion and dust dispersal;
- ❖ Water runoff and acid mine drainage; and
- ❖ Continued displacement and fragmentation of the faunal community

Table 8-27: Significance rating of operational impacts on Biodiversity during operation

NATURE OF IMPACT 1: Excavation of silt: Erosion, dust, alien invasive plant species encroachment, continued disruption of fauna species.		
	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	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Alteration of fauna assemblages due to habitat modification ❖ Loss of ecosystem services ❖ Reduced plant seed dispersal		
Mitigation measures ❖ 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. ❖ An alien invasive species control plan must also be compiled and implemented for the footprint of the project area, with removal of alien plants on a quarterly basis. ❖ Monitoring impacts of operational activities on fauna so that adaptive management practises can be implemented if required.		

Table 8-28: Significance rating of operational impacts on Biodiversity during operation

NATURE OF IMPACT 2: Storing and drying of silt: Erosion, dust, alien invasive plant species encroachment, draining of polluted water into the surrounding area.		
	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	Medium term
Magnitude *(Major, Moderate, Minor)*	Moderate	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		

❖ Diseases due to the increase in the dust levels ❖ Faunal mortality (direct and indirectly) ❖ Groundwater pollution ❖ Loss of ecosystem services
Mitigation measures ❖ Polluted water runoff must be limited by installing a lined base below the silt that will be piled and drainage system must accompany this to restrict the spreading to the now concentrated polluted water. ❖ 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. ❖ An alien invasive species control plan must also be compiled and implemented for the footprint of the project area, with removal of alien plants on a quarterly basis.

Table 8-29: Significance rating of operational impacts on Biodiversity during operation

NATURE OF IMPACT 3: Hauling of silt on existing and new roads: Encroachment of alien invasive plant species, Erosion , Dust, continued disruption of fauna species.		
	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	Medium term
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Diseases due to the increase in the dust levels ❖ Faunal mortality (direct and indirectly) ❖ Loss of ecosystem services		
Mitigation measures ❖ Implementation of alien invasive plant management plan needs to be continued during operation to prevent the growth of invasive on cleared areas. ❖ 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 kill. ❖ 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.		

8.2.2.2 Wetlands

Addressed in Construction Impacts above.

8.2.2.3 Surface Water

During the operational phase, the silt will be mechanical excavated and will be transported to the stockpiling area. From the stockpiling area, the silt will be transported off site.

The activities and impacts that could potentially occur during the operational phase are summarised in Table 8-30.

Table 8-30: Summary of activities and impacts for the operational phase

ACTIVITY	IMPACT DESCRIPTION
Uncontrolled dirty water runoff from the mining and stockpiling areas.	**Impact 1:** Runoff into the downslope Russell Stream impacting on water quality and sedimentation.
Poor maintenance of stormwater infrastructure.	**Impact 2:** Silted paddocks and channels as well as eroded berms, can lead to spills into the downslope Russell Streams impacting on water quality and sedimentation.
Flooding of the mining and stockpiling area.	**Impact 3:** Mechanical mining will take place within the Russell Stream floodplain. The stockpiling of silt is in close proximity to the floodplain. High rainfall can potentially result in flooding and consequent downstream water quality issues.

The ratings and proposed mitigation measures for the impact indicated in Table 8-30, are indicated in Table 8-31.

Table 8-31: Significance rating of operational impact 1.

NATURE OF IMPACT 1: Uncontrolled dirty water runoff from the mining and stockpiling areas running off into the downslope Russell Stream 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)*	Long term (operational phase is 6 years)	Long term (operational phase is 6 years)
Magnitude *(Major, Moderate, Minor)*	Major	Moderate
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
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 provided that rehabilitation is done appropriately.		
Mitigation measures ❖ Implementation of the proposed SWMP. It must be ensured that stormwater measures are designed, constructed and operated, to ensure that stormwater does not spill more than once in 50 years, to be		

NATURE OF IMPACT 1: Uncontrolled dirty water runoff from the mining and stockpiling areas running off into the downslope Russell Stream impacting on water quality and sedimentation
compliant with GN R704 regulations; and ❖ Water quality sampling must be implemented upstream and downstream of the mining and stockpiling areas. It is recommended that Total Suspended Solids (TSS) and turbidity are included in the current water quality monitoring programme.

Table 8-32: Significance rating of operational impact 2

NATURE OF IMPACT 2: Poor maintenance of stormwater infrastructure resulting in silted paddocks and channels as well as eroded berms, leading to spills into the downslope Russell Stream 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)*	Long term (operational phase is 6 years)	Long term (operational phase is 6 years)
Magnitude *(Major, Moderate, Minor)*	Major	Moderate
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
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 detailed in the EMPr.		

Table 8-33: Significance rating of operational impact 3

NATURE OF IMPACT 3: Poor maintenance of stormwater infrastructure resulting in silted paddocks and channels as well as eroded berms, leading to spills into the downslope Russell Stream 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)*	Long term (operational phase is 6 years)	Long term (operational phase is 6 years)
Magnitude *(Major, Moderate, Minor)*	Major	Moderate
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	**High**	**Medium**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	

NATURE OF IMPACT 3: Poor maintenance of stormwater infrastructure resulting in silted paddocks and channels as well as eroded berms, leading to spills into the downslope Russell Stream impacting on water quality and sedimentation	
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. It must be ensured that stormwater measures are designed, constructed and operated, to ensure that they can convey/contain the 50 year runoff, to be compliant with GN R704 regulations; and ❖ It is recommended that the proposed paddock walls and berms are constructed to a height above the floodline.	

8.2.2.4 Groundwater

8.2.2.4.1 Groundwater Quality

Historically the sources of pollution associated with the Valley Silts area include:

- Contaminated storm water runoff from the slime's dams and sand dumps along the Russell Stream;
- Seepage water from the slimes dams and return water dams (RWD), possibly containing high sulphates and metals; and
- Recharge of contaminated water by means of seepage from the dumps and any unlined storm water channels.

Groundwater quality will be negatively affected with potential increase in salt loads, especially sulphate concentrations during the excavation activities. The silt will potentially contain pyrite minerals and when exposed to oxygen and water during excavation it will result in the formation of acidic conditions. The risk of groundwater contamination during the excavation activities will be higher compared to the existing impacts, as chemical reactions and leaching from the silt will increase when exposed to oxygen and rainwater. Surface water management and containment guidelines must be followed carefully during the desilting process. The desilting activities will be driven by mechanical excavation. No water is used in the process.

The current understanding of the aquifers present and the potential sources to groundwater contamination suggests that the impact on groundwater quality during the operational phase will mainly be limited to the disturbed areas. Within the disturbed areas, both the simulated sulphate and iron concentrations are expected to exceed the Klip River catchment unacceptable water quality guidelines. This impact may extend between 200 and 500 m from the excavations, depending on aquifer conditions.

It is furthermore likely that a small portion of the wetland situated to the east of the Valley Silts project may experience groundwater quality in terms of sulphate and iron concentrations that exceed tolerable interim target water qualities. In the long-term groundwater qualities are expected to improve to within acceptable management targets in this wetland. There is currently insufficient information available to estimate the salt load on this wetland as a result of contamination groundwater baseflow components.

The wetlands to the west of the Valley Silts project are expected to experience similar conditions to those discussed above. The area over which this impact may occur will most probably be larger compared to the wetland to the east of the project area, but this is mainly due to the regional impact of historical tailings deposition in this area and not only to the Valley Silts project.

Monitoring of groundwater quality and water levels must be implemented along and downgradient of the Russell Stream, with continuous review and updating of the monitoring network based on the monitoring results.

A cause for concern in reclaimed residue deposits is incomplete clean-up operations. Any remaining material, in particular sulphide minerals, poses an environmental hazard. It is important that a sound stormwater management plan is implemented during the operational phase to ensure that dirty footprints and runoff are contained. In addition, it is important that the necessary cut-off trenches and berms are put in place between the Valley Silts project area and the historical TSF to avoid future wash of silts and slimes into the excavated and rehabilitated areas, thus compounding the project again.

Table 8-34: Operational 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)*	Long term	Long term
Magnitude *(Major, Moderate, Minor)*	Major -	Moderate -
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
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.	
Residual Impacts ❖ Combined impact with other mining and industrial activities. Refer to Chapter 10 of the Groundwater Impact Assessment		
Mitigation measures ❖ Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted to the cut-off trenches and sumps. No pooling of water on surface allowed. ❖ Monitor groundwater quality in all boreholes installed. The groundwater monitoring network efficiency must be assessed, and new monitoring boreholes drilled, if required. ❖ Ensure that cut-off trenches with sumps can contain all dirty water generated during the desilting process to prevent overflows and spillages. ❖ Ensure that sufficient cut-off trenches and berms are implemented to avoid future wash of silt and slimes from the historical TSF situated adjacent to the Valley Silts project.		

8.2.2.4.2 Groundwater Quantity

The proposed Russell Stream desilting project will not have any significant impacts on the groundwater quantity (Table 18 of the Groundwater impact study in Appendix D4).

The desilting activities will be driven by mechanical excavation. No water is 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 8-35: 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)	**Positive**	**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)	**Medium**	**Medium**
Reversibility: (Reversible or Irreversible)	Reversable	
Irreplaceable loss of resources: (Yes or No)	No	
Cumulative impacts (yes or no)	Yes. Refer to Chapter 10 of the groundwater impact assessment	
Mitigation measures ❖ Monitor groundwater levels in all boreholes.		

8.2.2.5 Air Quality

See Table 8-12 in the construction phase.

8.2.2.6 Heritage and Palaeontology

See Table 8-13 in the construction phase.

8.2.2.7 Social Impact

Refer to Chapter 7, section 7.10.8 for a description of the anticipated social impacts of the proposed project.

Table 8-36: Impacts on Job security and skills development

NATURE OF THE IMPACT: JOB SECURITY AND SKILLS DEVELOPMENT		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Long term	Long term

Magnitude	Moderate +	Major+
Probability	Possible	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
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 as per the Social and Labour Plan (SLP);
- Aim to absorb the youth (as the area has a high dependency ratio);
- Effective implementation of training and skills development initiatives through EBDA;
- It is recommended that as part of the CSI programme, the contractor makes use of local labour as and when required; and
- Comply with the Skills Development Act, (Act No.97 of 1998).

Table 8-37: Impacts of stimulating economic growth.

NATURE OF THE IMPACT: STIMULATION OF ECONOMIC GROWTH		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Long term
Magnitude	Minor +	Major +
Probability	Possible	Definite
Calculated Significance Rating	Low	High
Impact Status: (positive or negative)	Positive	Positive
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

- 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 8-38: Safety Impacts for employees and communities

NATURE OF THE IMPACT: SAFETY IMPACTS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Medium-
Probability	Possible	Definite
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	

Residual impacts

- Residual impacts are expected only if accidents occur during the construction and operational phases- Compromised quality of life is expected due to accidents that could possibly occur;
- Increased perception of unsafety

Mitigation measures

- Mine security patrols should monitor the perimeters of the project site thereby providing an increased security presence;
- All project infrastructure should be contained in a secured area to prevent unauthorized access and therefore potential health and safety risks;
- A grievance management mechanism should be in place to receive incident related queries;
- Appoint competent safety personnel to ensure construction site personnel to comply with their responsibilities for health and safety and to achieve progressive improvement in safety performance;
- Comply with the Mine Health and Safety Act;
- Safety warning and informative signs should be placed in area with potential hazards and risk of accident.

Table 8-39: Increased traffic due to hauling of silts

NATURE OF THE IMPACT: INCREASED TRAFFIC FROM HAULING		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Short term
Magnitude	Major -	Medium-
Probability	Possible	Definite
Calculated Significance Rating	High	Medium
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	

Residual impacts

- Residual impacts are expected only if accidents occur during the construction and operational phases- Compromised quality of life is expected due to accidents that could possibly occur;
- Increased perception of unsafety

Mitigation measures

❖ Adhere to the mitigation measures as recommended in the Traffic Impact Assessment; ❖ Consider the use of traffic signs to warn construction vehicles of the presence of pedestrians; ❖ A grievance management mechanism should be in place to receive incident related queries

Table 8-40: Disruption of movement patterns

NATURE OF THE IMPACT: DISRUPTION IN DAILY MOVEMENT PATTERNS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Short term
Magnitude	Moderate -	Medium-
Probability	Possible	Definite
Calculated Significance Rating	Medium	Low
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
Residual impacts ❖ Restricted access which might disrupt daily movement patterns		
Mitigation measures ❖ Adhere to the mitigation measures as recommended in the Traffic Impact Assessment; ❖ A grievance management mechanism should be in place to receive incident related queries; ❖ Safety awareness (especially for school children who might be wandering to the project site) should be considered - the applicant should consider communicating the risks of wandering to site and the safety aspect with the affected communities.		

Table 8-41: Exposure to dust fallout and health impacts

NATURE OF IMPACT: INCREASED DUST LEVELS AND RISE IN ASSOCIATED HEALTH IMPACTS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Short Term
Magnitude	Moderate-	Minor -
Probability	Probable	Probable
Calculated Significance Rating	**High**	**Medium**
Impact Status: (positive or negative)	Negative	Negative
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	Yes	
Can impacts be enhanced: (Yes or No)	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 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; ❖ Consider mitigation measures indicated in the AQIA, 2019:58: "*Either keeping all unpaved haul roads at least 175 m from residential areas and 320 m from the northern boundary of the 3L10/11/12 footprint; Or wet suppression/chemical stabilization of unpaved haul roads. Regular sweeping/vacuuming of paved haul roads. Keeping drop height for loading of dried silt onto haul trucks to a minimum. Keeping loading and drying areas as far from the northern boundary of the 3L10/11/12 footprint as possible*".

8.2.2.8 Community Health

Refer to impacts assessment in Section 8.2.1.8.

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 8-42: Summary table of the Activities associated with this decommissioning phase of the project

ACTIVITY	DESCRIPTION
Decommissioning Phase	
1	Demolition of temporary infrastructure and Rehabilitation of the project area. Ergo aims to rehabilitate the Valley Silts area by shaping the areas where silt was removed and make the area free draining. Thereafter, appropriate species will be planted to stabilise the soil.
2	Closure forum to be established with key stakeholders.

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 rehabilitation 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 8-43: Assessment of significance of potential decommissioning of the development pre- and post-mitigation

NATURE OF IMPACT 1: Encroachment of alien invasive plant species.

	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	Short term (construction phase period)
Magnitude *(Major, Moderate, Minor)*	Moderate	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 ❖ Loss of habitat for indigenous species		
Mitigation measures ❖ Implementation of alien invasive plant management plan needs to be continued during decommissioning to prevent the growth of invasive on rehabilitated areas; ❖ Rehabilitation of site with indigenous vegetation that occurs in the vicinity of project area.		

Table 8-44: Assessment of significance of potential decommissioning of the development pre- and post-mitigation

NATURE OF IMPACT 2: Continued displacement, direct mortalities and disturbance of faunal community (including multiple threatened species) due to habitat loss and disturbances (such as dust).		
	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)*	Medium term	Medium term
Magnitude *(Major, Moderate, Minor)*	Moderate	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		
Mitigation measures ❖ All infrastructure that could have a negative impact on faunal species (silt drying area sheeting etc) needs to be decommissioned and removed		

Table 8-45: Assessment of significance of potential decommissioning of the development pre- and post-mitigation

NATURE OF IMPACT 3: If rehabilitation 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.		
	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)*	Medium term	Medium term
Magnitude *(Major, Moderate, Minor)*	Moderate	Minor
Probability *(Definite, Possible, Unlikely)*	Definite	Possible
Calculated Significance Rating (Low, Medium, High)	Medium	Low
Reversibility: (Reversible or Irreversible)	Reversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Residual impacts ❖ None		
Mitigation measures ❖ Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces		

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 8-46: DWS Risk Impact Matrix for the Valley Silts Project During Decommissioning

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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**
CLOSURE																			
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 rehabilitation and closure plan. Appropriately rehabilitate the project area by filling, landscaping and re-vegetating with locally indigenous species.
			With	1	1	1	1	1	2	2	5	1	1	5	2	9	45	L	
Cumulative Effects	Contamination and sedimentation	Cumulative contamination and sedimentation risk from upstream reclamation projects to downstream users	Without	4	5	4	4	4.3	3	5	12	3	3	5	4	14	184	H	Effective application of required mitigation and rehabilitation for all reclamation projects in the region.
			With	3	3	3	3	3	2	2	7	1	1	5	2	0	63	M	

8.2.3.3 Surface Water

The target areas where silt has been removed will be shaped to allow free drainage and will be vegetated. The activities and impacts that are likely to occur during the closure and rehabilitation phase are summarised in Table 8-47.

Table 8-47: Summary of activities and impacts for the closure phase.

ACTIVITY	IMPACT DESCRIPTION
Exposure of soil during the closure and rehabilitation phase activities, once all silt has been removed.	Erosion and consequent deterioration of water quality in the Russell Stream.

The ratings and proposed mitigation measures for the impact indicated in Table 8-47, are provided in Table 8-48.

Table 8-48: Significance rating of closure impact 1

NATURE OF IMPACT 1: The exposure of soil once all silt has been removed, has the potential to be washed into the downslope Russell Stream, 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 in place while rehabilitation is taking place; and ❖ Water quality monitoring must continue upstream and downstream until the site has been fully rehabilitated.		

8.2.3.4 Groundwater

8.2.3.4.1 Groundwater Quality

Groundwater quality along the Russell Stream is expected to improve as the in-stream source of contamination will be removed. Sulphate concentrations in the immediate vicinity of the stream may reduce by between 800 and 3,000 mg/L as a result of silt removal. The zone of impact over which sulphate concentrations would exceed unacceptable Klip River catchment water quality targets will reduce in the long-term. The contamination is however not expected to dissipate, but it is likely that sulphate and iron concentrations would reduce to within tolerable interim and even acceptable management water quality targets in the long-term. Historical groundwater contamination will most likely continue to move through the aquifers in a westerly direction towards the tributary of the Klip River. The removal of the silt and sediments in the Russell Stream is however expected to reduce the zone of impact in the long-term.

The impact as a result of the desilting is anticipated to be positive after the waste material and sand have been removed

Table 8-49: Decommissioning Phase water quality impacts.

NATURE OF THE IMPACT: Water quality impacts when silt 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.	
Mitigation measures ❖ Monitor groundwater quality in all boreholes. ❖ Maintain sound surface runoff management to ensure that all dirty runoff is contained and diverted away from the Russell Stream.		

8.2.3.4.2 Groundwater Quantity

There will be no impacts on the groundwater quantity during decommissioning. The desilting activities and addition of water will have stopped and any form of seepage of contaminated water 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.
Mitigation measures ❖ Monitor groundwater levels in all boreholes.	

8.2.3.5 Air Quality

See Table 8-12 in the construction phase.

8.2.3.6 Heritage and Palaeontology

No impacts are envisioned for decommissioning.

8.2.3.7 Social Impact

Refer to Chapter 7, section 7.10.8 for a description of the anticipated social impacts of the proposed project.

Closure will involve downscaling and retrenchment of the workforce over a number of years. Although there will be downscaling during this phase, some community members would have worked on the mine, and will constitute a reserve of trained workforce

Table 8-50: Impacts on Job security and skills development

NATURE OF THE IMPACT: JOB SECURITY AND SKILLS DEVELOPMENT		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate +	Major+
Probability	Possible	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Negative	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
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.

Table 8-51: Impacts of stimulating economic growth.

NATURE OF THE IMPACT: STIMULATION OF ECONOMIC GROWTH		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Moderate+	Major+
Probability	Possible	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Developed economy; ❖ Increased capacity to develop and maintain livelihood strategies		
Mitigation measures ❖ None.		

The residential area (Mogol Street) adjacent to the project area currently experiences floods during the rainy season. The street lies at the bottom of a slope and when it rains, the households and street gets flooded https://westside-eldos.co.za/50222/heavy-downpours-flood-riverlea-homes-residents-demand-restitution/ <Date accessed: 23 October 2019>. This statement was also supported by residents interviewed during the SIA interviews, respondents indicated that the stormwater drains are currently blocked by the silts and when it rains the area gets flooded. One respondent indicated that she struggles to keep the flooding under control and the water damages their properties and belongings.

The silt has not only blocked the storm water drains; the sewer system is blocked which affects the ablution facilities. One respondent indicated that her toilet has been blocked and out of use as a result of the blocked sewage system. She mentioned that she uses her neighbour ablution facilities.

It is anticipated that the removal of the silt should improve the water flow dynamics and assist in ameliorating current flooding issues experienced in the area of Riverlea. After removal of the silt from the target areas, Ergo intends to rehabilitate the target area by shaping the area where silt was removed and making the area free draining. The target area should provide attenuation in the future thus reduce the risk of flooding

Table 8-52: Potential to ameliorate current flooding issues

NATURE OF THE IMPACT: POTENTIAL TO AMELIORATE THE CURRENT FLOODING ISSUES		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Long term	Long term
Magnitude	Moderate +	Major+
Probability	Possible	Definite
Calculated Significance Rating	Medium	High
Impact Status:	Positive	Positive
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	Yes	
Residual impacts ❖ Desilted stream- free from pollution		
Mitigation measures ❖ Stakeholders must be informed that the rehabilitation of the entire Russell Stream will need to be a collaborative effort between Government Departments, Municipalities and private sector, and therefore changes may not happen almost immediately; ❖ Stakeholders' expectation should be managed- this can be done by establishing a community forum where issues/risks/opportunities regarding the proposed project are discussed and addressed.		

Table 8-53: Safety Impacts for employees and communities

NATURE OF THE IMPACT: SAFETY IMPACTS		
	Impact Rating Without Mitigation	**Impact Rating with Mitigation**
Extent	Local	Local
Duration	Medium term	Medium term
Magnitude	Major -	Medium-
Probability	Possible	Definite
Calculated Significance Rating	Medium	Low
Impact Status:	Negative	Negative
Reversibility:	Not applicable	
Irreplaceable loss of resources:	Not applicable	
Can impacts be enhanced:	No	
Residual impacts ❖ Increased perception of unsafety		

Mitigation measures
❖ Mine security patrols should monitor the perimeters of the project site thereby providing an increased security presence; ❖ All project infrastructure should be contained in a secured area to prevent unauthorized access and therefore potential health and safety risks; ❖ A grievance management mechanism should be in place to receive incident related queries; ❖ Appoint competent safety personnel to ensure construction site personnel to comply with their responsibilities for health and safety and to achieve progressive improvement in safety performance; ❖ Comply with the Mine Health and Safety Act; ❖ Safety warning and informative signs should be placed in area with potential hazards and risk of accident.

8.2.3.8 Community Health

Refer to impacts assess in Section 8.2.1.8.

8.2.3.9 Traffic

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 8-54: 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

Should rehabilitation be successfully implemented, then it is unlikely that any negative impacts will occur during the post closure phase. The removal of silt is likely to result in a long-term positive impact on the surrounding watercourses provided that rehabilitation is successfully implemented.

8.2.4.2 Groundwater

8.2.4.2.1 Groundwater Quality

Overall, there should be an improvement in the groundwater qualities along the Russell Stream post closure as the source of in-stream contamination has been removed.

Table 8-55: Post Closure Phase water quality impacts

NATURE OF THE IMPACT: Groundwater quality impacts after silt 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.	
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-desilting.

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 Biodiversity

Cumulative impacts are important for this project as the removal of the silt from the system will result in the bioaccumulation of other heavy metals that will not be removed along with the gold. The surface water is polluted currently, however by using the silt drying process the ground water will also be polluted, this can be mitigated through the use of a successful water drainage system. The air will also be polluted because of the large amount of dust that will be generated by the process.

Table 8-56: Cumulative impact rating for surface water quality

NATURE OF IMPACT: Extraction storage/drying and hauling of silt: Pollution discharge into the stream, bioaccumulation of heavy metals, Atmospheric pollution		
	OVERALL IMPACT OF THE PROJECT CONSIDERED IN ISOLATION	**CUMULATIVE IMPACT OF THE PROJECT AND OTHER PROJECTS IN THE AREA**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Local	Local
Duration *(Short term, Medium term, Long term)*	Medium term	Medium term
Magnitude *(Major, Moderate, Minor)*	Moderate	Moderate
Probability *(Definite, Possible, Unlikely)*	Possible	Possible
Calculated Significance Rating (Low, Medium, High)	**Medium**	**Medium**
Reversibility: (Reversible or Irreversible)	Reversible	Reversible
Irreplaceable loss of resources: (Yes or No)	No	No
Can impacts be enhanced: (Yes or No)	Yes	Yes
Mitigation measures ❖ The disturbance of the area can be mitigated through the successful rehabilitation of the area. ❖ The surface water is polluted currently, however by using the silt drying process the ground water will also be polluted, this can be mitigated through the use of a successful water drainage system. ❖ Continues dust suppression will be needed, this can be achieved through the spraying of dust suppressants along with the establishment of indigenous grass species		

8.2.5.2 Surface Water

The Project is located in a catchment that is highly impacted by mining, urban and industrial activities. The implementation of a sound SWMP is crucial to contain contaminated runoff from the operational area. The monitoring and maintenance of the implemented SWMP is of utmost importance, to ensure that spillages into the downslope watercourses do not occur. Furthermore, the implementation of a rehabilitation plan that ensures that the area is free draining and appropriately vegetated, could enhance the catchment water quality. Should the above not be done, then in the long term, the proposed project has the potential to cumulatively add to the already deteriorated water quality within the Russell Stream catchment.

The cumulative impact of the proposed project on the surface water quality of the catchment is rated in Table 8-57.

Table 8-57: Cumulative impact rating for surface water quality

NATURE OF IMPACT: Should dirty water runoff not be contained and an appropriate rehabilitation plan for the Russell Stream valley not be undertaken, then the proposed Project has the potential to add cumulatively to the already deteriorated surface water quality of the catchment		
	OVERALL IMPACT OF THE PROJECT CONSIDERED IN ISOLATION	**CUMULATIVE IMPACT OF THE PROJECT AND OTHER PROJECTS IN THE AREA**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Long term (in excess of the Project life)	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)	**High**	**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.		
Mitigation measures • Effective stormwater management that captures and contains all site runoff as proposed in the surface water impact assessment, and in accordance with GN R704 Regulations; • Successful rehabilitation of the Valley Silts target areas to a free draining and vegetated area; and • Water quality monitoring upstream and downstream of the proposed project.		

8.2.5.3 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 Valley Silts project is near other historical tailings deposition, mining activities, industrial activities and residential developments. Cumulatively all these activities contribute to the surface and groundwater quality impacts identified at the Valley Silts project area and could also impact the groundwater resources, especially in terms of quality.

The outcome of the Valley Silts desilting groundwater assessment indicates that the desilting activities will have an overall positive impact on the receiving environment.

Establishing monitoring boreholes (indicated in section 13 of the Groundwater report: Appendix D4) along the Russell Stream and downstream areas are required to assess the implications that stream desilting will have on the aquifers and to identify if poor quality groundwater will reach a sensitive receptor. The monitoring data recorded as desilting operations progress must be used to update the monitoring programme.

Table 8-58: Cumulative impact rating for groundwater

GROUNDWATER CUMULATIVE IMPACT		
	OVERALL IMPACT OF THE PROJECT CONSIDERED IN ISOLATION	**CUMULATIVE IMPACT OF THE PROJECT AND OTHER PROJECTS IN THE AREA**
Impact Status: (positive or negative)	**Negative**	**Negative**
Extent *(Local, Regional, International)*	Regional	Local
Duration *(Short term, Medium term, Long term)*	Long term (in excess of the Project life)	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)	**High**	**Low**
Reversibility: (Reversible or Irreversible)	Irreversible	
Irreplaceable loss of resources: (Yes or No)	No	
Can impacts be enhanced: (Yes or No)	Yes	
Mitigation measures • Ensure that contaminated surface and groundwater from the adjacent mining and industrial activities are effectively managed and that polluted water is not allowed to enter the rehabilitated Russell Stream.		

8.2.5.4 Air Quality

Emissions from the reclamation of the Valley Silts 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.

8.2.5.5 Heritage and Palaeontology

No significant cumulative impacts are envisaged.

8.2.5.6 Social Impact

According to the consultations and interviews undertaken, there are proposed developments within the project area such as the Johannesburg Roads Agency. From a social perspective, some of the most significant cumulative impacts relate to the following aspects:

8.2.5.6.1 Economic Investment

Overtime the local economy will be influenced by the proposed project and the desiltation project undertaken by the Johannesburg Roads Agency. The proposed projects will result in increased expenditure, which will most likely benefit smaller businesses, suppliers and contractors.

8.2.5.6.2 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.

8.2.5.6.3 An increase in Direct Project Nuisance Factors

An increase in nuisance factors namely, noise, air pollution and increased number of vehicles could further impact negatively on the sense of place for some receptors. It is likely that the levels of traffic usage and dust will increase particularly during the construction phase, when there are construction vehicles travelling to and from the construction sites. This increase in traffic will have a cumulative impact for other surrounding businesses and private individuals using the roads in the area. It is anticipated that there will be increased dust levels and it is understood from stakeholders that they rea currently affected by the dust from the Mooifontein dump.

8.2.5.7 Community Health

8.2.5.7.1 Surface Water

The Project is located in a catchment that is highly impacted by mining, urban and industrial activities. The implementation of a sound SWMP is crucial to contain contaminated runoff from the operational area. The monitoring and maintenance of the implemented SWMP is of utmost importance, to ensure that spillages into the downslope watercourses do not occur.

Furthermore, the implementation of a rehabilitation plan that ensures that the area is free draining and appropriately vegetated, could enhance the catchment water quality. Should the above not be done, then in the long term, the proposed Project has the potential to cumulatively add to the already deteriorated water quality within the Russell Stream catchment.

8.2.5.7.2 Groundwater

The Project is near other historical tailings depositions, mining activities, industrial activities and residential developments. Cumulatively all these activities contribute to the surface and groundwater quality impacts identified at the Project area and could also impact the groundwater resources, especially in terms of quality. The outcome of the Valley Silts rehabilitation groundwater assessment indicates that the remediation activities will have an overall positive impact on the receiving environment.

Establishing monitoring boreholes along the Russell Stream and downstream areas are required to assess the implications that stream rehabilitation will have on the aquifers and to identify if poor quality groundwater will reach a sensitive receptor. The monitoring data recorded as remediation operations progress must be used to update the monitoring programme.

8.2.5.7.3 Air Quality

Emissions from the remediation of the Valley Silts are expected to temporarily increase ambient concentrations of PM_{10} and $PM_{2.5}$ up to 2 km from the Project boundary. Concentrations of these criteria pollutants **are already exceeded** in the CoJ metropolitan area.

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 Valley Silts 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

8.3.1.1 Proposed Mitigation Actions

The following are general mitigations that are relevant for all stages of the process and should help reduce the significance of potential impacts associated with the project. The mitigation actions provided below are important to consider with other specialist assessments. These mitigation measures should be implemented in the Environmental Management Plan (EMP) should the project go-ahead. The focus of mitigation measures is to reduce the significance of potential impacts associated with the development:

- All dumping and storage must be within the existing infrastructure footprint and the low sensitivity areas;
- All laydown, storage areas etc should be restricted to transformed areas close to the preferred option and existing roads should be used as far as possible;
- The number (and size) of laydown, storage and staff facilities must be kept to a minimum for the duration of the project. These areas must be designated in already disturbed areas;
- Building material must be stored in areas that have previously been disturbed and are classified as a low risk according to the sensitivity map in this report;
- Building materials may not be stored for extended periods of time and must be removed from the site once the project has been concluded;
- Infrastructure needs to be removed once the project has been concluded;
- Dust-reducing mitigation measures must be put in place and must be strictly adhered to. This includes wetting of exposed soft soil surfaces;
- A spill management plan must be put in place to ensure that should there be any chemical spill out or over that it does not run into the surrounding areas. This is included in the EMPr;
- During construction activities, all rubble generated must be removed from the site;
- No vehicles or activities, dumping or clearing is permitted within the sensitive areas as defined in this report;
- The contractors used for the construction should have spill kits available prior to construction to ensure that any fuel, oil or hazardous substance spills are cleaned-up and discarded correctly;
- Environmental protection activities during the reclamation process are;
  - Keep storm water away from the working areas;
  - Prevent rainwater and the process water that has fallen on site from leaving the site in an uncontrolled and unregulated fashion; and
  - Prevent dust pollution during dry, windy conditions.
- If any faunal are recorded during construction, activities should temporarily cease, and time permitted for the species to move away. In the event the species does not move away (voluntarily), the species must be removed safely from the area and relocated to a suitable area that will not be directly disturbed by the project;
- Fauna species such as frogs and reptiles that have not moved away should be carefully and safely removed to a suitable location beyond the extent of the development footprint by a suitably qualified ECO trained in the handling and relocation of animals;

- Waste management must be a priority and all waste must be collected and stored adequately. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site;
- The intentional killing of any animals including snakes, insects, lizards, birds or other animals should be strictly prohibited;
- Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when not in use;
- Dust fallout monitoring must be undertaken in accordance with the EMPr;
- Monitoring of Alien Invasive Plant species and their presence, in conjunction with the alien invasive plant management plan for the life of the project;
- Aquatic monitoring should be done on a bi-annual basis for the life of the project;
- Leaking equipment must be repaired immediately or be removed from site to facilitate repair;
- All personnel and contractors to undergo Environmental Awareness Training. A signed register of attendance must be kept for proof;
- Develop and implement a rehabilitation and closure plan and
- Appropriately rehabilitate the project area by filling, landscaping and re-vegetating with locally indigenous species.

8.3.1.2 Impact Statement

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 provides a means to facilitate the “rehabilitation” of a portion of the Russell Stream wetland, namely Dam B. However, temporary contamination of downstream watercourses during operation remains a possibility 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 rehabilitation of contaminated land. It is anticipated that through carefully planned reclamation efforts the system can be restored to a state where it represents a viable and functioning wetland system. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the reclamation efforts but is likely to remain one of the most challenging issues.

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. Maintenance of stormwater measures is of utmost importance and should be conducted as outlined in section 7 of the Surface Water Impact Assessment. Furthermore, water quality monitoring must continue upstream and downstream of the proposed reclamation and stockpiling areas. The removal of the silt is expected to have a positive impact in the long-term on the surrounding watercourses, provided that rehabilitation is successfully implemented.

The following is a summary of the recommendations provided in the report:

- Exemption from GN R704 is obtained for mining activities and infrastructure proposed to be undertaken within the 1:100 year floodline or within 100 m of a watercourse;
- The SWMP is implemented, and that all conditions specified in GN R704 are strictly adhered to;
- The impact mitigation measures provided under section 6 of the surface water impact assessment are implemented; and
- The monitoring plans recommended in this report are implemented.

8.3.3 Groundwater

The Russell Stream is underlain predominantly by the Booysens Subgroup (shale) of the Witwatersrand Supergroup. On average, the depth to water table is between surface and 5 metres below surface. The groundwater flow direction will be in a westerly to south-westerly direction, towards the Klip River.

During the 2019 hydrocensus 4 boreholes were identified. The hydrocensus included visits to several private and commercial properties in the area, e.g. Riverlea Primary School, residential areas, communication with community members, communication with other mining operations and security staff at the various tailings storage facilities and sand mining dumps, and a visit to the old Crown Mines Golf Club. It was concluded that groundwater is not used in the area and all properties make use of municipal supply. No boreholes were identified along the eastern portion of the project area. The excavation of sediment as part of this project will not entail the introduction of additional water.

8.3.3.1 Current Water Quality:

Groundwater in the project area represents a Calcium/ Magnesium-sulphate water, indicating contaminated water. Based on the water quality results, the following conclusions were drawn:

1. Chronic Health effects:
   - Iron – An elevated iron concentration was measured for water sampled at the north-eastern corner of the Mooifontein TSF drainage canal (Storm1), 342 mg/L versus the maximum allowable concentration of 2 mg/L. The two borehole water samples however indicate very low iron concentrations.
   - Manganese – All three samples measured a manganese concentration that could result in chronic health effects. The highest concentration was measured in the surface water sample (Storm1) and the lowest in the borehole at the N1 highway (VAL1).
   - Total Organic Carbon – a high TOC value (13.3 mg/L) was measured for Storm1. The two groundwater samples were within acceptable limits.
   - pH – the pH value for Storm1 (4.13) is below the SANS guideline limit of 5. The pH for the two groundwater samples were near neutral.

2. Acute Health effects:
   - Sulphate – Sulphate concentrations were very high in Storm1 and borehole CRG B15, and also exceeded the aesthetic limits for borehole VAL1.
3. Aesthetic effects:
   - Aluminium – Storm1 recorded an elevated Al concentration – 19 mg/L (0.3 mg/L allowed). The aluminium concentrations in the two groundwater samples were very low.
   - Ammonium – A high ammonium concentration was measured in boreholes VAL1.
   - Sodium – Storm1 and borehole CRG B15 exceed the aesthetic limits for drinking water.
   - Turbidity – Turbidity was high in Storm1 and borehole CRG B15.
   - Magnesium – High magnesium concentrations were measured in Storm1 and borehole VAL1.
   - Total hardness – High total hardness values were measured in all 3 sites – very hard water. High concentrations of calcium were measured at all 3 sites.

The chemicals of concern for the Valley Silts project area (associated with the 3 sampled sites) are pH, dissolved iron, manganese, sulphate and total organic carbon. Parameters exceeding aesthetic limits include ammonium, aluminium, calcium, magnesium and sodium. Most of these are only elevated in the trench water sample and also the borehole next to the Mooifontein TSF (B15). The element concentrations seem to reduce in the groundwater, further away from the TSF as a results of alkaline groundwater conditions and buffering impacts. The element concentrations are also much lower in the groundwater compared to the trench water, at source.

8.3.3.2 Geochemistry:

The 2005 Council for Geosciences study identified Co, Ni, Cu, As and U as the principal elements of concern. The Council for Geosciences found – "The leachable fractions determined from the compliance batch leach tests are uniformly low, with nickel slightly more mobile than the other elements.

The samples were all deposited in a sub-aqueous environment and are in contact with water for most of the year. Any easily mobilised metals will therefore be mobilised, while the more strongly bound fraction will require a more aggressive leachate than clean water to remobilise them. As long as the current conditions are maintained in these wetlands, i.e. continuous discharge of water to the wetlands and the maintenance of reducing conditions, it is unlikely that the metals will be mobilised.

The proposed plan at Valley Silts will be to remove the silts, stockpiling it at 3L10-12 to dry out. The excavation of the silt from the water course will trigger oxidation reactions that will result in acidic conditions and leaching of salts and metals. Negative surface and groundwater quality impacts are expected in the excavated areas and also the stockpile areas.

In the deeper silt pockets the pH will be much lower and element concentrations higher, but due to current stable conditions that include saturation, low permeability and low oxygen levels, metal and salt leaching does not happen readily. This will change when the silt excavation process introduces oxygen and disturbs the stable conditions.

8.3.3.3 Source Term:

The impact of desilting on groundwater quality was assessed at the hand of both sulphates and iron. The sulphate plumes provide a general indication of the anticipated impact of desilting in terms of salt load and the iron plumes the impact of desilting in terms of heavy metal mobilisation.

The Russell Stream generally has sulphate concentrations below 200 mg/L. Elevated sulphate concentrations (3,208 mg/L) were measured in the seepage from the Mooifontein TSF (sample Storm 1). Groundwater associated with historical tailings dams are also elevated, varying between 417 mg/L (sample Val 1) and 1,843 mg/L (sample Crg B15).

Iron concentrations show different trends. Two of the surface water samples in the Russell Stream (CR4 and CR7) exceed 1 mg/L. Seepage from the tailings dam (Storm 1) had very high iron concentrations of 342 mg/L, but the concentrations were very low in the sampled groundwater. This relates to alkaline groundwater conditions further from source.

The water qualities associated with Storm1 was used as source quality information for the numerical model simulations.

8.3.3.4 Modelling:

It is understood that Ergo does not intend to excavate the entire length of the Russell Stream. Desilting will only take place in areas where sediments settled from runoff. To complete the potential impact of desilting the mine plan provided for the first two years was included during simulations.

8.3.3.4.1 Outcome of Simulations Completed:

A low level of confidence is currently attached to the outcome of the simulations presented due to the limited dataset and the completion of limited model calibration and sensitivity analysis. The results are however suitable to demonstrate a first approximation of the potential impacts of desilting and must be updated once more detailed information becomes available.

All simulations suggest that groundwater quality would be impacted regionally by impacts associated with the historical TSFs.

8.3.3.4.2 Simulated Sulphate concentrations:

The simulations suggest that under low aquifer potential conditions, the extent of sulphate contamination will be mainly limited to the footprint areas of the excavated areas and of the historical TSFs.

Due to the fact that the Valley Silts project is mainly situated on low permeable shale, it is unlikely that sulphate contamination would migrate significantly from the desilting areas during the operational phase, as well as in the long-term. Potential contamination movement in the higher permeability crystalline aquifers will most likely be more rapid and spread further from the potential sources of contamination, like the historical TSF.

During excavation, sulphate concentrations may increase within the disturbed areas for a short period of time due to exposure to oxygen during the process. As no water will be introduced during excavation, the rate at which leachate may leak into the surrounding aquifers will most likely be controlled by rainfall conditions and stormwater management.

The potential sulphate plumes are not expected to migrate more than 450 m from the desilting areas. The affected zone is likely to extent 200 m to 300 m from the desilting areas.

Regionally, the sulphate plumes from both the Valley Silts, as well as the historical TSFs are expected to migrate in a westerly direction towards the tributary of the Klip River adjacent to the project area.

Under average aquifer conditions, sulphate concentrations are expected to increase to above the Klip River unacceptable water quality guideline (>500 mg/L) within the desilting areas. If the silts and sediments are removed and the disturbed areas rehabilitated, sulphate concentrations are expected to reduce to below acceptable management target concentrations (250 to 300 mg/L).

In the long-term, sulphate concentrations in plumes reaching the tributary of the Klipspruit to the west of the Valley Silts project area are also expected to reduce to within the acceptable management target concentration of 250 to 300 mg/L.

8.3.3.4.3 Simulated Iron Concentrations:

The extent of the iron plumes is greater compared to that for the sulphate concentrations. This is mainly due to the fact that the extent of the plumes is defined by lower concentrations, thus resulting in larger plumes. It is likely that the iron plume may migrate further than 500 m from the desilting areas during the operational phase, especially under enhanced aquifer conditions. Under average aquifer conditions, the plumes are not expected to migrate more than 350 m from the areas to be excavated. The simulated concentrations at measured points are overestimated by the model, most likely because site specific geochemistry / leach potential data was not available, and a conservative approach was used for the modelling. As for the simulated sulphate plumes, the impacts are expected to be restricted to close to the footprint areas under reduced aquifer conditions.

In the long-term the extent of the zone of impact for iron is expected to increase, especially in a westerly direction along regional groundwater flow pattern. It is likely that the iron plume may migrate more than 900 m in the long-term from the desilting areas in this direction, most likely because of mobility of iron at lower pH. This movement will be curbed by pH and the extent could be much less at more alkaline conditions.

Iron concentrations are expected to exceed the Klip River tolerable water quality guideline (1 to 1,5 mg/L) during the operational phase. It is possible that the unacceptable guideline (1,5 mg/L) may also be exceeded. This impact will most likely be restricted to the disturbed areas and is not likely to extend further than 200 m from the areas where desilting will take place. Once the sediments and slimes are removed, iron concentrations are expected to reduce to within acceptable management target guidelines, provided that all slimes and sediments that are disturbed, are removed.

In the long-term, any plume is expected to preferentially flow along the Russell Stream towards the west. Worst case scenario, iron concentrations are likely to exceed the tolerable interim water quality guideline of 1 mg/L in groundwater reaching the stream, thus affecting baseflow quality. There is a possibility that iron concentrations may continue to exceed 1 mg/L in the long-term despite removal of silt and sediments from the Russell Stream due to the regional impact of tailings deposition in the area and the proximity of these old tailing's dams to the Valley Silts project.

8.3.3.5 Impact on Wetlands:

The wetland situated immediately east of the desilting areas, for the first two years may experience an increase in both sulphate and iron concentrations in the long-term. The area over which this impact may occur is however limited and the impact should therefore not be significant in extent. It is possible that iron concentrations may increase to above 1 mg/L in groundwater that may feed this wetland. Iron precipitation will occur in the sediment as soon as lower pH conditions are encountered. Sulphate concentrations may exceed 500 mg/L for a short period of time while desilting takes place in this area but are expected to reduce to below 250 mg/L in the long-term.

It is likely that the wetland associated with the tributary of the Klip River, situated west of the Valley Silts project will be affected by a reduction in groundwater quality. The impact of historical tailings deposition in this area will probably have a far more significant impact on this wetland, compared to the Valley Silts project.

There is currently no information available to assess the interaction between groundwater and surface water, as well as the wetlands with any confidence. To make this calculation, it is important to understand the depth to the groundwater table in the areas of interest, as well as to determine the permeabilities of the sediments present.

8.3.3.6 Impact Assessment:

There is currently not enough groundwater data available for the Valley Silts area, especially along the Russell Stream to quantify the current impacts of the silt in the riverbed on the underlying groundwater environment. Excavation of the silts will trigger oxidation reactions and the pH might drop, linked to leaching of salts and metals. In the long term, the excavation of the silt will have a positive impact on the groundwater environment directly underlying the stream, but only if surface and groundwater discharge from the slime's dams and sand dumps along the Russell Stream is effectively managed and kept out of the Russell Stream.

8.3.3.6.1 Construction Phase:

Due to the short duration of the construction phase, this impact is not expected to have a significant negative impact in terms of salt and heavy metal concentration increases, nor be laterally extensive.

8.3.3.6.2 Operational Phase – Excavation / desilting:

Groundwater Quality:

Groundwater quality along the Russell Stream will be negatively affected with potential increase in salt loads, especially sulphate concentrations during the excavation activities. The silt will potentially contain pyrite minerals and when exposed to oxygen and rainwater during excavation it will result in the formation of acidic conditions.

The current understanding of the aquifers present and the potential sources to groundwater contamination suggests that the impact on groundwater quality during the operational phase will mainly be limited to the disturbed areas. Within the disturbed areas, both the simulated sulphate and iron concentrations are expected to exceed the Klip River catchment unacceptable water quality guidelines. This impact may extend between 200 and 500 m from the excavations, depending on aquifer conditions.

It is furthermore likely that a small portion of the wetland situated to the east of the Valley Silts project may experience groundwater quality in terms of sulphate and iron concentrations that exceed tolerable interim target water qualities.

Groundwater Quantity:

The proposed Russell Stream desilting project will not have any significant impacts on the groundwater quantity. There will be a temporary increase in recharge conditions because of disturbed soil conditions and this may have a positive impact in terms of water quantity, even though it would increase the AMD potential for a short time.

8.3.3.6.3 Decommissioning:

Groundwater Quality:

Groundwater quality along the Russell Stream is expected to improve as the in-stream source of contamination will be removed. Sulphate concentrations in the immediate vicinity of the stream may reduce by between 800 and 3,000 mg/L as a result of silt removal. The zone of impact over which sulphate concentrations would exceed unacceptable Klip River catchment water quality targets will reduce in the long-term. The contamination is however not expected to dissipate, but it is likely that sulphate and iron concentrations would reduce to within tolerable interim and even acceptable management water quality targets in the long-term.

Groundwater Quantity:

There will be no impacts on the groundwater quantity during decommissioning.

8.3.3.7 Recommendations

There is currently no information available to assess the interaction between groundwater and surface water, as well as the wetlands with any confidence. To make this calculation, it is important to understand the depth to the groundwater table in the areas of interest, as well as to determine the permeabilities of the sediments present.

It is crucial that dedicated monitoring boreholes are drilled along and downstream of the Russell Stream for monitoring purposes, before the desilting activities start, to define the pre-excavation status (starting at least 1 year in advance and sampling every quarter thereafter). The database will help the client identify groundwater quality and level trends and will serve as reference to identify and quantify potential impacts on the groundwater environment.

During the drilling program aquifer parameters needs to be established with aquifer tests and soil profiling (auger / probe holes in the desilting areas). At the new monitoring targets (BH1 to BH3), a cluster of one shallow and one deep monitoring borehole must be drilled to assess impacts on the shallow weathered and deeper fractured aquifers. The depth of the deeper boreholes must be at least 50 m. The deep monitoring boreholes must be fitted with a seal to the base of the weathered zone to ensure that it measures only the fractured rock aquifer. The depth of the paired shallow borehole, at each monitoring target must be drilled to the depth of weathering, approximately 20 m below surface. It is recommended that the additional monitoring positions are drilled based on the expected shape and movement of the simulated sulphate plumes.

The excavated silt and any water must be removed from open and exposed formation surfaces as soon as possible to avoid seepage of contaminated water into the shallow weathered and deeper fractured aquifers. The desilting will be a continuous process and water will be in the silts. It has to be assumed that the groundwater system will take a portion of this load and ways to manage, contain and minimise the mobilisation of loads must be adopted. When the monitoring boreholes are put in place and chemicals of concern updated, the modelling needs to be updated to improve the understanding of the impact of tailings reprocessing on groundwater quality.

The risk of groundwater contamination during the desilting process will be higher compared to the existing impacts, as chemical reactions and leaching from the silt will increase, due to increased surface area exposed to oxygen and rainwater. Surface water management and containment guidelines must be followed carefully during the desilting process.

In addition to the above, it is important that the necessary cut-off trenches and berms are put in place between the Valley Silts project area and the historical TSFs to avoid future wash of silts and slimes into the excavated and rehabilitated areas, thus compounding the project again.

Ergo 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 cut-off trenches and sumps and not allowed to freely drain away and back to the Russell Stream. Pooling of water must not be allowed on open surfaces, except if lined.

8.3.4 Air Quality

The following conclusions can be made from the modelling results:

- With 50 000 t of silt moved per month from a reclamation front, exceedances of the NAAQS can be expected up to approximately 175 m from the haul roads. This affects the residents of Riverlea to the north of the western project area, and the industrial area to the south of the eastern project area. Doubling up the amount of silt moved and hence the number of haul trucks required leads to exceedances being experienced up to approximately 320 m from the haul roads. Halving the number of haul trucks leads to exceedances being experienced up to approximately 120 m from the haul roads.
- The modelled configuration of roads and drying area indicates that exceedances of the NAAQS may be expected up to 300 m from the 3L10/11/12 footprint boundary. This affects some of the residents of Riverlea living to the east of Nasrec Road and parts of the industrial area to the north of the boundary of 3L10/11/12.
- For the purposes of the modelling, it was assumed that during reclamation of areas to the north of the river in the western project area, haul trucks will use the existing tarred roads of Riverlea Extension 1. If unpaved roads are used in this area, exceedances may be expected up to 175 m from the roads.
- The modelling indicates that sharing the hauling between the northern and southern roads in the western project area results in the lowest impact on the residents of Riverlea.

The air quality impacts from the Valley Silts Reclamation Project can be mitigated by keeping roads as far from the residential areas as possible, preferably more than 175 m away. Alternatively, wet or chemical suppression of unpaved roads should be used. Where possible, existing tarred roads should be used, and these roads should be swept/vacuumed regularly. To reduce the impact on the residential and industrial area to the north of the drying area, roads should be placed as far south as possible. Areas for drying and loading the silt should also be kept as far from the northern TSF footprint boundary as possible.

Furthermore, dust fallout rates 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 Dust Control Regulations, the mitigation programme will have to be increased until compliance is achieved.

Some of the parameters required for the modelling were unavailable and assumptions had to be made. Whilst care has been taken to assess the potential air quality impact from the proposed project, more accurate input data may result in different conclusions

Heavy construction is a source of dust emissions that may have a substantial temporary impact on local air quality. Building and road construction are two examples of construction activities with high 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. Wet suppression and wind speed reduction are the two most common methods used to control open dust sources at construction sites (WRAP, 2006).

8.3.4.1 Mitigation Measures

Haul vehicles represent the largest source of emissions for the Valley Silts reclamation project. The main source of emissions is from the suspension of loose material on the road surface as particles are lifted and dropped from the rolling wheels and kept in suspension by the turbulent air caused by the passing vehicle.

When a vehicle travels on an unpaved road, the force of the wheels on the road surface causes pulverization of surface material. However, there can also be resuspension of loose material on tarred roads. The loose material on the road can originate from spillage of material from the haul trucks and from dirt tracked onto the road by the haul truck wheels. This is, therefore, a concern for any areas which lie along, or close to, project haul routes. This is particularly a concern for the residential areas of Riverlea to the north of the western project area where haul roads may have to be close to the houses. It is also a concern for the residential and industrial areas to the north of the drying area and the industrial areas to the south of the eastern project area. The higher impacts from the drying area are a result of it including two haul routes – to and from the reclamation area as well as to and from the processing plant.

The following mitigation methods are recommended:

- Haul roads in the reclamation areas should be kept as far from residential areas as possible.
- In the drying area, haul roads should be kept as far from the northern boundary as possible to reduce the impact on the residential area to the east of Nasrec Road and the industrial area to the north of the drying area footprint.
- When areas to the north of the river near the suburb of Riverlea are worked on, the tarred roads of the Riverlea suburb should be used for hauling. These roads should be swept/vacuumed regularly to keep re-entrained dust emissions to a minimum for this residential area. Alternatively, any project haul roads within 175 m of the houses should be tarred or mitigated with chemical stabilisation/wet suppression.
- Temporary storage piles for the scalped reeds should be kept to a minimum.
- The drop height for loading haul trucks after the silt has been dried should be kept to a minimum.

If the dust monitoring indicates that an increase in exceedances of the National Dust Control Regulations are being caused by the project, the following additional mitigation measures should be implemented:

- Strict speed control of all vehicles on site to 40 km/hr. In a study by Countess Environmental (WRAP, 2006), it was found that limiting speeds on unpaved roads to 40 km/hr demonstrated a control efficiency of 44%.
- If reducing speeds to 40 km/hr does not reduce emissions sufficiently, chemical stabilisation or wet suppression mitigation methods should be used on all unpaved roads.

8.3.5 Heritage

The HIA has shown that the study area and surrounding area has some heritage resources situated within the proposed development boundaries. Through data analysis and a site investigation the following issues were identified from a heritage perspective. The project will encompass a range of activities during the construction phase, including ground clearance, establishment of construction camp areas and small-scale infrastructure development associated with the project.

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. Development surrounding infrastructure and construction of facilities results in significant disturbance, however foundation holes do offer a window into the past and it thus may be possible to rescue some of the data and materials. It is also possible that substantial alterations will be implemented during this 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, but still need to be catered for.

During the construction 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 the following chance find procedure should be implemented

8.3.5.1 Heritage Sites

The fieldwork identified two heritage features (VS1 and VS2). VS1 is a partly exposed stone structure probably related to early mining history, while VS2 is a cemetery with approximately 50 visible graves.

8.3.5.2 Historical structures

VS1 has a medium heritage significance with a heritage grading of IIIB.

The impact significance before mitigation on the historical structures will be Medium negative before mitigation. Implementation of the recommended mitigation measures will modify this impact rating to an acceptable Low negative.

8.3.5.3 Burial Grounds and graves

The cemetery at VS2 has a high heritage rating and a heritage grading of IIIA.

The impact significance before mitigation on the cemetery and graves sites will be High negative before mitigation. Implementation of the recommended mitigation measures will modify this impact rating to an acceptable Medium to Low negative.

It should be noted that, in addition to the large informal burial ground (VS2) identified during the fieldwork for this project, several unmarked burial grounds have been identified and uncovered by previous development and construction projects in the surrounding area (i.e. two at Fleurfhof and one at Stormill). In addition, an example of a burial ground that had been covered by a slimes dam/sand dump and was exposed after the dump had been reclaimed is known from the Crown Mines/ Langlaagte area in Johannesburg (Anton Pelser 2012 and pers.comm.; Esterhuysen et al 2018).

The communities of Riverlea have also indicated that the possibility of graves in the areas just below Riverlea does exist even though fieldwork has revealed no evidence of this.

8.3.5.4 Palaeontology

As noted in Section 5 of the HIA, the Valley Silts occur in an area where the palaeontology is assessed as being almost entirely of Low sensitivity (coloured blue) and no palaeontological studies are required. 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.

8.3.5.5 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 Section 6 of this report have been developed to minimise the project impact on heritage resources.

8.3.6 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 potential to ameliorate the current flooding issues. 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.

Identified social risks include attitude formation and social unrest, both these risks have a potential to affect the company's social licence to operate. It is recommended that effective stakeholder engagement is implemented. Stakeholder engagement develops a "social licence" to operate and depends on mutual trust, respect and transparent communication between the applicant and stakeholders. Solutions to address service delivery require interventions from the local authorities. However, the applicant can address potential issues that could lead to unrest by ensuring that an effective grievance mechanism is put in place to ensure that stakeholders are provided with a platform to raise their concerns/complaints.

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, it is recommended that the proposed project is approved 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.

8.3.7 Community Health Impact Assessment

Current sources of pollution associated with the Valley Silts area include surface- and groundwater contamination and air quality impacts.

Based on the cHIA and the contributing specialist studies, it is apparent there is a larger cumulative impact resulting from operations in the greater area (TSFs, Robinson landfill site, industry, etc.), whose impacts already have and will continue to contribute to a polluted environment. The Project area is located within this greater area and is negatively contributing to this compounding impact, but not substantially, and impacts can be managed and mitigated. The remediation of Valley Silts will assist in the direct amelioration of varying pollutants impacting the Riverlea community.

During the excavation of the silts and the drying of the silts, localised air quality and surface water will be impacted upon. In the long term, the excavation of the silt will have a positive impact on the groundwater environment, but only if surface and groundwater discharge from the slimes dams and sand dumps along the Russell Stream is effectively managed and kept out of the Russell Stream. A cause for concern in reclaimed residue deposits is incomplete clean-up operations. Any remaining material, in particular sulphide minerals, poses an environmental hazard.

Stakeholders must be informed that only portions of Russell Stream will be remediated and that it will be a collaborative effort between Government Departments, Municipalities and Ergo, and therefore changes may not happen immediately. The residents of Riverlea Township have a right to a healthy environment. Expectations should be managed; this can be achieved through the establishment of a community forum where issues/risks/opportunities regarding the proposed Project are discussed and addressed.

Furthermore it is recommended that a pre-reclamation radiological assessment be undertaken to determine the current state of radioactivity at the Valley Silt project site. In addition, this will indicate if the removal of the silts will have a positive or negative radiological impact to members of the public and whether surface and groundwater pathways will be contaminated. It is strongly suggested that a baseline radiological assessment be conducted prior to remediation taking place[10].

As mentioned above, the radiological assessment and/or a safety case is to be undertaken by the Applicant in accordance with the requirements discussed and agreed upon with the NNR. It is recommended that the remediation of Valley Silts proceeds, as it will have a positive impact on the community of concern, provided the recommended mitigation measures are implemented, and adhered to, to manage the impacts thus ensuring compliance with current legislative requirements.

8.3.7.1 Recommendations

The following potential health issues are regarded as important for the proposed study:

- Water Management; and
- Air Quality.

8.3.7.1.1 Water Management (Health)

Stormwater measures must be implemented prior to mining. At the mining areas, it is proposed that runoff from upslope areas are must be diverted around the mining areas through the implementation of berms and channels. Downslope of the mining areas, it is proposed that dirty runoff from the operation is captured and contained in a series of paddocks.

The stockpiling area which previously consisted of historical dumps that have now been reclaimed, will be managed in a similar fashion. Runoff from upslope areas will be diverted around the stockpiling area, whilst runoff from the stockpiles will be captured and contained in downslope paddocks.

It is crucial that dedicated monitoring boreholes are drilled along and downstream of the Russell Stream for monitoring purposes, before the rehabilitation activities start (if approved), to define pre-remediation status (starting at least one year in advance and sampling every quarter thereafter). The database will help the client identify groundwater quality and level trends and will serve as reference to identify and quantify potential impacts on the groundwater environment.

No biological sampling has been conducted on the water to determine whether there are any health contaminants. Access to safe and clean water and good sanitation are a vital determinant of health and can be positively or negatively affected by the proposed Project.

Groundwater monitoring will establish both groundwater level and quality trends, allowing for early detection and mitigation measures. Monitoring of inorganic constituents should be conducted quarterly to reflect

[10] A site survey which sampled 50 readings within the Valley Silts project area closest to the highway found that the highest measurements were for 0.349 Bq/g for Uranium (U) and 0,281 Bq/g for Thorium (Th). Therefore, this material is below the 0.5 Bq/g limit and currently not regarded as radioactive

influences of wet and dry seasons and monitoring of organic constituent should be conducted biannually. Parameters to be monitored include:

- Inorganics:
  - TDS, EC, pH, Alkalinity;
  - Major ions (Ca, Mg, Na, K, SO4, NO3, F, Cl; and
  - Minor and trace metals (As, Al, Co, Cr, ZN, Cd, Cu, Fe, Ni, Pb, V, Mn, U.
- Organics:
  - Total Coliform, E. Coli and Heterotrophic plate count.

8.3.7.1.2 Air Quality (Health)

In order to assess the air quality impacts of particulate emissions from the reclamation of the Project, particularly regarding the health implications for residents in the near vicinity, ongoing dust fallout monitoring must be undertaken. This monitoring should be implemented as far prior to the start of the Project as possible, but at least one year before the start of the Project, in order to establish a baseline against which the impacts of the reclamation activities can be assessed. The dust fallout monitoring should be used as an indicator as to whether the mitigation measures are being strictly implemented and are sufficiently effective.

There are currently four operational dust fallout monitoring stations within 250m of the Project area boundary. Although the monitoring at these stations will form a good baseline to evaluate the effects of the Project on ambient air quality, it is recommended that samplers be positioned near the boundary, on all sides where the Project will potentially have an impact on nearby receptors. Four monitoring stations, approximately equally distant from each other, is the minimum required by ASTM D1739 (ASTM, 2017) for each area or zone to be monitored. The samplers must be operated in accordance with the National Dust Control Regulations (Government Notice No. R827, 2013) and the proposed revised regulations once these are promulgated. It is recommended at a minimum that the Jhb City Council House be reinstated (or another sampler be placed in that general area) and that samplers be placed in the Industrial area of Amalgam directly to the north of the drying area, in the residential township of Riverlea that lies to the east of Nasrec Road, and to the south of the Project area near the N17 road.

8.3.8 Traffic Statement

The traffic statement is for the silt reclamation of the Russel Stream in the Valley Silts area near Riverlea situated on Portions of the Farms Paardekraal 226-IQ, Langlaagte 224-IQ, Mooifontein 225-IQ and Turffontein 96-IR. It is the intention to reclaim the existing silt within the Russel Stream and Rehabilitate the stream through mechanical excavation.

- Zoning Rights are already in place for the planned activities.
- The site is located south of Riverlea, Johannesburg, Gauteng.
- A total of 22 trips will be generated in the Weekday AM Peak hour and 22 trips during the Weekday PM Peak hour at the site.

- The proposed access is situated on Crownwood Road (M17). The access and geometric details are shown on Drawing 19054/AL/01 of the Traffic Statement
- On-site traffic circulation was analysed as a swept path analysis for both heavy vehicles and passenger vehicles. Details are shown on Drawing 19054/AL/01 of the Traffic Statement.
- 10 Parking bays are proposed, as well as 2 delivery zones for heavy vehicles are proposed at the site.
- A pick-up and Drop-off facility needs to be provided with space for at least one minibus-Taxi at the site, as shown on Drawing 19054/AL/01 of the Traffic Statement.

Access safety measures are as follow:

- A short separate right turning lane on Crownwood Road, as shown on Drawing 19054/AL/01.
- Speed Limit Signs (60km/h) at least 200m from the proposed accesses in both directions on Crownwood Road (M17).
- Heavy Vehicles Turning signs at least 100m from the proposed access in both directions on Crownwood Road (M17).
- Sight distances of at least 180m in both directions are available on Crownwood Road (M17). 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 Crownwood Road (M17). See Drawing 19054/AL/01.
- A minimum stacking distance of 24m are required before any gate or boom at the proposed access.

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 Valley Silts project should be approved, on condition that the Ergo implements all identified management measures and implements the monitoring plan.

Key Findings

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
Positive (+)	Major (high)				❖ Monitoring	Major (high)	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Improved aquifer yield ❖ Job Security ❖ Skills Development ❖ Economic growth ❖ Amelioration of flooding potentially	❖ Improved aquifer yield ❖ Job Security ❖ Skills Development ❖ Economic growth ❖ Amelioration of flooding potentially
Positive (+)	Moderate (medium)	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth	❖ Job Security ❖ Skills Development ❖ Stimulation of economic growth			Moderate (medium)	❖ Improved water quality and drinking water	❖ Improved water quality and drinking water	❖ Improved surface water quality ❖ Improved groundwater quality ❖	❖ Improved surface water quality ❖ Improved groundwater quality
Positive (+)	Minor (low)					Minor (low)			❖ Improved ecosystem health and functioning	❖ Improved ecosystem health and functioning
No Impact	No Impact					No Impact				
Negative (-)	Minor (low)	❖ Groundwater quality impacts ❖ Traffic, congestion and impacts damage	❖ Groundwater quality impacts ❖ Traffic, congestion and impacts damage			Minor (low)	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Water Quality impacts ❖ Groundwater quality impacts ❖ Impact on cemetery ❖ Destruction of historical structures ❖ Disruption of daily movement patterns ❖ Traffic, congestion and impacts damage	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Water Quality impacts ❖ Groundwater quality impacts ❖ Impact on cemetery ❖ Destruction of historical structures ❖ Disruption of daily movement patterns ❖ Traffic, congestion and impacts damage	❖ Encroachment of alien species ❖ Faunal mortalities ❖ Safety impacts for community members and employees	
Negative (-)	Moderate (medium)	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Sedimentation ❖ Water Quality impacts ❖ Destruction of historical structures ❖ Disruption of daily	❖ Biodiversity Impacts ❖ Flow Modification of the Russell Stream ❖ Sedimentation ❖ Water Quality impacts ❖ Destruction of historical structures ❖ Disruption of daily	❖ Encroachment of alien species ❖ Faunal mortalities ❖ Safety impacts for community members and employees		Moderate (medium)	❖ Direst Loss of Wetlands ❖ Contamination of watercourse ❖ Sedimentation ❖ Air quality impacts ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts)	❖ Direst Loss of Wetlands ❖ Contamination of watercourse ❖ Sedimentation ❖ Air quality impacts ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts)		

IMPACT	RATING PRE-MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING	RATING POST MITIGATION	CONSTRUCTION	OPERATION	DECOMMISSIONING	POST DECOMMISSIONING
		movement patterns	movement patterns				❖ Increased Traffic	❖ Increased Traffic		
Negative (-)	Major (high)	❖ Direst Loss of Wetlands ❖ Contamination of watercourse ❖ Air quality impacts ❖ Impact on cemetery ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic	❖ Direst Loss of Wetlands ❖ Contamination of watercourse ❖ Air quality impacts ❖ Impact on cemetery ❖ Impact on possible graves ❖ Safety Impacts (including traffic safety impacts) ❖ Increased Traffic			Major (high)				

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 (5th of September);
- A single season survey was conducted in spring. Although faunal activity is lower during this time, based on the specialists 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;
- Migratory species likelihood of occurrence were assessed based on the SABAP2 data;
- GIS data layers might be outdated and could possibly not represent the actual in the project area;
- The use of two of the main wetland indicators namely hydromorphic soils and hydrophytic vegetation was limited in many of the project area;
- The GPS used for wetland delineations is accurate to within five metres. Therefore, the wetland delineation plotted digitally may be offset by at least five m to either side;
- The exact layout of the infrastructure was not provided, as such assumptions were made of the expected impacts;
- The project footprint was adjusted since the initial report, which was classified and adjusted on a desktop level; these adjustments have been only included in the habitat and sensitivity mapping; 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 moderate 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 for the project area. To complete an assessment of the impacts of silt excavation on groundwater quality, literature-based aquifer parameters were considered. These are listed in Table 9-1. It is shown that a wide range of values are reported for the affected geological formations and is expected in fractured aquifers, where groundwater flow is complex and changes with time. However, for the purpose of simulations, simplifications are required. For this reason, average, 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 limited 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 two boreholes situated south of the Valley Silts project area (Val 1 and CRG B15). The provisional model calibration completed suggests that the average permeability of the fractured crystaline formations is 6,74E-2 m/d and that of the shale is an order of magnitude lower, around 2,78E-3 m/d. Under these conditions the rate of recharge to the aquifers is around 1,5% of MAP. The simulated and calibrated groundwater flow patterns for the average aquifer conditions are presented in Figure 7-31. It is shown that groundwater flows regionally in a westerly direction. The Booysens shale band in the central part of the model results in a retardation of groundwater flow patterns due to its lower permeability.
- It is noted that the inadequate level of model calibration limits the level of confidence in the output. This needs to be updated before any desilting starts through drilling and testing and evaluating best management options of minimising impacts to the groundwater system and receiving environments.

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)
Shale (minimum)	8,64E-09	8,64E-09	1,50E-06	1	0	Shale (minimum)	8,64E-09
Shale (maximum)	8,64E-05	1,73E-04	6,90E-05	5	10	Shale (maximum)	8,64E-05
Fractured crystalline rock (minimum)	8,64E-04	6,91E-04	6,90E-05		0	Fractured crystalline rock (minimum)	8,64E-04
Fractured crystalline	8,64E+02	2,59E+01	3,30E-06		10	Fractured crystalline	8,64E+02

rock (maximum)						rock (maximum)	

- To test the model's sensitivity to possible variations in aquifer permeabilities, average, 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 Table 9-2. This means that the difference between inflows and outflows simulated are within generally acceptable bounds.

Table 9-2: Model water balance

FLOW TERM	INFLOW (M^3/D)	OUTFLOW (M^3/D)	BALANCE (M^3/D)
Storage	1,54E+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	4,58E+03	0,00E+00	5,52E+02
River Leakance	1,32E+01	1,43E-01	-1,32E-01
Head Dependent Boundaries	4,61E+03	8,33E-01	-5,87E-01
Total	Water Balance Error (%)	6,15E+02	-3,45E+00
Water Balance Error (%)			1,54E+01

- 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 anticipated historical impact of the tailing's dams situated south of the Valley Silts project 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 is a source of dust emissions that may have a substantial temporary impact on local air quality. However, there will be minimal construction activities for this project as temporary administration buildings, change houses and ablution facilities will be used (Kongiwe Environmental (Pty) Ltd, 2019).
- Construction of roads is also a substantial temporary source of PM emissions. As far as possible, existing access roads will be utilised for the project, and where this is not possible, these will be constructed as a two-by-two roadway, operating in both directions. Intersections will be properly designed to provide safe entry and exit into the mining area (Kongiwe Environmental (Pty) Ltd, 2019). However, the position and extent of road building was not known at the time compiling this report.

- Vehicle-entrained dust emissions from the haul roads were modelled as a series of volume sources at 200 m intervals.
- The modelling results show hauling over the full length of the project area as well as hauling of the expected total daily maximum of 50 000 tons at two reclamation fronts at the same time. For the modelling of the central area, it was assumed that both reclamation fronts would be in the central area. Thereafter, it was assumed that one front would be in the eastern area and one in the western area. Increasing reclamation rates above this would, therefore, increase impacts.
- The modelling was based on operating times of 7 days a week, 8 hours a day. Any change to the operating times will affect the expected impacts.
- It was assumed that the main haul roads will be situated in areas on the outskirts of the project area to avoid the risk of causing muddy, slippery areas. For this reason, no reduction in emissions was included for the roads possibly having high moisture contents.
- It was assumed that hauling will be required on both sides of the river valley in the western project area. This is a concern for the residents of Riverlea. For the modelling it was assumed that when areas to the north of the river near the suburb of Riverlea are worked on, the tarred roads of the Riverlea suburb will be used for hauling. With regular sweeping/vacuuming this will keep the amount of vehicle-entrained dust emissions to a minimum for this residential area.
- Three different scenarios were modelled for reclamation of the western project area. One scenario with hauling only on the southern boundary, one with hauling only on the northern boundary and one with half (25 000 t) of the material hauled along the northern boundary and half along the southern boundary.
- The exact area to be used for turning, drying and loading were unknown. Therefore, a rectangular area spanning most of the length of the footprint of 3L10/11/12 was used as an area source for the modelling.
- 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.

9.1.5 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.

Please note that the 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.

9.1.6 Social

- The 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- Only a few stakeholders living adjacent to the project area were interviewed. The specialist was informed that additional interviews with community can only be undertaken once meaningful consultation has been undertaken with community members;
- 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.

9.1.7 Community Health

- The cHIA assessed the health impact related directly to the communities in the vicinity of the Valley Silts 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 cHIA assumes that the existing impacts resulting from Valley Silts are a health risk to the surrounding community;
- This study has taken comments gathered during the environmental authorisation process to understand the community concerns; and
- Community engagement with nearby communities, clinics or health officials was not directly conducted as part of the cHIA. Concerns, as raised by community members and interested parties, are ongoing for the duration of the environmental process and these concerns have been taken into account and addressed within this report.

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 Ergo management to provide guidance and instructions to employees and contractors;
- Ergo should conduct annual internal auditing of environmental performance and annual reporting to the DMRE;
- Ergo 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;
- The Applicant must report to the Department, with reason, if requirements of the EA have not been met.
- 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;
- A community forum should be implemented by Ergo, with the aim of engaging Stakeholders and the public;
- All laydown, storage areas etc should be restricted to transformed areas close to the preferred option and existing roads should be used as far as possible;
- Keep storm water away from the working/mining areas;
- Prevent rainwater and the process water that has fallen on site from leaving the site in an uncontrolled and unregulated fashion;
- Prevent dust pollution during dry, windy conditions.
- All necessary authorisation must be in place prior to commencement of the project activities.
- Ergo 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.
- Should the economic gold price diminish and not be seen as favourable to continue reclamation activities, Ergo must continue to implement monitoring and rehabilitation requirements as set out in this EMP.
- 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.
- Exemption from GN R704 is obtained for mining activities and infrastructure proposed to be undertaken within the 1:100 year floodline or within 100 m of a watercourse.
- Management and Monitoring plans contained in the EMPr must be strictly adhered to.
- A Chance Find procedure for heritage resources and artefacts needs to be in place. .

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 Valley Silts 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 Valley Silts 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 Valley Silts Project;
- Maintain a state of Environmental Quality following completion of the Valley Silts Project;
- Ensure appropriate restoration of areas affected by the Valley Silts Project; and
- Prevent long term environmental degradation.

9.4 Rehabilitation Requirements

Final rehabilitation will be carried out once the Valley Silts 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 (shaping, 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.

Rehabilitation has been dealt with throughout this EIA. Mitigation / Management and Monitoring measures are proposed in the EMPr.

9.5 A Reasoned Opinion: Should the Valley Silts Reclamation and Reprocessing Project be Approved?

Key findings from the EIA have been incorporated into a high-level summary presented in the risk matix found in Chapter 8.4.

9.5.1 Conclusions of the report

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 Valley Silts 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. Impacts are largely Moderate (negative) in significance, being mitigated to Low (negative) Significance. During the decommissioning and post-decommissioning phases, the majority of the impact are expected to be Moderate – High (positive) in significance after mitigation.

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. Based on the information contained in this report, it is the opinion of the EAP that the negative environmental impacts resulting from the Valley Silts 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 report as well as legislative requirements are implemented and adhered to.

There is a possibility that there may be temporary contamination of downstream watercourses during operation, and if authorised, Ergo will need to minimise such contamination by following the prescribed mitigation stipulated in this EIA / EMPr, the water use licence and all relevant best practice guidelines and legislation regarding the rehabilitation of contaminated land. It is anticipated that through carefully planned reclamation efforts **the system can be restored** to a state where it represents a viable and functioning wetland system. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the reclamation efforts but is likely to remain one of the most challenging issues.

9.5.2 Economic Benefits of Silt Removal

Ndasi (2007) found that dam sediments are trap sites for heavy metals originating from surrounding tailings dumps. In the Russell Stream deposits, the maximum thickness is defined by a region of greater than 12 m of sediment fill just below and behind the dam wall in Dam B. An axial zone following the original river course contains sediments in excess of 10 m over a distance of 250 m. Dam C downstream of Dam B shows a similar pattern with an axial zone of greater than 8 m thickness. In addition, high concentrations of gold in these sediments have been proven to be economically viable in the Russell Stream dams. Reserve calculations on the Russell Stream sediments (still unmined) gave a total estimated gold content of 3.8 million tons at an average grade of 1.0 g/t Au.

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 Valley Silts Project will retrieve gold from the gold bearing silts of the Russell Stream. 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.

9.5.3 Social Benefits of the Silt Removal

The Russell Stream forms part of a greater wetland system which stretches approximately 25 km from Soweto to southern Gauteng. Due to rapid urbanisation, erosion, siltation from mine tailings and illegal dumping in this stream, the Russel Stream and New Canada Dam are under threat and highly polluted.

The land being cleared could be a secondary or consequential product. The clearing of land and subsequent removal of mine residue is extremely important as well as a major positive benefit. It is envisioned that the removal of these silts could significantly reduce a source of water and land pollution. Additionally, the removal of the silts will also aid in the flow of the stream and help with flooding that occurs sporadically, in the wet seasons in the Riverlea area.

The Silts contained within the Russell stream is also an allure for illegal elements, like *Zama-Zamas* (informal miners). As informal miners settle into the area, crime becomes a concern for the residents of Riverlea due to the level of uncontrollability and lawlessness of these individuals. The removal of these silts from the dams may help alleviate the levels of crime and lawlessness found within the area.

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 Ergo. The delivery of the mine residue material to the Knights plant will help keep the plant operational ensuring current and future employees with a form of employment.

Overall, the Proposed Project is in line with the objectives of the Gauteng Mine Residue Area Strategy (2012), which is to reclaim and/or rehabilitate areas that have been affected by the mine dumps to the point where they become safe for adjacent communities. This strategy also aims at making previously unavailable land, available for use.

9.5.4 Environmental Benefits of Silts Removal

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. It is anticipated that the removal of silts will have a positive impact on groundwater and surface water in terms of improved water quantity and quality.

Specialist reports found that through carefully planned rehabilitation efforts the system could potentially be reinstated to where it represents a valuable greenbelt and open space asset, that is actively utilised for land-based recreational purposes. However, the in-stream water quality is severely impacted by raw sewerage input, an impact whose rectification is pivotal to the success of the rehabilitation efforts but is likely to remain one of the most challenging issues.

In conclusion, the EAP is of the reasoned opinion that the **project should be authorised to proceed**. It is furthermore stressed that a collective effort needs to be made by relevant Government Departments to address the current municipal issues experienced in Riverlea, to ensure that the end result of this project is positive in the long-term and is aligned to future development plans for the site.

CHAPTER 10: CLOSURE COSTING

10.1 Financial Provisioning:

Ergo have applied for an Environmental Authorisation for activities triggered by the NEMA. The listed activities applied for do not require Financial Provisioning, nor is this project linked to any prospecting, exploration, mining or production operations rights/authorisations. The closure and rehabilitation actions that Ergo intends on implementing at the end of the Life of the operation are described below. These actions are planned to comply with the requirements of the vision and objectives detailed in Section 8.2 of the closure and rehabilitation plan, in addition to these the detailed risk mitigation closure strategies identified during the risk assessment are addressed.

The main aim in developing the Final Rehabilitation, Decommissioning and Closure Plan is to minimise and mitigate the impacts caused by the reclamation activities and the removal of the silts and to restore land back to a satisfactory standard. It is best practice to develop the Plan as early as possible so as to ensure the optimal management of rehabilitation and closure issues that may arise. It is critical that a final rehabilitation, decommissioning and closure plan is defined and understood from before the commencement of the operation and that it is complimentary to the objectives and goals set. Rehabilitation and closure objectives need to be tailored to the project at hand and be aligned with the Environmental Management Programme Report (EMPr).

The Final Rehabilitation, Decommissioning and Closure Plan aims to inform on the actions required to rehabilitate the project to ensure that the area is socially and environmentally, safely and sustainably closed. Importantly, the Rehabilitation Plan consists of direct activities associated with rehabilitation of various infrastructure components.

This Plan should inform how Ergo's infrastructure is either handed over legally or removed from site. During the operational phase, it is recommended that an assessment be undertaken of the infrastructure to determine if some of the infrastructure can be utilised post closure.

The rehabilitation and closure actions for the particular infrastructure are detailed below and separated into phases.

10.1.1 Rehabilitation Actions and Management Plans

The area from which the silts were excavated, dried and loaded for transportation, will need to be rehabilitated.

Only temporary infrastructure will be established to support the Reclamation activities for the Project and this infrastructure footprint will need to be rehabilitated. The temporary structures proposed for the project include:

- Temporary administrative buildings and portable ablution facilities.

10.1.2 Rehabilitation, Decommissioning and Closure Phase

Project closure is an ongoing programme designed to restore the physical, chemical and biological quality or potential of air, land and water regimes disturbed by the operation to a state acceptable to the regulators and to post operation land users. The activities associated with closure are designed to prevent or minimise adverse long term environmental impacts, and to create a self-sustaining natural ecosystem or alternate land use based on an agreed set of objectives. The objective of closure is to obtain legal (government) and community agreement that the condition of the closed operation meets the requirements of those entities, whereupon the companies' legal liability is terminated. For closure of the proposed site a certificate stating that the site is safe for use will also be required from the NNR.

Closure will include some form of rehabilitation. Rehabilitation can be divided into two different phases, namely concurrent rehabilitation and final rehabilitation. Concurrent rehabilitation must be carried out along with the reclamation operations on site and will decrease the final liability that Ergo will carry at the time of closure. This concurrent rehabilitation will be carried out within the context of the approved EMPr. In the case of this project, the reclamation of the silts from the stream can be considered as concurrent rehabilitation. Final rehabilitation will be carried out once the operation goes into its closure phase. This final rehabilitation will be carried out within the context of a closure plan and will include the stream area, the drying areas as well as any other active area on the proposed project site.

The operation will obtain a closure certificate only once it can prove that rehabilitation is satisfactory, and that if any residual pollution effects exist, it can be adequately managed. It is recommended that, whatever form of rehabilitation is used, a post-closure monitoring programme is implemented before Ergo applies for closure. The institution of this monitoring programme will enable Ergo to identify and rectify any residual pollution impacts.

Due to the nature of the reclamation method (mechanical reclamation), the majority of actions will take place in the decommissioning phase when all silts have been removed and the drainage of the stream has been restored.

Closure actions are provided for the each of the infrastructure areas.

10.1.2.1 Access and Service Roads

Roads that can and will be used for rehabilitation/ monitoring or by other users post-closure should be left *in situ* provided this is agreed upon by all parties concerned. If there is no future use for roads onsite, they will require the following actions:

- Soil should be tested for contamination. If contamination is discovered, this soil should be removed and disposed of at the appropriate waste disposal facility;
- Appropriate topsoil should be replaced to a minimum of 300 mm thick in all rehabilitated areas. This must be included in the monitoring programme;
- Remove alien invasive plants; and
- Ensure that robust care and maintenance plans are in place.

10.1.2.2 Groundwater

To restrict the impacts post closure on the groundwater environment (quality) and mitigate the loss of groundwater from the catchment, the following is recommended:

- Use the results of the monitoring programme to validate the predicted impacts on groundwater quality after closure every five years;
- Update existing predictive tools to verify long-term impacts on groundwater;
- Maintain sound surface runoff to ensure that all dirty runoff is contained and diverted away from the Russell Stream.
- Present the results to Government on an annual basis to determine compliance with the closure objectives set during the Decommissioning Phase;
- Continue the groundwater quality monitoring until the site has been fully rehabilitated, and closure has been awarded. This will help establish post-closure groundwater quality trends. If required, the monitoring information will be used to update, verify and recalibrate the predictive tools used during the study.

10.1.2.3 Stormwater (Surface Water)

Prior to closure a final stormwater management plan will be prepared to identify at closure where water can be designed to flow freely from the site and away from potential areas of contamination. All berms and trenches will be flattened to a functioning topography to assist with the functionality of the stream, except where they have been positioned to prevent additional water flowing onto rehabilitated areas. Structures which may potentially remain onsite will have a stormwater management plan which will ensure that any potential impact to surface water is managed

To restrict the impact post closure on the surface water environment (quality, flow and functionality) and to mitigate the stagnation and degradation of the stream, the following is recommended:

- The implemented spill management plan must be continually implemented throughout closure and rehabilitation.
- Use the results of the monitoring programme to validate the predicted impacts on the surface water post closure;
- Present the results to the government on an annual basis to determine compliance with the closure objectives set during the decommissioning phase;
- Monitoring of surface water quality must continue both upstream and downstream until the site has been fully rehabilitated, and closure has been awarded. This will help establish post-closure surface water quality trends. This data should be used to update, verify and recalibrate the predictive tools used during this study.

10.1.2.4 Biodiversity and Ecosystem

Prior to closure a biodiversity management plan will be prepared to identify at closure the functionality of the stream as well as the fauna and flora present on site. The required monitoring programme will need to be created and put in place to monitor and evaluate the development of the ecological function of the stream. It is advised that the site be monitored for five years to ensure that the mitigation measures proposed at closure and for rehabilitation are effective. It is also crucial to ensure that the areas is revegetated accordingly to the specialists assessment to ensure that the required habitats are restored and that indigenous fauna and flora can flourish. It is also advised that an invasive plant species removal and management plan is implemented during decommissioning and closure to ensure that only indigenous flora establishes on the proposed site at closure.

10.1.2.5 NNR Certificate

An assessment of the final rehabilitated area under the NNRA. National Nuclear Regulator Act, 1999 (Act No. 47 of 1999) must be undertaken and a closure certificate obtained.

10.1.2.6 Removal of Infrastructure

Prior to closure and rehabilitation all of the equipment and infrastructure will need to be removed from site and the designated areas, where these infrastructures, machinery and activities occurred or were housed, will need to be rehabilitated. A list of the infrastructure and equipment expected to be used on site is as follows:

- Mechanical excavation equipment (Backhoes or Excavators);
- 6 x 30 ton Articulated Dump Trucks (ADT's);
- 25 x 30 ton Dump Trucks;
- Water Bowser Truck;
- Temporary administration buildings, ablution facilities; and
- The drying areas.

10.1.3 Closure Cost Methodology

The closure cost calculation has been performed in accordance with NEMA GN R1147 of 2015 Financial Provision Regulations. The methodology employed to calculate the closure costs is detailed in Section 15.1.3. Section 15.1.3.1 of the closure cost report and presents the potential unplanned closure costs (worst case scenario) for year 1 of the Project. Rehabilitation spend (excluding concurrent rehabilitation) will be greatest during the latter part of the project's lifecycle (decommissioning phase) as this is when the area is rehabilitated, and the entire operational footprint prepared for the submission of a closure certificate.

Due to the current uncertainty surrounding the change in the Financial Provision Regulations, this report has utilised the current existing regulations and has only determined a provision for Year 1 of the potential operations. If the Mining Right granted by the DMRE, the financial provision will require updating annually, and as such any future disturbances post Year 1 will be determined and closure provisions made accordingly.

It must be noted that the amounts presented in this section are nominal and undiscounted, the calculation does not include the time-value of money.

To ensure that the site is up to standards for the proposed land use, the following activities need to take place:

All equipment and infrastructure need to be removed from site, and any foundations and other cemented platforms or contaminated areas will also need to be removed to a metre below the surface. After all of the infrastructure has been removed the surfaces outside of the stream will need to be levelled and revegetated and, all haul and other activity roads will need to be ripped and vegetated.

10.1.3.1 Concurrent Annual Environmental Cost

Concurrent annual environmental costs will be included into the operating budget of the operation. The operation has not been initiated and a Zero (R 0.00) rand concurrent annual environmental cost is reported.

10.1.3.2 Closure cost of Valley Silts Project

The period of the EA applied for is **10 years.** It must be noted that even though the EA applied for is a 10 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 closure cost indicates the proposed closure cost for the entire Valley silts study area.

The approach to calculating the closure quantum as specified in the DMRE Guideline is summarised as follows and is reported in Table 2-2 of the guideline:

- Step 1: Determine the Mineral Mined which will be Gold Tailings.
- Step 2A: Determine Primary Risk Class which is determined as **Medium Risk (Class B)**.
- Step 3: Determine Environmental Sensitivity has been determined by reference to Table B.4 of the DMR Guideline as "**Medium**"
- Step 4.1: Determine level of information – Limited information is available at this stage of the project and as such Option 3 a rule-based approach will be followed.
- Step 4.2: Determine the closure components and associated rates; Table 10-1 details the rates which have been used.
- Step 4.3: Determine the unit rates for closure components. The rates used in the assessment are based on the original 2005 rates included in the guideline, with these rates inflated by the Consumer Price Index (CPI) as published by Trading Economics 2019 (September 2019 CPI 113,4).
- Step 4.4: Determination of weighting factors:
    - Weighting Factor 1: The nature of the terrain where the operation is located is **Flat**.
    - Weighting Factor 2: The proximity of the operation to an urban centre. In this instance the Project is considered **Urban**.
- Step 4.5: Identify areas of disturbance. Table 10-2 details the areas of disturbance measured for proposed infrastructures, as disturbed during operation. Note that the areas have been

calculated based on the initial project development plan; however, opinions of the EAP have been taken to adequately calculate reclamation structures and infrastructure associated with similar operations. Therefore, areas covered hereunder may not correspond with the areas as detailed in the initial project development plan for the Project.

- Step 4.6: Identify closure costs from Specialists. At this stage of the project no specific closure costs have surfaced based on specialist studies completed to date.
- Step 4.7: Proposed closure costs for the Project.

Table 10-1: Rates associated with Closure Components 2019

MAIN DESCRIPTION	DMR MASTER RATE 2019	COMMENTS
Rehabilitation		
Rehabilitation of access roads	R37,87	200m x 5m
General surface rehabilitation, including grassing of all denuded areas	R117 187,43	Ha Size determined from Google earth with the provided initial project development plan.
Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required)	R44 557,96	Ha Size determined from Google earth with the provided initial project development plan.
2 to 3 years of maintenance and aftercare	R15 595,28	Ha Size determined from Google earth with the provided initial project development plan.
Radiation clearance	R41 572,44	Assumption
Radiation clearance Soil sampling	R33 650,56	Assumption

The total closure provision required for the project is detailed in the Table 10-2 below.

Table 10-2: Total Closure Provision

Valley Silts Project									
Risk Class	Medium Risk (Risk Class B)								
Area Sensitivity	Medium								
Nature of Terrain (Weighting Factor 1)	Flat (1.00)								
Proximity to Urban Area (Weighting Factor 2)	Urban (1.00)								
Main Description	**Included in Project**	**Units**	**Quantity**	**Master Rate 2019**	**Multiplication Factor**	**Weighing Factor 1**	**Weighing Factor 2**	**Amounts**	**Comments**
Rehabilitation									
Rehabilitation of access roads		m2	1000	R37,87	1	1	1	R37 870,00	Assumption
General surface rehabilitation, including grassing of all denuded areas		Ha	122	R117 187,43	1	1	1	R14 296 866,46	Ha Size determined from Google earth.
Water management (Separating clean and dirty water, managing polluted water and managing the impact on groundwater, including treatment, when required)		Ha	122	R44 557,96	0,6	1	1	R3 261 642,67	Ha Size determined from Google earth.
2 to 3 years of maintenance and aftercare		Ha	122	R15 595,28	1	1	1	R1 902 624,16	Ha Size determined from Google earth.
Radiation clearance		Item		R41 572,44				R41 572,44	
Radiation clearance Soil sampling		Item		R33 650,56				R33 650,56	
							Sub Total 1	**R19 574 226,29**	
VAT @ 15%								R2 936 133,94	
Grand Total								**R22 510 360,24**	

CHAPTER 11: 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 Ergo Mining (Pty) Ltd. 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**

09 December 2019

Date

CHAPTER 13: REFERENCING

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