mineral resources

Department:
Mineral Resources
REPUBLIC OF SOUTH AFRICA

VANDYKSDRIFT CENTRAL INFRASTRUCTURE AND MINING DEVELOPMENT

PART A

CONSULTATION ENVIRONMENTAL IMPACT ASSESSMENT REPORT

SUBMITTED FOR ENVIRONMENTAL AUTHORISATIONS IN TERMS OF THE NATIONAL ENVIRONMENTAL MANAGEMENT ACT, 1998 AND THE NATIONAL ENVIRONMENTAL MANAGEMENT WASTE ACT, 2008 IN RESPECT OF LISTED ACTIVITIES THAT HAVE BEEN TRIGGERED BY APPLICATIONS IN TERMS OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (MPRDA) (AS AMENDED).

NAME OF APPLICANT: South32 SA Coal Holdings Proprietary Limited: Wolvekrans Colliery

TEL NO: 013 689 4135

FAX NO: 011 376 2160

POSTAL ADDRESS: P.O. Box 61820, Marshalltown

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FILE REFERENCE NUMBER SAMRAD: MP30/5/1/2/2/379MR

1. IMPORTANT NOTICE

In terms of the Mineral and Petroleum Resources Development Act (Act 28 of 2002 as amended), the Minister must grant a prospecting or mining right if among others the mining “will not result in unacceptable pollution, ecological degradation or damage to the environment”.

Unless an Environmental Authorisation can be granted following the evaluation of an Environmental Impact Assessment and an Environmental Management Programme report in terms of the National Environmental Management Act (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 section 16(3)(b) of the EIA Regulations, 2014, any report submitted as part of an application must be prepared in a format that may be determined by the Competent Authority and in terms of section 17 (1) (c) the competent Authority must check whether the application has taken into account any minimum requirements applicable or instructions or guidance provided by the competent authority to the submission of applications.

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

It is furthermore an instruction that the Environmental Assessment Practitioner 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.

2. OBJECTIVE OF THE ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

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 on an impact and risk assessment process inclusive of cumulative impacts and a ranking process of all the identified development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects of the environment;

(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—

(aa) can be reversed;

(bb) may cause irreplaceable loss of resources, and

(cc) 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.

Report No.: JW285/19/G535-10- Rev 0
November 2019

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CONSTITUENT ABBREVIATIONS	
Abbreviation	Meaning
Al	Aluminium
As	Arsenic
B	Boron
Ba	Barium
Be	Beryllium
Ca	Calcium
Cd	Cadmium
CH_4	Methane
Cl	Chloride
Co	Cobalt
CO_2	Carbon dioxide
Cr	Total Chrome
Cr VI	Chromium VI
Cu	Copper
EC	Electrical Conductivity
COD	Chemical Oxygen Demand
F	Fluoride
Fe	Total Iron
$FeCO_3$	Ferrous carbonate
FeS	ferrous sulphide
H_2O	Water vapour
HFCs	Hydrofluorocarbons
Hg	Mercury
K	Potassium
Mg	Magnesium
Mn	Total Manganese
Mo	Molybdenum
N_2O	Nitrous oxide
Na	Sodium
NH_4	Ammonium
Ni	Nickel
NO_3	Nitrate as N

CONSTITUENT ABBREVIATIONS	
Abbreviation	Meaning
NOx	Nitrogen oxides
O_3	Ozone
Pb	Lead
PFCs	Perfluorocarbons
PO_4	Phosphate
Sb	Antimony
Se	Selenium
SF_6	Sulphur hexafluoride
Sn	Tin
SO_2	Sulphur dioxide
SO_4	Sulphate
SS	Suspended Solids
TALK	Total Alkalinity
TDS	Total Dissolved Solids
V	Vanadium
Zn	Zinc

GENERAL ABBREVIATIONS	
Abbreviation	Meaning
ABA	Acid Base Accounting
AMD	Acid mine drainage
AMIRA	Australian Mining Industry Research Association
APM	Archaeology, Palaeontology and Meteorites
ASPT	Average score per taxon
BID	Background Information Document
BMC	Blast Management & Consulting
BMK	Boschmanskrans Pit
BPG	Best Practice Guidelines
CBA	Critical Biodiversity Area
CBD	Central Business District
CR	Critically Endangered
CRR	Commenting and Response Report
CSR	Consultation Scoping Report
dB	decibel
dBA	Descriptor that is used to indicate 10 times a logarithmic ratio of quantities that have the same units, in this case sound pressure that has been A-weighted to simulate human hearing.
dBL	Linear decibel
DAFF	Department of Agriculture, Forestry and Fisheries
DMO	Douglas Middelburg Optimisation project
DMR	Department of Mineral Resources
DWA	Department of Water Affairs
DWAF	Department of Water Affairs and Forestry
DWS	Department of Water and Sanitation
EA	Environmental Authorisation
EAP	Environmental Assessment Practitioner
EC	Electrical Conductivity
ECA	Environmental Conservation Act, 1989 (Act No. 73 of 1989)
ECO	Environmental Control Officer
EHS	Environmental, Health and Safety
EIA	Environmental Impact Assessment
EIR	Environmental Impact Report
EIS	Ecological Importance and Sensitivity

GENERAL ABBREVIATIONS	
Abbreviation	Meaning
ELM	eMalahleni Local Municipality
EME	Earth Moving Equipment
EMP	Environmental Management Plan
EMPr	Environmental Management Programme
EMPR	Environmental Management Programme Report
EN	Endangered
ESA	Ecological Support Area
FEPA	Freshwater Ecosystem Priority Area
FLAC	Fuel, lube, air and coolant
GDP	Gross Domestic Product
GHG	Greenhouse gases
GN	Government Notice
GNR	Government Notice Regulation
GVA	Gross value added
ha	hectares
HGM	Hydrogeomorphic
HIA	Heritage Impact Assessment
HMA	Heavily Modified Areas
HPA	Highveld Priority Area
I&APs	Interested and Affected Parties
IAIAsa	International Association for Impact Assessment: South Africa
IDP	Integrated Development Plan
IFC	International Finance Corporation
IHIA	Intermediate Habitat Integrity Assessment
IUA	Integrated Unit of Analysis
IUCN	International Union for Conservation of Nature
IWMSA	Institute of Waste Management of Southern Africa
IWULA	Integrated Water Use Licence Application
IWWMP	Integrated Water and Waste Management Plan
J&W	Jones & Wagener Engineering and Environmental Consultants
JMA	Jasper Muller and Associates
K	Hydraulic conductivity
L_{Aeq}	The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured) (in dBA)

GENERAL ABBREVIATIONS	
Abbreviation	Meaning
LAC	Low Ash Coal
LaRSSA	Land Rehabilitation Society of Southern Africa
LDV	Light Duty Vehicle
LoM	Life of mine
m	metre
mamsl	metres above mean sea level
m/s	metre per second
mbs	metre below surface
mg/ℓ	milligram per litre
mg/m^2/day	milligram per square metre per day
mm	millimetre
mm/a	millimetre per annum
mS/m	milliSiemens per metre
MAE	Mean Annual Evaporation
MAP	Mean Annual Precipitation
MAR	Mean Annual Runoff
MBSP	Mpumalanga Biodiversity Sector Plan
MDARDLEA	Mpumalanga Department of Agriculture, rural Development, Land and Environmental Affairs
MEND	Mine Environment Neutral Drainage
MIRAI	Macroinvertebrate Response Assessment Index
MLL	Minimum Living Level
MOD AASHTO	Modified American Association of State Highway and Transportation Officials – classification of soils
MPHG	Mpumalanga Highveld
MPRDA	Mineral and Petroleum Resources Development Act, 2002 (Act 28 of 2002)
MRA	Mining Rights Area
MTPA	Mpumalanga Tourism and Parks Agency
N/A	Not applicable
NAAQS	National Ambient Air Quality Standards
NAG	Net Acid Generation
No	Number
NDCR	National Dust Control Regulations (GNR827 of 1 November 2013)
NDM	Nkangala District Municipality

GENERAL ABBREVIATIONS	
Abbreviation	Meaning
NEMA	National Environmental Management Act, 1998 (Act 107 of 1998)
NEM:AQA	National Environmental Management Air Quality Act, 2004 (Act 39 of 2004)
NEM:BA	National Environmental Management Biodiversity Act, 2004 (Act 10 of 2004)
NEM:PAA	National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003)
NEM:WA	National Environmental Management Waste Act, 2008 (Act 59 of 2008)
NFEPA	National Freshwater Ecosystem Priority Area
NGO	Non-Governmental Organisation
NHRA	National Heritage Resources Act, 1999 (Act 25 of 1999)
NWA	National Water Act, 1998 (Act 36 of 1998)
ONA	Other natural areas
PA	Protected Area
PAG	Potentially Acid Generating
PCD	Pollution control dam
PES	Present Ecological State
PHD	Pulles, Howard and De Lange
PIA	Palaeontological Impact Assessment
PM	Particulate matter
POI	Point of Interest
PSS	Power Station Smalls
PWRT	Public Works, Roads and Transport
RMF	Regional Maximum Flood
ROM	Run-of-Mine
RQO	Resource Quality Objective
RWQ	Resource Water Quality
S&EIR	Scoping and Environmental Impact Report
South32	South32 SA Coal Holdings (Pty) Limited
SAHRA	South African Heritage Resources Agency
SAHRIS	South African Heritage Resources Information System
SANBI	South African National Biodiversity Institute
SANS	South African National Standards
SAPS	South African Police Service
SASS5	South African Scoring System Version 5
SAWS	South African Weather Service

GENERAL ABBREVIATIONS	
Abbreviation	Meaning
SCC	Species of conservation concern
SDS	Safety Data Sheet
SEMAs	Specific Environmental Management Acts
SIA	Social Impact Assessment
SKS	Steenkoolspruit
SMMEs	Small, Medium, Micro Enterprises
STOT-RE	Specific target organ toxicity – repeat exposure
tpa	Tonnes per annum
T	Transmissivity
TBC	The Biodiversity Company
TDS	Total Dissolved Solids
TC	Total Concentration
TSP	Total Suspended Particulates
TWA-OEL-RL	Time Weighted Average Occupation Exposure Limit Recommended Limit
TWQR	Target water quality range
µg/ℓ	microgram per litre
USBM	United States Bureau of Mines
VDDC	Vandyksdrift Central
VDDN	Vandyksdrift North
WESSA	Wildlife and Environmental Society of SA
WISA	Water Institute of Southern Africa
WMLA	Waste management licence application
WSA	Water Services Authority
WSP	Water Services Provider
WTP	Water Treatment Plant
WUL	Water Use Licence
WVK	Wolvekrans Colliery
XRD	X-ray diffraction-

Checklist of compliance with the contents of the Environmental Impact Assessment Report as outlined in Appendix 3 of the 2014 EIA Regulations, as amended:

Information requirement as per Appendix 3 of GNR 326			Section in this Report
(a)	Details of		
	(i)	the EAP who prepared the report; and	3.2
	(ii)	the expertise of the EAP, including a curriculum vitae	3.2 Appendix 1
(b)	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;	Table 4-1
	(ii)	where available, the physical address and farm name; and	Table 4-1
	(iii)	where the required information in items (i) and (ii) is not available, the coordinates of the boundary of the property or properties;	Not applicable
(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—		Figure 5-4 Figure 5-5 Appendix 5
	(i)	a linear activity, a description and coordinates of the corridor in which the proposed activity or activities is to be undertaken;	
	(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; and	Table 5-1
	(ii)	a description of the associated structures and infrastructure related to the development;	5.2.2
(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;		5.2.3 6
(f)	A motivation for the need and desirability for the proposed development, including the need and desirability of the activity in the context of the preferred development footprint within the approved site as contemplated in the accepted scoping report;		7
(g)	A motivation for the preferred development footprint within the approved site as contemplated in the accepted scoping report;		8
(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:		
	(i)	details of the development footprint alternatives considered;	8.1
	(ii)	details of the public participation process undertaken in terms of regulation 41 of the Regulations, including copies of the supporting documents and inputs;	9
	(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;	9.2

Information requirement as per Appendix 3 of GNR 326			Section in this Report
	(iv)	the environmental attributes associated with the development footprint alternatives focusing on the geographical, physical, biological, social, economic, heritage and cultural aspects;	10
	(v)	the impacts and risks identified including the nature, significance, consequence, extent, duration and probability of the impacts, including the degree to which these impacts—	11
		(aa) can be reversed;	
		(bb) may cause irreplaceable loss of resources; and	
		(cc) can be avoided, managed or mitigated;	
	(vi)	the methodology used in determining and ranking the nature, significance, consequences, extent, duration and probability of potential environmental impacts and risks;	12
	(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;	13
	(viii)	the possible mitigation measures that could be applied and level of residual risk;	Table 18-6 to Table 18-8
	(ix)	if no alternative development footprints for the activity were investigated, the motivation for not considering such; and	Not applicable
	(x)	a concluding statement indicating the location of the preferred alternative development footprint within the approved site as contemplated in the accepted scoping report;	16
(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—		17
	(i)	a description of all environmental issues and risks that were identified during the environmental impact assessment process; and	
	(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;	
(j)	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;		18
	(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;	
	(v)	the degree to which the impact and risk can be reversed;	
	(vi)	the degree to which the impact and risk may cause irreplaceable loss of	

Information requirement as per Appendix 3 of GNR 326			Section in this Report
		resources; and	
	(vii)	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;		19
(l)	An environmental impact statement which contains—		
	(i)	a summary of the key findings of the environmental impact assessment:	20.1
	(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	20.2
	(iii)	a summary of the positive and negative impacts and risks of the proposed activity and identified alternatives;	20.3
(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;		19
(n)	The final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment;		20.2
(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;		23 25.2
(p)	A description of any assumptions, uncertainties and gaps in knowledge which relate to the assessment and mitigation measures proposed;		24
(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;		25
(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;		26
(s)	An undertaking under oath or affirmation by the EAP in relation to –		31
	(i)	the correctness of the information provided in the reports;	
	(ii)	the inclusion of comments and inputs from stakeholders and I&APs;	
	(iii)	the inclusion of inputs and recommendations from the specialist reports where relevant; and	
	(iv)	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;	
(t)	Where applicable, details of any financial provision for the rehabilitation, closure, and ongoing post decommissioning management of negative environmental impacts;		27
(u)	An indication of any deviation from the approved scoping report, including the plan of study, including—		28

Information requirement as per Appendix 3 of GNR 326			Section in this Report
	(i)	any deviation from the methodology used in determining the significance of potential environmental impacts and risks; and	
	(ii)	a motivation for the deviation;	
(v)	Any specific information that may be required by the competent authority; and		29
(w)	Any other matters required in terms of section 24(4)(a) and (b) of the Act.		30

Checklist of compliance with the information requirements listed in the waste management licence application form

Appendix A1 Information needed when applying for scheduled activities listed under Category B of the list of waste management activities in terms of NEM:WA		Section in this Report
	Scoping and Environmental Impact Assessment Report which should include	
	• Description of the environment that may be affected by the proposed activity and the manner in which the geographical, physical, biological, social, economic and cultural aspects of the environment may be affected by the proposed activity	10
	• Description of significant environmental impacts, including cumulative impacts, that may occur as a result of the undertaking of the activity	18
	• Conducting public participation as outlined in EIA Regulations	9
	• Closure plan (report)	Rehabilitation plan attached as Appendix 10
	• Operational plan	
	• Waste disposal facility designs	Appendix 11
	• End-use plan (only apply to site closure)	Not applicable
	• Closure/Remedial designs (only apply to site closure)	Not applicable
	• Latest external audit report (only apply to permit amendment)	Not applicable
	• Application and report documents (four hard copies for all applications)	This report
	• A3 size layout plans (four hard copies for all applications)	Appendix 5
	• Landfill conceptual designs	Appendix 11
	• Geo-hydrological report (only apply to landfill sites, storage and treatment of waste)	Appendix 8.9
	• Consideration of alternatives	8.1
	• Description of mitigation measures and risk assessment	Table 18-6 to Table 18-8
	• Any inputs made by specialists to the extent that may be necessary	19
	• Any specific information as may be required by the competent authority	29
	• Plan of study for environmental impact assessment which must among others include:	Not applicable – was included in the Scoping Report that was accepted by DMR on 23 October 2019
	o Description of the tasks to be undertaken as part of the environmental impact assessment process, including specialist report or specialized processes, and a manner in which such tasks will be undertaken	
	o An indication of stages of stages at which the competent authority will be consulted	
	o Description of methods for assessing issues and alternatives, including the no-go alternative	
	o Particulars of participation process that will be conducted during the EIA	

Appendix A1 Information needed when applying for scheduled activities listed under Category B of the list of waste management activities in terms of NEM:WA		Section in this Report
	process	
	• Compilation of EIA report must be based on tasks outlined in the Plan of Study for EIA, and the below listed reports must also be attached.	Appendix 8
	o Draft environmental management plan (only apply to EIA reports. No draft EMP should be included in the scoping report)	
	o Copies of any specialist reports and specialized processes (only apply to EIA reports. No copies of specialist studies and specialized processes should be included in the scoping report)	

Appendix B1		
1	Extremely clear Google Earth colour picture of the site (dated not more than a month from the date of the application)	Appendix 5
2	1:50 000 topography /topo-cadastral map of the area showing	Appendix 3
	2.1 the site and 5km radius	
	2.2 Existing residential and industrial areas	
	2.3 Possible future development (indicate the type of development)	
	2.4 Other waste handling sites (existing or closed) in the area	
	2.5 Existing and possible future residential areas.	
	2.6 Sites which are listed as national monuments or archaeological, paleontological and cultural historical sites or objects worthy of conservation;	
3	Security and access aspects of the site	5.2.1.1
4	The site plan drawn to scale showing the site's boundary showing:	Appendix 5 Appendix 11
	4.1 Activities or development existing on all 4 directions of the site.	
	4.2 Waste receipt, storage and handling areas	
	4.3 Impermeable surfaces	
	4.4 Sealed drainage systems	
	4.5 Drainage system for the site including sumps and discharge points	
	4.6 Road names and access from all major roads in the area	
	4.7 Land Owner's consent (letter with signature)	
5	Waste hierarchy implementation plan	Not applicable
6	Emergency preparedness plan	Part B - EMPr

SCOPE OF ASSESSMENT AND ENVIRONMENTAL IMPACT ASSESSMENT REPORT

1. INTRODUCTION

South32 SA Coal Holdings (Pty) Ltd (South32), is the holder of an amended mining right for coal, granted by the Minister of Mineral Resources, in terms of the Mineral and Petroleum Resources Development Act, 2002 (MPRDA, Act 28 of 2002) and notarially executed on 21 May 2015 under Department of Mineral Resources (DMR) reference MP30/5/1/2/2/379MR, in respect of its Wolvekrans – Ifalethu Colliery[1]. This mining right comprises of the following areas:

- Ifalethu Colliery (previously referred to as Wolvekrans North Section[2]) consisting of the Hartbeestfontein, Bankfontein (mining now ceased), Goedehoop, Klipfontein sections and the North Processing Plant; and
- Wolvekrans Colliery (previously referred to as the Wolvekrans South Section) consisting of the Wolvekrans, Vlaklaagte (mining ceased), Driefontein, Boschmanskrans, Vandyksdrift, Albion and Steenkoolspruit sections, as well as the South Processing Plants (Eskom and Export). Some of these areas were previously known as Douglas Colliery.

Jones & Wagener (Pty) Ltd Engineering and Environmental Consultants (J&W) has been appointed by South32 as an independent Environmental Assessment Practitioner (EAP) to undertake an Integrated Regulatory Process to obtain the required authorisations for the proposed infrastructure and mining development at the Vandyksdrift Central (VDDC) section of its Wolvekrans Colliery.

2. PROJECT BACKGROUND

The VDDC section falls within the footprint of historic underground mining operations at the old Douglas Colliery. In 2007, an amendment of the Environmental Management Programme Report (EMPR) for the Douglas Colliery operations was approved, to allow pillar mining (opencast) of the area previously mined by underground bord and pillar mining. Authorisation of the VDDC mining project included the following:

- Opencast operation on the farm Kleinkopje 15 IS;
- Opencast operation on the farm Steenkoolspruit 18 IS;
- Pillar extraction operation on the farm Vandyksdrift 19 IS;
- Reclamation of existing slurry ponds; and
- Rewashing of existing discard dumps (PHD, 2006).

The water uses associated with the opencast mining have been authorised in terms of Water Use Licence (WUL) number 24084535 dated 10 October 2008, issued to Douglas Colliery.

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[1] Middelburg Mine Services as per Mining Right

[2] This was previously referred to as Middelburg Colliery

The No. 2 seam workings are flooded with water and must be dewatered to enable the open pit development to proceed. A dewatering strategy has therefore been developed and an application for Environmental Authorisation (EA) of the dewatering activities was submitted to the DMR (Jaco-K Consulting, 2016); a decision in this regard is pending. The water use activities associated with this upfront dewatering strategy have been authorised by WUL number 06/B11F/GCIJ/7943 dated 19 July 2018.

The 2007 approved EMPR Amendment included limited additional infrastructure in support of the opencast mining operations, as it was assumed at that stage that existing infrastructure will be used. In addition, the applications for authorisation of the activities associated with the dewatering strategy, were limited to the infrastructure to facilitate dewatering (i.e. dewatering boreholes, pumps, pipelines, storage tanks, mechanical evaporators, roads and power lines).

A pre-feasibility investigation has since been conducted, and the need to develop additional infrastructure to support the proposed opencast mining was identified. The additional infrastructure includes the following:

- Stormwater management structures (drains and berms);
- Water management measures for the management of mine impacted water, including a modular water treatment plant (WTP) and mechanical evaporators;
- Overburden dumps;
- Run-of-Mine (ROM) coal stockpile areas;
- Mixed ROM coal and slurry stockpile areas;
- Topsoil stockpiles following clearance of vegetation;
- Pipelines for the conveyance of water;
- Hard park area and brake test ramp; and
- Haul roads and service roads.

The Consultation Scoping Report (CSR) for the proposed infrastructure development was made available for public review from 8 October to 7 November 2018, which described the proposed infrastructure development. Prior to finalisation of the Scoping Report, several changes to the proposed application were made. In addition to changes in the infrastructure lay-out, the proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation differs from the mine lay-out in the 2007 approved EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be opencast mined. A Revised CSR was made available from 7 August to 9 September 2019 for public review. Following the public review period, the Final Scoping Report was submitted to the DMR. The DMR accepted the Scoping Report on 23 October 2019.

The project is collectively referred to as the VDDC infrastructure and mining development and includes the development of the infrastructure as listed above, as well as the opencast mining areas not previously authorised.

3. CONTACT PERSON AND CORRESPONDENCE ADDRESS

3.1 Details of the EAP who prepared the report

Name of the Practitioner:	Tolmay Hopkins
Tel No:	011 519 0200
Fax No:	011 519 0201
e-mail address:	tolmay@jaws.co.za

3.2 Expertise of the EAP

3.2.1 The qualifications of the EAP

(With evidence attached as Appendix 1)

Tolmay Hopkins:

- MSc (Agric) Microbiology (University of Pretoria)
- Registered Professional Natural Scientist (Pr.Sci.Nat.) 400322/14
- Member of Institute of Waste Management South Africa (IWMSA)
- Member of International Association for Impact Assessment South African Affiliate (IAIAsa);
- Member of Water Institute of South Africa (WISA).

Jessica Badenhorst:

- MSc Entomology (University of Pretoria)
- Member of International Association for Impact Assessment South African Affiliate (IAIAsa)
- Member of Land Rehabilitation Society of South Africa (LaRSSA).

3.2.2 Summary of the EAP's past experience

(In carrying out the Environmental Impact Assessment Procedure)

Tolmay Hopkins has over 19 years' experience in the field of environmental management, in both the regulatory and the consulting field. While at the then called Department of Water Affairs and Forestry, she was responsible for the review of numerous impact assessments and applications. She has been involved in the authorisation and regulation of waste disposal sites and was responsible for the authorisation of four hazardous and 23 general waste disposal sites. She was involved in the assessment of water use licence applications for the impeding, altering, diverting and changing of the characteristics of a watercourse, as well as for stream flow reduction activities (afforestation) in the Mpumalanga Province in terms of the National Water Act, 1998 (Act 36 of 1998).

In her capacity as consulting environmental scientist, she has been involved in the compilation of more than 20 applications for authorisations in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) and its Regulations, the National Environmental Management: Waste Act, 2008 (Act 59 of 2008) and the NWA and its Regulations.

Jessica Badenhorst has approximately two years experience in environmental management, mostly being involved in mine closure planning in terms of the National Environmental Management Act, 1998 (Act 107 of 1998) Financial Provision Regulations (GNR 1147 and proposed regulations GNR 1228), as well as environmental and water use licence auditing.

4. DESCRIPTION OF THE PROPERTY

4.1 Property details

The list of properties on which the development will take place is summarised in **Table 4-1**.

Table 4-1: Property details

Farm Name:	Kleinkopje 15 IS, Steenkoolspruit 18 IS, Vandyksdrift 19 IS and Wolvekrans 17 IS
Application area (Ha)	The total VDDC project area is approximately 1 600 ha. Most of the infrastructure will be developed within this extent. The opencast mining area not included in the 2007 approved EMPR, is approximately 196 ha.
Magisterial district:	eMalahleni Local Municipality within Nkangala District Municipality
Distance and direction from nearest town	30 km south-east of eMalahleni
21 digit surveyor General Code for each farm portion	Kleinkopje 15 IS: Ptn 9: T0IS0000000000150009 Ptn 14: T0IS0000000000150014 Ptn 4: T0IS0000000000150004 Steenkoolspruit 18 IS: Ptn 2: T0IS0000000000180002 Ptn 5: T0IS0000000000180005 Vandyksdrift 19 IS: RE of Ptn 3: T0IS0000000000190003 Ptn 9: T0IS0000000000190009 Ptn 10: T0IS0000000000190010 Ptn 11: T0IS0000000000190011 Wolvekrans 17 IS: Ptn 6: T0IS0000000000170006 Ptn 10: T0IS0000000000170010 Remaining Extent: T0IS0000000000170000 Ptn 35: T0IS0000000000170035

4.2 Locality map

(Show nearest town, scale not smaller than 1:250000)

Wolvekrans Colliery is located approximately 30 km south-east of the town of eMalahleni, within the Nkangala District Municipality. A locality map is provided in **Figure 4-1,** with a large-scale map provided in **Appendix 3**.

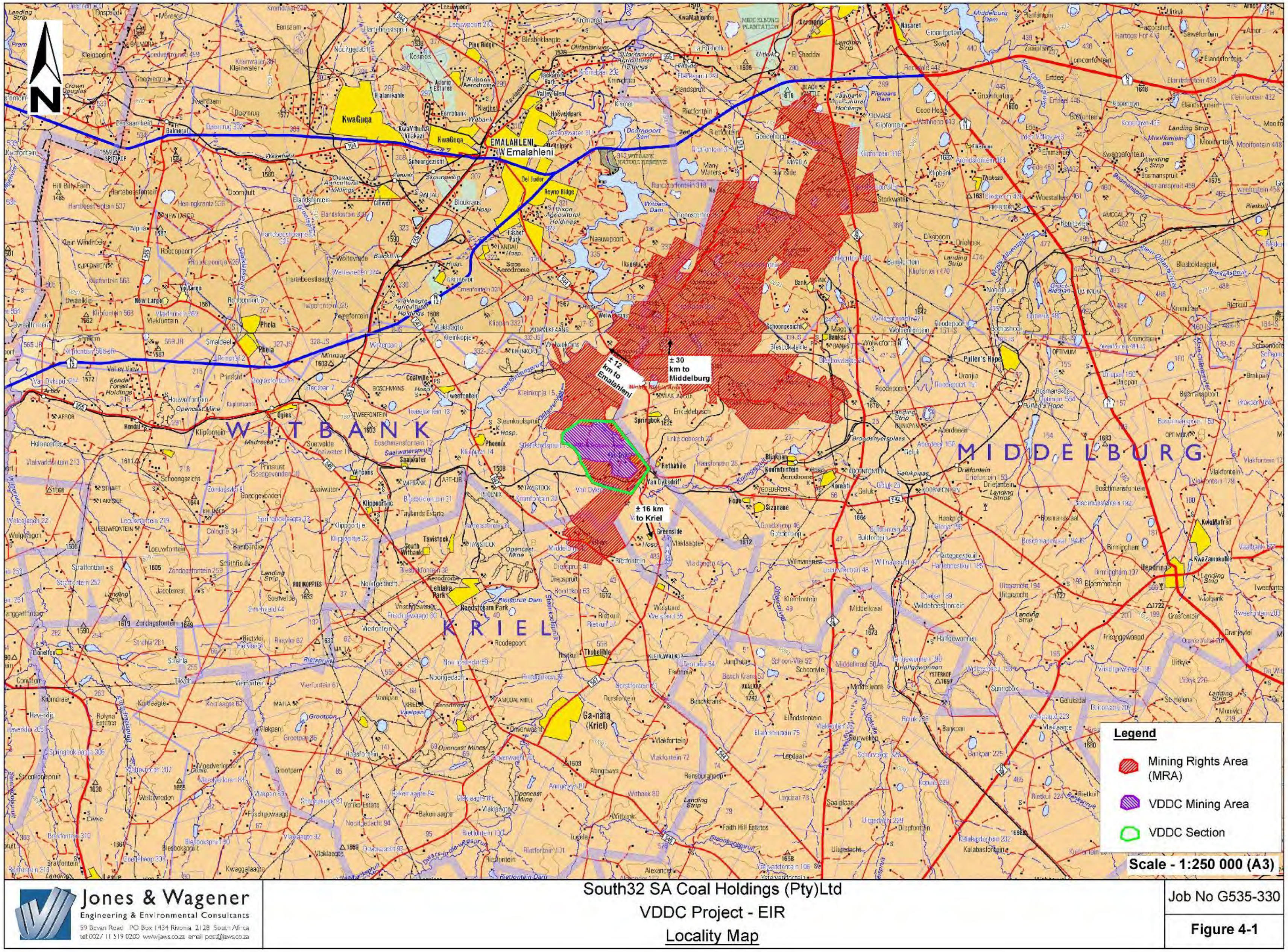

Figure 4-1: Locality map

4.3 Property and property ownership

Detail of the properties affected by the proposed development is provided in **Table 4-2**, and illustrated on **Figure 4-2**.

Table 4-2: Details of properties affected by proposed development

Farm name	Portion	Property owner	Title deed number
Kleinkopje 15 IS	Ptn 9	Anglo Operations (Pty) Limited	T35745/1974
	Ptn 14	Anglo Operations (Pty) Limited	T27780/1977
	Ptn 4	Ingwe Surface Holdings Ltd	T76581/1999
Steenkoolspruit 18 IS	Ptn 2	Ingwe Surface Holdings Ltd	T76581/1999
	Ptn 5	Ingwe Surface Holdings Ltd	T76581/1999
Vandyksdrift 19 IS	RE of Ptn 3	Ingwe Surface Holdings Ltd	T76548/1999
	Ptn 9	Ingwe Surface Holdings Ltd	T76547/1999
	Ptn 10	Ingwe Surface Holdings Ltd	T76547/1999
	Ptn 11	Ingwe Surface Holdings Ltd	T76547/1999
Wolvekrans 17 IS	Ptn 6	Ingwe Surface Holdings Ltd	T76586/1999
	Ptn 10	Ingwe Surface Holdings Ltd	T76554/1999
	Ptn 35	Ingwe Surface Holdings Ltd	T76587/1999
	RE	Ingwe Surface Holdings Ltd	T76586/1999

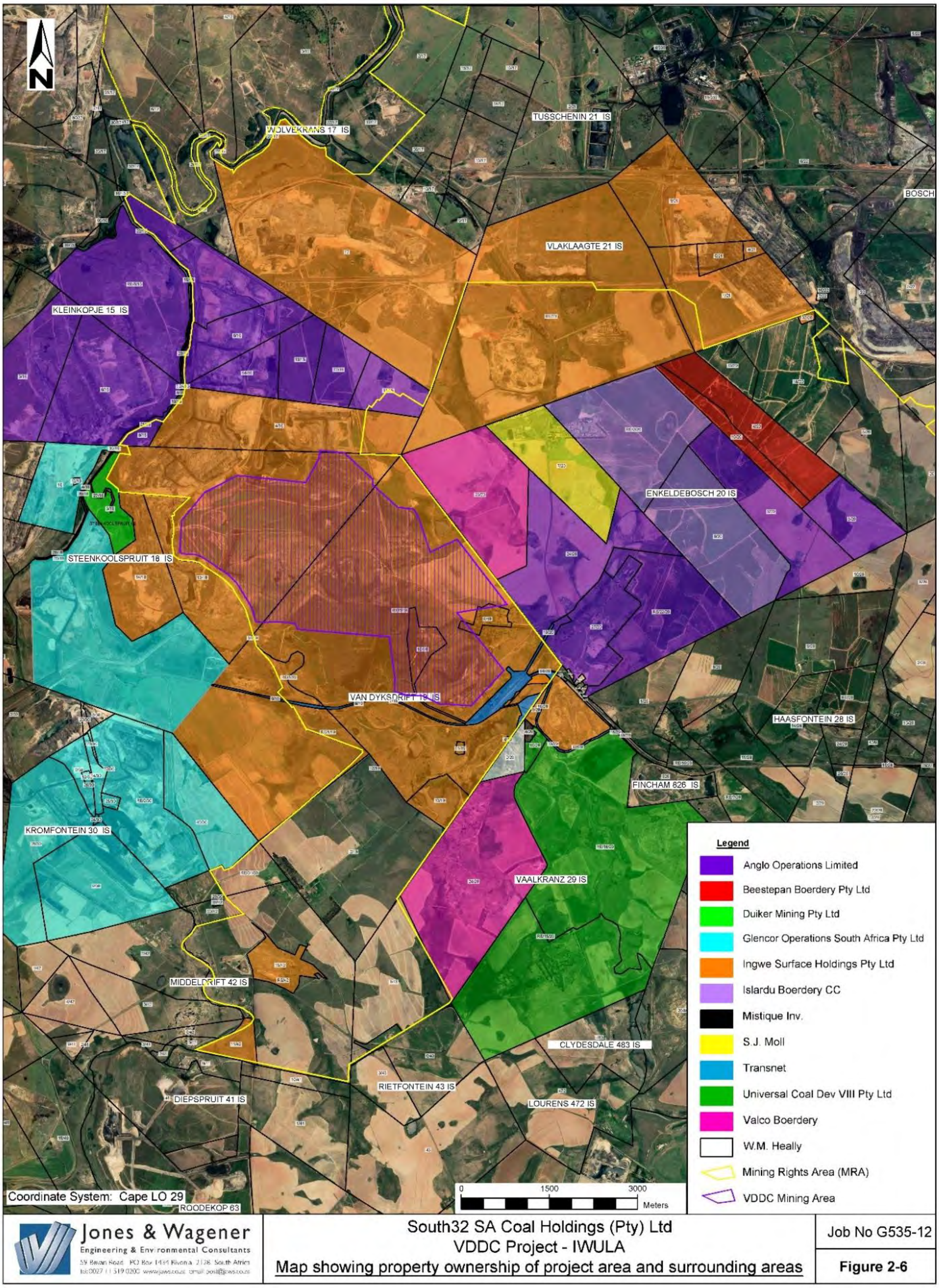

Figure 4-2: Map showing property ownership of project area and surrounding areas

5. DESCRIPTION OF THE SCOPE OF THE PROPOSED OVERALL ACTIVITY

5.1 Listed and specified activities

Provide a plan drawn to a scale acceptable to the competent authority but not less than 1: 10 000 that shows the location, and area (hectares) of all the aforesaid main and listed activities, and infrastructure to be placed on site

A list of activities to be undertaken as part of the proposed infrastructure and mining development is provided in **Table 5-1** and shown on **Figure 5-4** and **Figure 5-5**. A large-scale map is provided in **Appendix 5**.

Table 5-1: Listed and specified activities

NAME OF ACTIVITY	AERIAL EXTENT OF ACTIVITY	LISTED ACTIVITY	APPLICABLE LISTING NOTICE
(All activities including activities not listed) (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, storm water control, berms, roads, pipelines, power lines, conveyors, **etc…etc…etc.**)	ha or m^2	Mark with an X where applicable or affected	GNR 544, GNR 545 or GNR 546 / NOT LISTED[3]
Listed activities as per NEMA EIA Regulations 2014 (as amended)			
Clearing of vegetation for the purpose of infrastructure development (including contractors lay-down areas and infrastructure areas)	~ 204 ha	X	GNR 325 of 2017: Activity 15
Infrastructure development in close proximity to watercourses, e.g. clean water diversion measures, topsoil stockpile and haul roads		X	GNR 327 of 2017: Activity 12
Infilling/depositing/excavation/removal or moving of soil of more than 10 m^3 from watercourse as a result of infrastructure development in close proximity to watercourses		X	GNR 327 of 2017: Activity 19
Development of dirty water pipelines (600 mm diameter) in excess of 1 000 m in length		X	GNR 327 of 2017: Activity 10
Development of clean water diversion pipelines (450 mm diameter) / canals in excess of 1 000 m in length		X	GNR 327 of 2017: Activity 9
Development of mobile water treatment plant (20 Mℓ/day treatment capacity) for treatment of mine impacted water	~2 ha	X	GNR 325 of 2017: Activity 25
Activities requiring a water use licence:		X	GNR 325 of 2017: Activity 6
• 4 Seam and 5 Seam stockpiles	~ 40 ha		

[3] GNR544 to GNR 546 has been superseded by GNR 326 to GNR 328

NAME OF ACTIVITY	AERIAL EXTENT OF ACTIVITY	LISTED ACTIVITY	APPLICABLE LISTING NOTICE
• Dust suppression using mine impacted water	Within the extent of the mining area		
• Pit dewatering			
• Boxcut spoils dumps	~ 55 ha		
• Overburden Dump 1	~ 23 ha		
• Overburden Dump at SKS Void	~ 134 ha		
• Mixed ROM coal and slurry stockpile areas	~ 26 ha		
• Construction activities close to, or within, watercourses	~ 20 ha		
• Discharge of treated water from mobile water treatment plant			
Construction of new haul roads (40 m wide) and service roads	~ 55 ha	X	GNR 327 of 2017: Activity 24(ii)
Upgrade of existing roads	~ 10 ha	X	GNR 325 of 2017: Activity 56
Development of topsoil stockpiles	~ 62 ha		
Opencast mining not previously authorised	~ 196 ha		
Development of mechanical evaporators at Steenkoolspruit Pit as part of dirty water management measures			
Waste management activities in terms of NEM:WA (GN 921 (2013) as amended in GN 332 (2014), GN 633 (2015), GN 242 (2017) and GN 1094 (2017))			
Mixed ROM coal and slurry will be stockpiled for a period to allow for the material to be dewatered. Slurry is a mine residue which will be dewatered (change to physical character) at the stockpile areas before it is sent to the processing plant	~ 26 ha	X	Category B, Activity 4(4)
• Boxcut spoils dumps; • Overburden dumps; • Mixed ROM coal and slurry stockpile areas.	~ 55 ha ~ 157 ha ~ 26 ha	X	Category B, Activity 4(11)
Construction of mine residue facilities: • Boxcut spoils dumps; • Overburden dumps; • Mixed ROM coal and slurry stockpile areas.	~ 55 ha ~ 157 ha ~ 26 ha	X	Category B, Activity 4(10)

5.2 Description of the activities to be undertaken

(Describe methodology or technology to be employed, and for a linear activity, a description of the route of the activity)

5.2.1 Historical activities and activities already authorised

The VDDC area falls within the footprint of historic underground mining operations known as Douglas Colliery. Limited opencast mining was done before 1990 in the top shallower No. 5 seam. The No. 4L, No. 2, No. 2A and No. 1 coal seams were mined in the past by means of underground mining. All underground operations were terminated during October 2008. The No. 2 Seam is the principal seam in the project area and its thickness can exceed 9 m, but only the lower select horizon of higher quality 2.5 m – 4.5 m was previously extracted. The targeted mineable seams are the No. 5, No. S4UA, No. S4L, No. S2RP, No. S2A and No. S1 seams respectively (South32, 2017a).

Mining activities at the Douglas Colliery was described in detail in an EMPR compiled by Jasper Muller and Associates in 2000, and subsequently approved by the (then) Department of Minerals and Energy in 2003. The 2003 EMPR included the past and (at that stage) current mining operations and associated infrastructure, including the Vandyksdrift Plant, PSS and LAC discard dumps, slurry dams; coal stockpile, a number of pollution control dams (PCDs), as well as workshops, maintenance and engineering buildings.

In 2007, an amendment of the EMPR for the Douglas Colliery operations was approved, to allow the opencast mining of the remaining No. 5, No. 4, No. 2 and No. 1 seams. Authorisation of the VDDC mining project included the following:

- Opencast operation on the farm Kleinkopje 15 IS;
- Opencast operation on the farm Steenkoolspruit 18 IS;
- Pillar extraction operation on the farm Vandyksdrift 19 IS;
- Reclamation of existing slurry ponds; and
- Rewashing of existing discard dumps (PHD, 2006).

The 2007 approved EMPR also included infrastructure such as clean and dirty water management systems, haul roads and conveyors.

As a result of the previous mining of the No. 2 Seam horizon by bord and pillar means, the following has resulted:

- The majority of the underground No. 2 seam workings are flooded because of water ingress from surface and from the underground aquifers. A dewatering programme will be implemented before opencast mining operations commence;
- An area of the No. 2 Seam was historically used for placement of slurry from the processing plant. It is believed to be contained in the southeast portion of the deposit by underground seals and barrier pillars (the expected slurry footprint is indicated in **Figure 5-1)**.

In order to mine the VDDC reserve, the water contained in the mined out underground workings must be removed prior to mining. This will be achieved by drilling a number of boreholes into the old underground workings and abstracting the water via these boreholes.

Water will be pumped from the boreholes accessing different underground compartments and will be transferred via borehole connector pipelines to a number of water storage/transfer tanks. From there, the water will be transferred via the main connector pipelines to the Vleishaft PCD and/or directly to the evaporation tanks that will be located at the evaporation sites where water will be evaporated using mechanical evaporators. Three evaporators sites have been identified (5 Seam void, Vleishaft PCD and Vlaklaagte Void). In addition, some water will be pumped and stored in the Steenkoolspruit Pit void once the pit is mined out (Jaco-K Consulting, 2016).

An application for the EA of the dewatering activities has been submitted to the DMR and their final decision is awaited. The water use licence for the dewatering project was issued on 19 July 2018.

The existing infrastructure in the VDDC area is shown on **Figure 5-2** and described below.

5.2.1.1. Access, transport and logistics

Access to the VDDC project area is via one of three existing approaches, depending on the size of the transport, namely:

- Current SKS main entrance;
- Current Wolvekrans main entrance (via BMK workshops); and
- Current Vandyksdrift main entrance (opposite Springbok village).

All personnel transport and light delivery vehicles will enter the site via the current SKS main entrance. Personal vehicles will park in the existing personnel vehicle parking, whilst busses will drop personnel off at the existing bus turnaround.

Light delivery vehicles and heavy delivery vehicles up to 10 t single body trucks will also enter via the existing SKS main entrance and deliver to the required location, or to the existing store facilities.

The heavy delivery vehicles and lowbeds will access the site via either the WVK main entrance or the Vandyksdrift main entrance, depending on the destination within the VDDC Project area (South32, 2017b).

A number of existing haul roads have been developed within the mining area.

5.2.1.2. Steenkoolspruit (SKS) facilities

Existing facilities at the SKS operations include the ROM tip and the overland conveyor system to the South Export Plant, the SKS complex offices, warehouse, change houses, workshops, wash bays, laydown areas, a sewage treatment plant and fuelling facilities.

The southern SKS facilities currently in use by the Vandyksdrift North (VDDN) operation include contractors' offices, laydown areas, as well as a fuel, lube, air and coolant (FLAC) station.

5.2.1.3. Topsoil dump

An existing topsoil dump is located on the north-eastern boundary of the VDDC section.

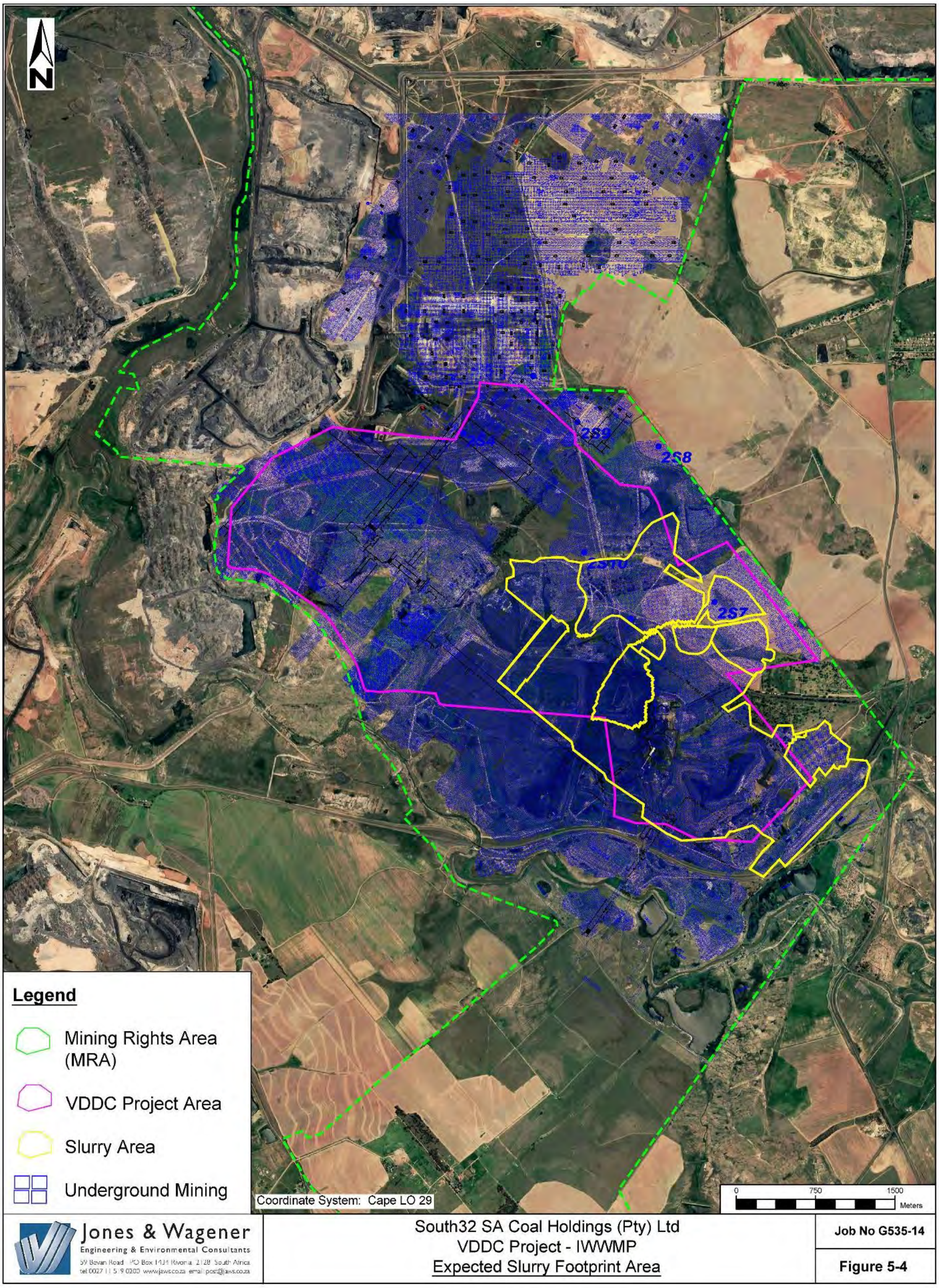

Figure 5-1: Expected slurry footprint area

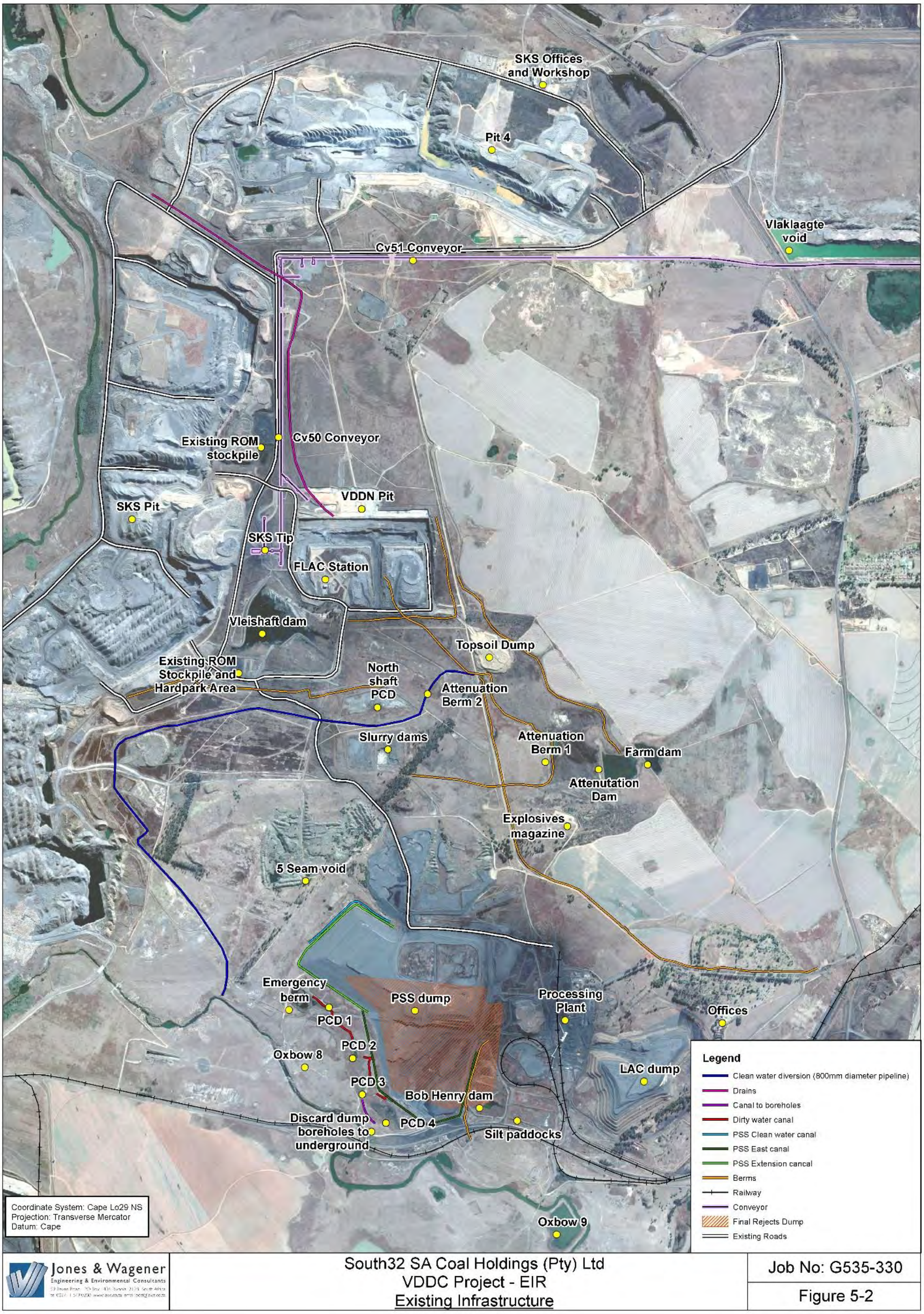

Figure 5-2: Existing infrastructure

5.2.1.4. *Surface dumps*

Surface discard dumps exist on the southern portion of the VDDC resource area, namely the PSS and LAC dumps. These dumps are in the process of being reclaimed and it is expected that approximately 40% of the material will be reclaimed. Final rejects from the reclamation process is disposed of on the southern portion of the PSS dump. This Final Rejects Dump will remain in future and the VDDC mining area has been changed to exclude this footprint from the mine plan.

5.2.1.5. *Storm water management measures*

A number of clean and dirty water management berms and canals have been constructed to ensure that runoff is managed. This includes a clean water diversion dam which contains clean runoff from the undisturbed areas to the north-east.

A number of dirty water canals drain dirty runoff to dirty water facilities. The Vleishaft PCD is an existing PCD with a capacity of 600 000 m^3, that has been authorised for the disposal of mine impacted water in terms of WULs issued to the mine.

Dirty runoff from the discard reclamation and processing plant drains to the Bob Henry dam and silt paddocks.

Existing water management measures at the PSS dump comprises of a clean water canal which collects clean water west of the PSS Dump Extension, as well as a system of unlined canals which collects dirty runoff from the PSS Dump and conveys the water to four PCD's. Excess water from the PCD's is pumped to the underground workings via a borehole. Water is abstracted from the workings via boreholes for re-use in the processing plant.

5.2.1.6. *ROM coal stockpiles*

Two ROM coal stockpiles have been developed:

- A ROM coal pad located between the SKS void and the haul road, from where it is taken to the South Export Processing Plant via conveyors from the SKS crushing plant;
- A ROM stockpile area to the south of the Vleishaft PCD, of which a portion is currently used as a hard park area.

5.2.1.7. *Power supply*

The VDDC section is supplied from Eskom's Klein 132 kV Substation, which feeds the Klein Olifant 132 kV Substation. The voltage is stepped down to 22 kV via two 20 MVA power transformers feeding the 22 kV switchgear located in the Klein Olifant Substation (South32, 2017b).

The main existing electricity infrastructure is shown on **Figure 5-3**.

A section of the Klein-Kromfontein 132 kV powerline must be relocated to allow opencast mining to proceed. This is the subject of a separate application that is undertaken by South32 in terms of a self-build agreement with Eskom. The EA for the powerline will be transferred to Eskom on completion of the construction phase.

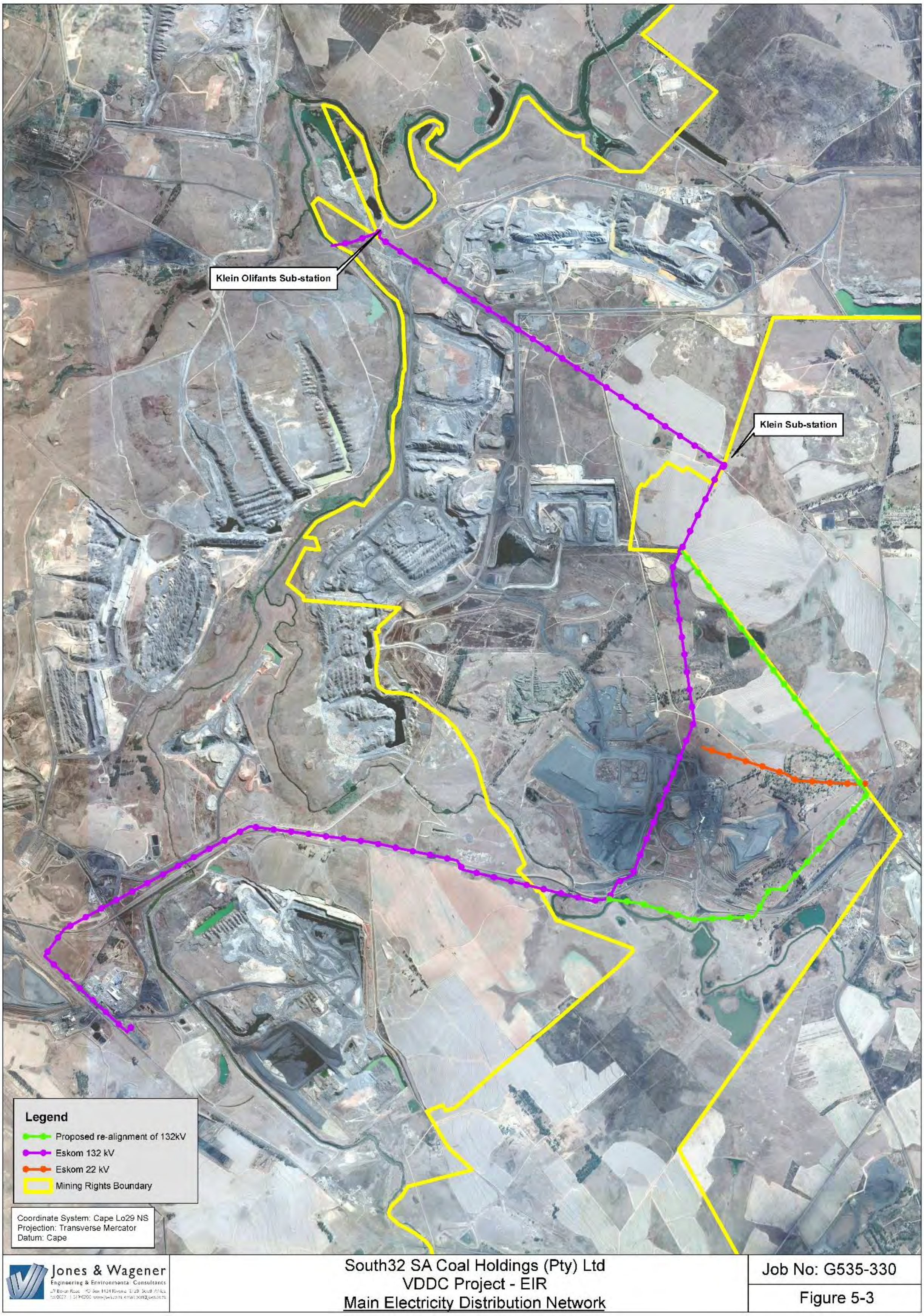

Figure 5-3: Main electricity distribution network

5.2.1.8. *Upfront dewatering infrastructure*

In order to mine the VDDC reserve, the water contained in the underground workings must be removed prior to mining. This will be achieved by drilling a number of boreholes into the old underground workings and to abstract the water via these boreholes.

Water will be pumped from the boreholes accessing different underground compartments and will be transferred via borehole connector pipelines to the Vleishaft PCD and/or directly to the evaporation tanks that will be located at the evaporation sites where water will be evaporated using mechanical evaporators. Three evaporators sites have been identified, namely No. 5 Seam void, Vleishaft PCD and Vlaklaagte Void.

In addition, some water will be pumped and stored in the Steenkoolspruit Pit void (Jaco-K Consulting, 2016(b)).

The following evaporators systems have been installed:

- Eight evaporators at Vleishaft PCD (2 Mℓ/day per evaporator);
- Twenty evaporators at Vlaklaagte void (2 Mℓ/ day per evaporator).

An additional 12 new evaporators (3 Mℓ/day per evaporator) will be installed at the No. 5 Seam void by the end of 2019.

5.2.2 Project description (proposed activities)

5.2.2.1. *Proposed new infrastructure*

A description of the infrastructure required in support of the VDDC opencast mining is provided below and shown on **Figure 5-4**. A large-scale map is provided in **Appendix 5**.

Topsoil dumps

The topsoil stripped from the box cut areas and areas cleared for the development of infrastructure will be relocated to a topsoil stockpile area to be located adjacent to the existing topsoil stockpile in the east of the project area. In addition, provision has been made for a topsoil stockpile area in between the ramps.

The box cut topsoil will be stockpiled due to the lack of direct placement option at the start of the opencast mining operations.

Overburden dumps

The boxcut will be done using a combination of dragline as well as truck and shovel. Overburden from the boxcut will be placed on four overburden dumps located in between the proposed ramps.

In addition, provision has been made for two overburden dumps. A new overburden dump will be developed in the south-east of the project area and the existing overburden dump at the SKS pit will also be used.

Upon steady state mining being achieved, rehabilitation activities can commence safely behind the active dynamic window of operations and the in-pit backfilling of overburden can advance. As the mine pit expand, there will be more opportunity to strip overburden and apply it directly to re-contoured areas, thus avoiding stockpiling. It has been assumed that overburden stockpiling will be during the initial stages of mining and that direct placement will commence when sufficient placement areas are available (South32, 2017a).

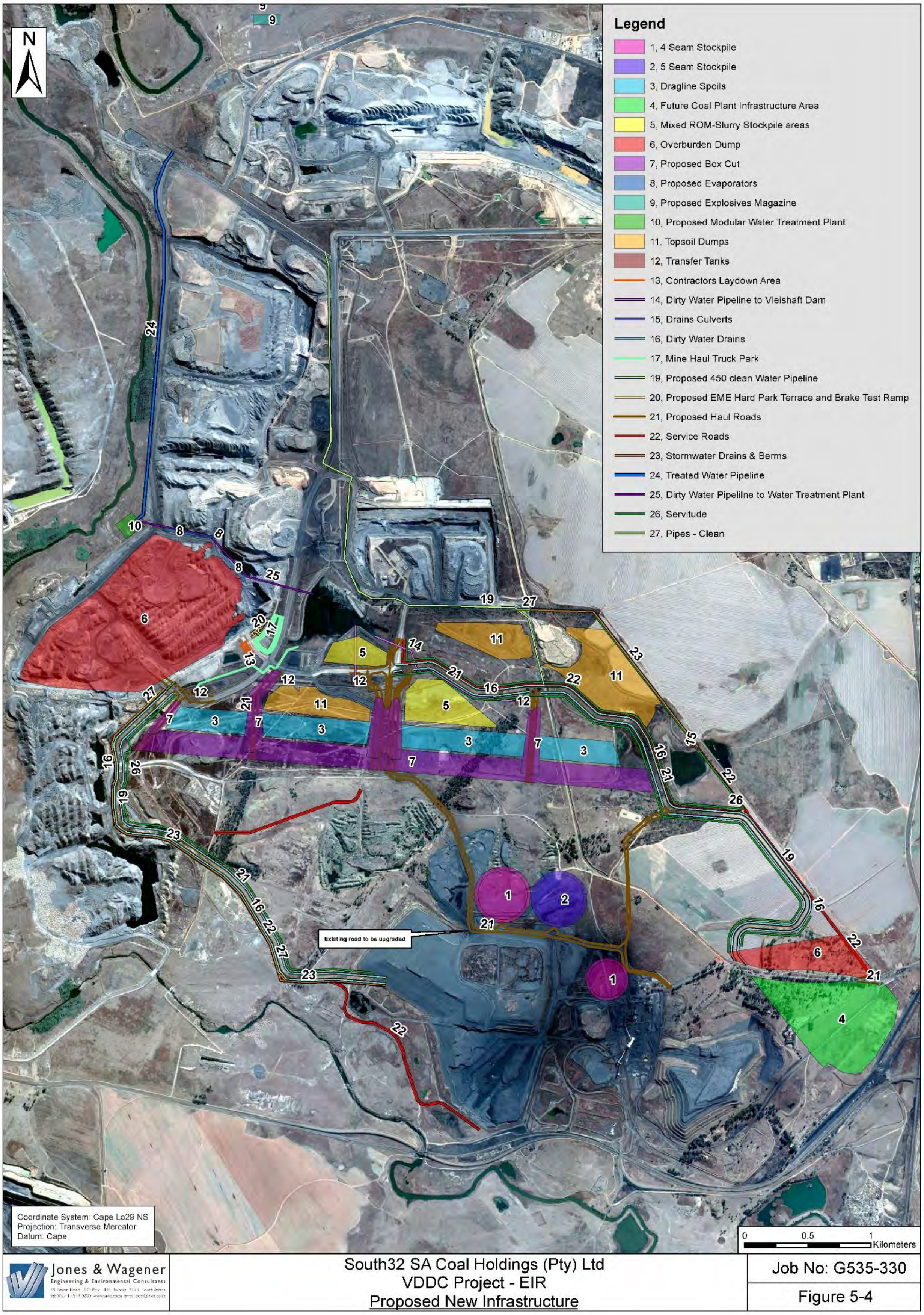

Figure 5-4: Proposed new infrastructure

ROM stockpiles and Mixed ROM coal and slurry stockpile areas

A portion of the underground No. 2 Seam was historically used for placement of slurry from the processing plant. It is believed to be contained in the southeast portion of the deposit by underground seals and barrier pillars. The expected slurry footprint is indicated in **Figure 5-1.**

Slurry will be mined with the ROM coal and the blended coal and slurry will be transferred to mixed ROM coal and slurry stockpile areas:

- Primary Mixed ROM coal and slurry stockpile area located between the ramps; and
- Secondary Mixed ROM coal and slurry stockpile area located directly south of the Vleishaft PCD.

The mixed material will be allowed to dewater before the mixed dried slurry and ROM coal is removed to the existing SKS tip, from where it will be taken to the South Export Processing Plant[4]. Water will be collected and conveyed via a silt trap to the Vleishaft PCD.

ROM coal from the No. 4 and No. 5 seams will be placed on transfer stockpiles. These stockpiles will be located on a partially reclaimed area of the PSS dump footprint. The stockpile positions will be moved as mining progresses but will remain within the footprint of the existing PSS dump or other previously mined out or disturbed areas.

Water consumption requirements

Potable water and wash water for vehicles and workshops will be supplied from the existing water supply at the SKS complex.

Water for dust suppression will be sourced from mine impacted water.

Management of mine impacted water

The proposed mining operations require the management of mine impacted water. Dirty areas that have been identified and included in the water management strategy are:

- Opencast pit;
- Mixed ROM coal and slurry stockpile areas;
- Overburden dumps;
- ROM stockpiles; and
- Hard park area.

<u>Opencast pit</u>

In order to manage the inflow of water into the mining operations, sumps will be constructed in the pit floor where the water will be collected at the bottom of the pit (at lowest points) and pumped out of the pit. These temporary sumps will be situated at the bottom of each access ramp and the piping routed in a berm servitude on the side of the access ramp, up to transfer tanks situated at the top of the ramp. Once the water reaches the transfer tanks, it will join the polluted water management system. Water will be

[4] Processing of the slurry at the existing South Plant may require changes to the processing plant. This, however, falls outside of this application process. Slurry from the Plant will be managed in terms of the existing slurry management practices, i.e. disposal in slurry cells.

pumped from the pit with self-priming diesel driven pumps mounted on trailers or skids to allow for easy movement (South32, 2017a). Water will be pumped to the Vleishaft PCD and from there, to one of the evaporator sites, with surplus water to the proposed modular WTP.

Mechanical evaporator sites are as follows:

- Three sites will be established as part of the upfront dewatering strategy as described above;
- As part of the VDDC infrastructure development, eight (8) new evaporators (3 Mℓ/day per evaporator) will be established at the SKS void;
- As mining progresses at VDDC, the 12 evaporators at No. 5 Seam void will move to the SKS void, bringing the number of evaporators at the SKS void to a total of 20.

Surplus water which cannot be handled through the evaporation system, will be conveyed to a mobile WTP which will be a scalable plant and the treatment capacity will be adjusted to respond to the operational needs, with a maximum treatment capacity of 20 Mℓ/day. At maximum capacity of 20 Mℓ per day, an expected 13 200 m^3 of treated water per day will be discharged into the existing northern canal. A new section of pipeline will be required between the existing 450 mm diameter pipeline and the northern canal. This new section of pipeline will be approximately 700 m in length and will be constructed along the existing haul road. Brine from the WTP will be conveyed to the evaporators on the SKS void. The WTP will be implemented if the evaporator system becomes not economically viable (e.g. excessive electricity cost) or unreliable.

Effluent from the WTP (i.e. treated mine water) will be conveyed via an existing mine water pipeline to the existing northern clean water canal, from where it will discharge via a wetland area into the Olifants River. Water will be treated to comply with Resource Quality Objectives (RQOs) for the Olifants River catchment as published in GN 466 in April 2016.

<u>Mixed ROM coal and slurry stockpile areas</u>

Mine impacted water from the Mixed ROM coal and slurry stockpile areas will be collected and conveyed to the Vleishaft PCD via silt traps.

<u>Overburden dumps</u>

The overburden dump located at the SKS void will drain to the void and no additional measures are foreseen.

Pollution control measures will be required at the Eastern overburden dump (located on the south-eastern boundary) to collect dirty runoff and seepage. Mine impacted water will be conveyed via suitable diversion structures to the dirty water management infrastructure and pumped into the underground via an existing borehole.

Dust Suppression

Dust on haul roads will be controlled using water bowsers. Bowsers will fill up at filling stations that will be located in close proximity to VDDC pit. The use of chemical dust suppressants will also be considered.

Clean water management

Clean runoff water from the area to the east of the VDDC mining area will be diverted away from the mining areas so that it will not become contaminated by the mining operations.

The existing VDDN clean water diversion canal will be diverted around the proposed new topsoil dumps on the eastern boundary of the mining right area.

High wall drains will be installed to divert clean water away from the mining area where practical. These drains will move as mining progresses.

Two 450 mm diameter clean water diversion pipelines will be installed from the existing clean water diversion dam, to the existing northern canal from where water will be discharged via a wetland area into the Olifants River.

Explosives magazine

The existing explosives magazine will be relocated to the north of Pit 4.

New roads

New roads required for the VDDC project include:

- Temporary high wall roads and dragline walkways which will be re-established as mining progresses;
- Earth Moving Equipment (EME) haul roads (40 m width) from the bottom of box cut ramps to the existing haul roads;
- Additional maintenance/service and access roads within the VDDC project area from the existing infrastructure to the box-cut;
- New haul road to the No. 4 seam and No. 5 seam stockpiles.

EME Hard park and Brake Test Ramp

A hard park will be developed between the Vleishaft PCD and the SKS pit. The hard park will include perimeter drains that convey polluted water runoff (primarily polluted with silt) to the SKS void.

A brake test ramp will be provided for EME traffic at the hard park area. The brake test ramp is positioned such that all vehicles will need to traverse the ramp before entering the pit areas. The ramp has been designed to enable the longest expected vehicle entering the mining areas to stop on the inclined sections, with both axles or all wheels. The incline sections are to the steepest recommended grade of these vehicles or to the incline of the ramps to the pits.

In-pit vehicle ramps are of similar construction to the remainder of the haul roads including safety berms.

Access control and security fencing

Access control will be through the existing control measures.

Triple security fencing will be provided at the explosives magazine. Triple fencing includes a triple barrier of 2.4 m high clear mesh, electric and normal security fencing. Electric fencing is connected to the local security system (South32, 2017b).

Other supporting infrastructure

The remainder of the supporting infrastructure is mostly catered for by the existing SKS complex facilities. Existing change houses, stores facilities, office facilities, tracked vehicle workshops, LDV workshops will be used.

No additional fuel or lube storage area, servicing bays or tyre bays are required.

Future coal plant infrastructure area

As indicated earlier, the PSS and LAC dumps are currently reclaimed and processed within the existing Vandyksdrift processing plant. As mining progresses, this plant will need to be relocated. An area has been allocated for this purpose and is situated to the south of the proposed new overburden dump in the south-eastern corner of the VDDC area.

5.2.2.2. Changes to opencast mining

The VDDC mine lay-out as determined through the pre-feasibility investigation, as well as the mine-lay-out included in the approved 2007 EMPR Amendment is shown on **Figure 5-5**. The area where the existing LAC dump is located, as well as a small area further north-east, were not included in the approved 2007 EMPR Amendment, and therefore requires authorisation for opencast mining.

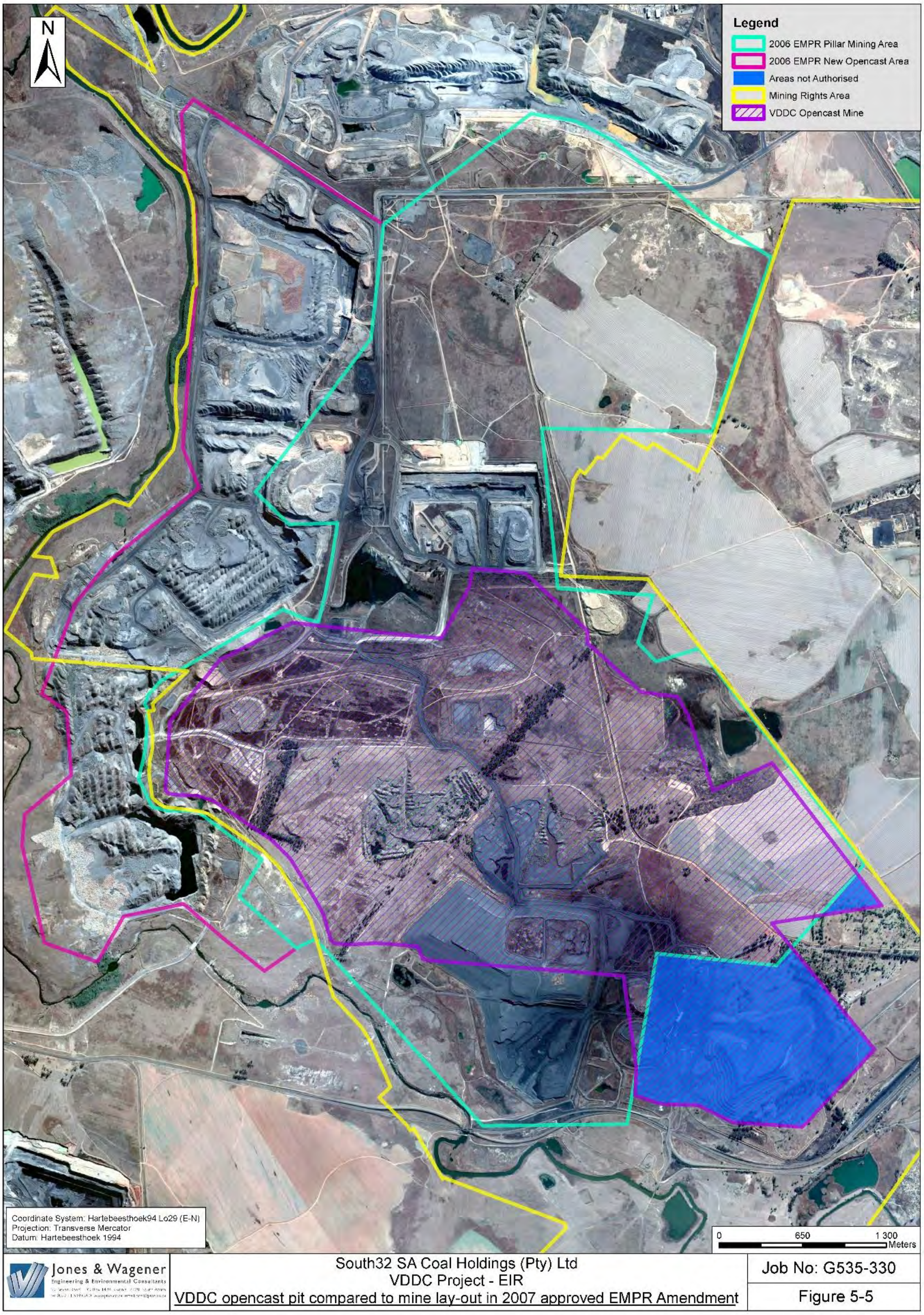

Figure 5-5: **VDDC opencast pit compared to mine lay-out in 2007 approved EMPR Amendment**

5.2.3 Waste management activities

Details of the waste management activities included in the application in terms of NEM:WA (refer to **Table 5-1**) is provided below.

5.2.3.1. Category B, Activity 4(4): The treatment of hazardous waste in excess of 1 ton per day calculated as a monthly average; using any form of treatment excluding the treatment of effluent, wastewater or sewage

The portion of the old No. 2 Seam workings that was historically used for placement of slurry from the processing plant is indicated in **Figure 5-1**. Slurry is a mine residue which comprise of coal fines and water, that is produced as a waste product in a coal preparation plant (Golder Associates, 2018).

The fine coal slurry stored in the underground workings will be in a wet state, due to the historical flooding of the mine. When mining takes place in the areas where slurry has been stored in the old underground workings, the ROM coal and slurry will be mined as a wet mixed material which will be stored temporarily on the Mixed ROM coal and slurry stockpile areas. At these facilities, the mixed material will be allowed to dewater. Approximately 17 000 tonnes of mixed material will be stockpiled per day.

Treatment is defined in the NEM:WA as *"any method, technique or process that is designed to—*

(a) change the physical, biological or chemical character or composition of a waste; or

(b) remove, separate, concentrate or recover a hazardous or toxic component of a waste; or

(c) destroy or reduce the toxicity of a waste".

Changing of the moisture content of the waste is a change in the physical character. This will be done through passive means, i.e. storing of the mixed ROM coal and slurry on the designated stockpile areas to allow water to drain from the material and make the material more manageable for transport. The drier material from the Mixed ROM coal and slurry stockpile areas will be hauled to the existing South Export Processing Plant for processing. Once the material from the Mixed ROM coal and slurry stockpile areas is taken to the processing plant, the dried slurry is no longer regarded as waste since it becomes part of the ROM product that is sent to the processing plant.

Details on the facilities at which the Mixed ROM coal and slurry will be allowed to dewater, are provided in section 5.2.3.2.

Characterisation of slurry from underground workings

A study was undertaken in 2019 by J&W to obtain an understanding of the geochemical characteristics of the slurry stored in the underground workings and is attached in **Appendix 8.13**. The objectives of the study were as follows:

- Conduct a geochemical assessment of the fine coal slurry;
- Conduct a SANS 10234 classification of the fine coal slurry as required in terms of GNR 634;
- Develop a Safety Data Sheet (SDS) for the fine coal slurry based on the SANS 10234 classification results;

- Conduct a waste assessment for stockpile and disposal purposes as required in GNR 635.

Acid Base Accounting

The results from the X-ray diffraction (XRD) analysis of the fine coal showed that the major minerals in the fine coal sample in descending order are kaolinite, quartz, muscovite, microcline, goethite and dolomite. The amorphous (graphite) percentage in the sample was 54.45%. It is noted the XRD results did not indicate any pyrite (FeS) or siderite ($FeCO_3$), which can result in the generation of Acid Mine Drainage (AMD).

Based on the information obtained, the coal slurry has concentrations of arsenic, barium, iron, molybdenum and zinc which are elevated above the average Alloway Crustal Abundance concentrations of the particular elements, which is simply an indication of the average abundance of an element in the earth's crust. By calculating the ratio of the elemental concentrations to the average composition of the earth's crust (Crustal abundances) an indication can be obtained whether the concentration of a particular element is raised above the average crustal abundance due to natural processes.

The coal slurry sample was subjected to Acid Base Accounting (ABA) and Net Acid Generation (NAG) potential testing. Two assessments methods were used, namely the MEND and the AMIRA method (please refer to the report attached in **Appendix 11.2** for details on the methodologies). The results are indicated in **Table 5-2**.

The Neutralising Potential Ratio results of the coal slurry is below one, the Net Acid Producing Potential is positive at NAG pH below 7.0 and the sample is therefore classified as Potentially Acid Generating (PAG) according to both the AMIRA and MEND systems (J&W, 2019c).

Table 5-2: Acid generation potential results of coal slurry from underground workings (J&W, 2019c)

Parameter	VDDC coal slurry
Paste pH	Not determined
Total Sulphur (%)	0.50
Sulphate Sulphur	0.43
Sulphide Sulphur	0.07
AMIRA method	
Acid Potential (AP) (kg/t)	16
Neutralization Potential (NP)	12
Nett Neutralization Potential (NNP)	-3.64
Neutralising Potential Ratio (NP/AP)	0.766
MEND method	
pH 4.5	
NAG pH	6.2
Nett Acid Producing Potential (kg H_2SO_4/t) TS	<0.01
pH 7	

Parameter	VDDC coal slurry
NAG pH	6.2
Nett Acid Producing Potential (kg H_2SO_4/t) TS	0.02
AMD Assessment	
MEND - Based on total Sulphur	Potentially Acid Generating
AMIRA - Based on total Sulphur	Potentially Acid Generating
Overall	Potentially Acid Generating

<u>SANS 10234 Classification in terms of GNR 634</u>

The results from the various analyses were used to classify the coal slurry in terms of SANS 10234.

The slurry is not classified as an explosive, flammable gas, oxidizing gas, gas under pressure, flammable liquid or flammable solid in terms of the physical hazard classification.

The human health hazard classification resulted in the following:

- The slurry is not classified as a skin and eye corrosion and irritation. However, although SANS 10234 does not include a specific hazard class for mechanical irritation, it is noted that dust and grit from the dried-out coal slurry may cause mechanical abrasion, and thus irritation in case of prolonged exposure of the unprotected skin and eyes;
- Based on the presence of quartz in the slurry, the coal slurry is classified as a Category 2 Specific target organ toxicity – repeat exposure (STOT-RE), which may cause damage to the lungs through prolonged or repeated inhalation in the case of dry slurry. The result of repeated exposure is not necessarily silicosis, but suitable respiratory equipment is recommended if dust is generated during use or handling. The applicable SANS Hazard Code is *H373: May cause damage to lungs through prolonged or repeated inhalation*;
- None of the constituents of the slurry are specifically classified as aspiration hazards and it is not classified as corrosive. However, the slurry is muddy and therefore, it was classified as a Category 2 aspiration hazard. The applicable SANS Hazard Code is *H305: May be harmful if swallowed and enters airways*.

It was concluded that the coal slurry is not hazardous to aquatic life, whether during or after short- or long-term exposure in the aquatic environment (J&W, 2019c).

<u>Waste assessment in terms of GNR 635</u>

Based on the analytical results obtained from the distilled water leach and the TC analysis performed on the fine coal slurry, the slurry is assessed as a Type 3 waste, which would required stockpiling and disposal on facilities with a Class C barrier system, provided there are no site specific risks, such as a sensitive groundwater environment, that require a more conservative barrier system.

The Type 3 waste assessment was the result of the LC value of lead (Pb) exceeding its specific LCT0 values, and the TCs of barium (Ba), copper (Cu) and lead (Pb) exceeding their respective TCT0 concentration values.

Note that two of the chemical constituents were not analysed for, namely total chromium VI and total fluoride. Total chromium VI concentration was, however, less than 5 mg/kg in a coal slurry sample from the PSS Dump assessed by J&W in 2014, while the total fluoride concentration was 564 mg/kg. The total fluoride concentration of 564 mg/kg resulted in a Type 3 waste assessment. An assessment of coal slurry from the Discard Processing Plant at the same time confirmed the total chromium VI and total fluoride concentrations (J&W, 2019c).

5.2.3.2. Category B, Activity 4(11): The establishment or reclamation of a residue stockpile[5] or residue deposit[6] resulting from activities which require a mining right, exploration right or production right in terms of the MPRDA

The following residue stockpiles will be established as part of the VDDC infrastructure and mining development:

Dragline spoils dumps

Four dragline spoils dumps will be developed between the ramps for the initial placement of overburden when the boxcut commences.

The stockpile areas will largely be developed on areas which has already been disturbed as a result of the previous mining activities. No specific base preparation will therefore be undertaken for the development of these stockpiles, apart from the removal of topsoil where still present.

Overburden material will be used in the concurrent rehabilitation of the pit as soon as steady state mining is achieved.

Overburden dumps

A new overburden dump will be developed in the south-east of the project area (referred to as the Eastern Overburden dump) and the existing overburden dump at the SKS pit will also be expanded for the stockpiling of overburden material from the VDDC pit.

Upon steady state mining being achieved, rehabilitation activities can commence safely behind the active dynamic window of operations and the in-pit backfilling of overburden can advance. As the mine pit expand, there will be more opportunity to excavate overburden and apply it directly to re-contoured areas, thus avoiding stockpiling. It has been assumed that overburden stockpiling will be during the initial stages of mining and that direct placement will commence when sufficient placement areas are available.

<u>Eastern Overburden Dump</u>

The proposed Eastern Overburden Dump will be developed in mid-2025. Towards mid-2037, the overburden material from this facility will be placed back in the pit and the area will be rehabilitated.

Previous assessments of the overburden at the SKS operation in terms of GNR 635, showed that overburden is a Type 3 waste and therefore a Class C barrier system will be applicable. An assessment was done by Jacana Environmentals and a Class D

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[5] Residue stockpile means any debris, discard, tailings, slimes, screening, slurry, waste rock, foundry sand, beneficiation plant waste, ash or any other product derived from or incidental to a mining operation and which is stockpiled, stored or accumulated for potential re-use, or which is disposed of, by the holder of a mining right, mining permit, production right or an old order tight.

[6] Residue deposit means any residue stockpile remaining at the termination, cancellation or expiry of a prospecting right, mining right, mining permit, exploration right, production right or an old order right.

barrier design was recommended for the Mixed ROM coal and slurry stockpile areas (refer to the Memorandum attached in **Appendix 11.3**). The environmental risk associated with drainage from the spoils is similar to that of a Type 4 waste due to low concentrations of leachable constituents (Jacana, 2019).

Base preparation of the dump will therefore comprise of a Class D barrier system, comprising:

- 300 mm topsoil strip to stockpile.
- Rip and recompact to a depth of 300 mm (or base preparation layer layer).
- Finishing, topsoiling and grassing of constructed embankments and disturbed area (Worley, 2019).

Perimeter pollution control drains will be constructed on all downstream slopes which are designed to retain all runoff and transported silt from the dumps. Runoff from this facility will be diverted to silt traps and then to an existing borehole which will convey water into the underground workings. This will allow the water to be temporarily stored until it can be pumped via the mine dewatering system to the Vleishaft PCD.

Paddock embankments are to be hydroseeded with appropriate mix for season (Worley, 2019).

The total infrastructure development at the Eastern Overburden Dump is approximately 23 ha, of which the proposed dump footprint is 20.8 ha. The facility has available airspace of 5 356 500 m^3 and approximately 48 600 m^3 of overburden will be stockpiled per day.

The lay-out and details of the Eastern Overburden Dump is shown on Drawing C00820-02BA-CI-DRD-0001-001 in **Appendix 11.1**. Details of the polluted stormwater drain are shown on Drawing C00820-05DH-CI-DRD-0002-001 in **Appendix 11.1**.

The design of the silt trap is provided on Drawing C00820-05DI-CI-DGA-0001-001 (lay-out) and Drawing C00820-05DI-CI-DGA-0001-002 (sections) (refer to **Appendix 11.1)**. Water from the silt trap will be conveyed via pipeline to an existing borehole to the No. 2 Seam workings.

<u>Overburden dump on SKS pit</u>

The proposed Overburden Dump on the SKS pit is located to the north west of the VDDC pit, above the existing and partially backfilled SKS pit. The stockpile covers an area of approximately 132 ha. Since it will be located on the backfilled SKS pit, no further base preparation is required other than the dozing of access ways on the dump itself.

The facility has available airspace of 74 752 000 m^3 and approximately 48 600 m^3 of overburden will be stockpiled per day.

Mixed ROM coal and slurry stockpile areas

The Mixed ROM coal and slurry stockpile areas are approximately 8 ha in size and is designed to provide for a maximum of 100 000 t of mixed ROM coal and slurry. Approximately 17 000 tonnes of mixed material will be stockpiled per day.

An assessment of the slurry stored in the underground workings by J&W in 2019 in terms of GNR 635 indicated that the slurry is a Type 3 waste and therefore storage facilities are to be equipped with a Class C barrier system. However, the requirement to conduct a waste assessment for mine residue facilities has been removed from the regulations related to the planning and management of residue stockpiles and replaced with a risk-based approach whereby resource-pathway-receptor modelling can be conducted to determine the barrier requirements for these facilities. An assessment was done by Jacana Environmentals and a Class D barrier design was recommended for the Mixed ROM coal and slurry stockpile areas (refer to the Memorandum attached in **Appendix 11.3**.

Base preparation of the stockpile areas will therefore comprise of the following:

- 300 mm topsoil strip;
- Rip and recompact 200 mm in situ material to 93% MOD AASHTO;
- Fills in 500 mm thick layers from dump rock stockpile, compacted to rock compaction specifications;
- 1 000 mm base layer compacted in 500 mm layers to rock compaction specifications.
- 200 mm wearing course layer of G7 and stabilised with Dust-a-side (Worley, 2019).

The stockpile terraces include concrete lined perimeter drains that convey polluted water runoff to a silt trap and then to the Vleishaft PCD.

The design drawing references of the two Mixed ROM coal and slurry stockpile areas are indicated in **Table 5-3** and attached in **Appendix 11.1**. The design of the silt trap is provided in section **Appendix 11.1**.

Table 5-3: Design drawing references for Mixed ROM Coal and Slurry Stockpile Areas

Facility	Design drawing reference
Primary Mixed ROM coal and slurry stockpile areas (next to the ramps)	C00820-05BC-CI-DAL-0001-001 (Lay-out and details) C00820-05BC-CI-DAL-0002-001 (Drain 1 lay-out and section) C00820-05BC-CI-DAL-0002-002 (Drain 2 lay-out and section)
Secondary Mixed ROM coal and slurry stockpile areas (south of the Vleishaft PCD)	C00820-05BC-CI-DAL-0003-001 (Lay-out and details) C00820-05BC-CI-DAL-0004-001 (Drainage lay-out and section, Sheet 1) C00820-05BC-CI-DAL-0004-002 (Drainage lay-out and section, Sheet 2)

Based on the SANS 10234 classification conducted, the following measures should be implemented at the mixed ROM and coal slurry stockpile areas as specified in the SDS:

- The applicable hazard pictogram and hazard labels must appear at the entrances of the Mixed ROM coal and coal slurry storage areas, as well as transport vehicles. Signage indicating the required personal protective equipment that must be worn, must also be displayed at the entrances.
- The following personal protective equipment must be worn in relation to the fine coal slurry:
    - Protective clothing and eye protection;
    - Protective gloves when handling the coal slurry by hand;
    - Respiratory protection (manufacturer/supplier to specify equipment) in case of repeated exposure to fine coal dust, i.e., employees exposed during working hours on a continuous daily basis;
- In addition, air quality monitoring should be conducted to ensure the required Time Weighted Average Occupation Exposure Limit Recommended Limit (TWA-OEL-RL) of 2.0 mg/m^3 is not exceeded as stipulated in the Occupational Health

and Safety Act’s hazardous chemical substance regulations of August 1995, as amended;

- As coal dust may cause explosions, all electrical equipment used at the Mixed ROM coal and coal slurry storage and processing areas must be earthed, while confined spaces must be well ventilated;
- During firefighting, full body protective clothing and positive pressure, self-contained breathing apparatus with a full-face piece should be worn (J&W, 2019c).

5.2.3.3. Category B, Activity 4(10): The construction of a facility for a waste management activity listed in Category B of this schedule (not in isolation to associated waste management activity)

This activity relates to the construction of mine residue facilities discussed in section 5.2.3.2.

5.2.4 Project phases

The project phases associated with the proposed VDDC infrastructure and mining development project, are described below.

Planning Phase

During the planning phase, the proposed project options are conceptualised. This includes undertaking preliminary/conceptual and detail designs of the proposed infrastructure development, environmental screening, specialist environmental baseline investigations and the application for the required EA and WUL.

Construction Phase of infrastructure components

Once the relevant authorisations have been received, construction activities will commence. This involves the establishment of the facilities and infrastructure as specified in **Table 5-1**. Activities to be undertaken that may impact the baseline environment include general construction activities such as civil works, movement of materials and equipment; and servicing of construction vehicles and equipment.

Rehabilitation of any surrounding areas impacted by the construction of infrastructure components must occur immediately after the construction thereof, except if the area will be opencast mined in future.

Operational Phase

For this project, the operational phase of mining will commence simultaneous to the construction phase of the infrastructure components. Topsoil stripping will be conducted, and topsoil stockpiles will be placed separately for use during rehabilitation. Boxcut spoils dumps will be established, and overburden will be stripped and stockpiled following blasting. Coal will be extracted and transported to the No. 4 and No. 5 seam stockpiles or to the mixed ROM coal and slurry stockpile areas. Mine-affected water will be collected and managed as described in section 5.2.2.1.

The "roll-over" mining method will be used for the opencast operations, whereby mining and rehabilitation will be undertaken concurrently as far as practicable, once steady state is reached[7]. As part of the ongoing mining operations the rehabilitation process will already start with topsoil stripping ahead of the mining operation. After the removal of the coal, the overburden will be levelled, and the topsoil replaced and re-vegetated.

The infrastructure will be commissioned during this phase.

The operational phase ends when the last reserves have been extracted.

Decommissioning Phase

This is the period directly after cessation of operational activities. It includes the removal of all operation-related equipment that has no beneficial re-use potential, as well as reclamation, rehabilitation and/or restoration of any final remaining areas (e.g. backfilling of final ramps and voids, landform shaping, topsoiling and seeding).

Closure Phase

The point in time when all decommissioning and rehabilitation activities have ceased, monitoring has been completed and the mine applies for a closure certificate.

6. POLICY AND LEGISLATIVE CONTEXT

The environmental applications foreseen include:

- Application for Environmental Authorisation through a Scoping and Environmental Impact Reporting (S&EIR) process and the compilation of an Environmental Management Programme (EMPr) in terms of the National Environmental Management Act, 1998 (Act 107 of 1998; NEMA) and its Regulations;
- Waste Management Licence Application (WMLA) in terms of the National Environmental Management: Waste Act, 2008 (Act 59 of 2008; NEM:WA); and
- Integrated Water Use Licence Application (IWULA) in terms of the National Water Act, 1998 (Act 36 of 1998; NWA), including an Integrated Water and Waste Management Plan (IWWMP).

The first two requirements outlined above, will be addressed in an Integrated Environmental Authorisation as allowed for in Section 24L of NEMA and Section 25(3) of GNR 326.

A Phase 1 Heritage Impact Assessment in terms of the National Heritage Resources Act, 1999 (Act 25 of 1999, NHRA) has been undertaken.

Details on the legislation applicable to the proposed infrastructure development, as well as policies and guidelines used, is summarised in **Table 6-1.**

[7] Concurrent rehabilitation will only commence once the mining direction changes

Table 6-1: Applicable legislation

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
(a description of the policy and legislative context within which the development is proposed including an identification of all legislation, policies, plans, guidelines, spatial tools, municipal development planning frameworks and instruments that are applicable to this activity and are to be considered in the assessment process)	(i.e. Where in this document has it been explained how the development complies with and responds to the legislation and policy context)	(E.g. In terms of the National Water Act:-Water Use Licence has/has not been applied for).
LEGISLATION		
National Environmental Management Act, 1998 (Act 107 of 1998)	Entire document	The EIAR is compiled in accordance with the NEMA as well as the Regulations thereunder.
Government Notice Regulation (GNR) 324 to 327 dated 7 April 2017: Environmental Impact Assessment Regulations 2014	11, 12, 17, 18, 19, 20 and 22	The listed and triggered activities that are included in the application are listed in Table 5-1.
GN 891 dated 2014: Guideline on Need and Desirability in terms of the Environmental Impact Assessment (EIA) Regulations, 2010	7	The need and desirability of the project is described in Section 7.
The National Heritage Resources Act, 1999 (Act 25 of 1999)	18, 19, 20.1 and 24	A heritage impact assessment was conducted of the project area and was submitted to the South African Heritage Resources Agency (SAHRA)
National Environmental Management: Air Quality Act (Act 39 of 2004) and amendments	10.1.1.14, 18, 19, and 20.1	An Air Quality Impact Assessment was conducted and is attached in Appendix 8.4.
GNR 827 dated 1 November 2013: National Dust Control Regulations		
GN 1210 dated 24 December 2009: National Ambient Air Quality Standards		
GN 486 dated 29 June 2012: National Ambient Air Quality Standard for Particulate Matter with Aerodynamic Diameter less than 2.5 Micron Metres ($PM_{2.5}$)		
GNR 533 dated 11 July 2014: Regulations Regarding Air Dispersion Modelling		
GN 144 dated 2 March 2012: Highveld Priority Area Air Quality Management Plan		
GNR 283 dated 2 April 2015: National Atmospheric Emission Reporting Regulations		
GN 275 dated 3 April 2017: National Greenhouse Gas Emission Reporting Regulations		

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
National Environmental Management: Biodiversity Act, 2004 (Act 10 of 2004) (NEM:BA)	10.1.1.6, 10.1.1.7, 10.1.1.9, 10.1.1.10, 11, 18, 19, and 20.1	A biodiversity impact assessment was conducted for the project which considered protected areas, as well as species of conservation concern.
National Environmental Management: Protected Areas Act, 2003 (Act 57 of 2003) (NEM:PAA)		
Environment Conservation Act, 1989 (Act 73 of 1989) (ECA)		
National Water Act, 1998 (Act 36 of 1998)	10.1.1.5, 10.1.1.6, 10.1.1.8, 11, 19, 18 and 20.1	An Integrated Water Use Licence Application (IWULA) has been compiled and will be submitted to the Department of Water and Sanitation for the new water uses associated with the proposed infrastructure development.
GNR 704 dated June 1999 in terms of the NWA: Regulations on Use of Water for Mining and Related Activities Aimed at the Protection of Water Resources		The IWULA includes an application for Exemption from the relevant Regulations in GNR 704
GN 466 dated 22 April 2016: Classes and Resource Quality Objectives of Water Resources for the Olifants Catchment	10.1.1.5 and 18	The RQOs for the catchment must be maintained and the treated water discharged from the WTP will comply to these objectives.
National Environmental Management: Waste Act, 2008 (Act 59 of 2008) (NEM:WA) and amendments	5.2.3 18	This application is an application for an integrated environmental authorisation which includes the waste management activities – refer to Table 5-1. The NEM:WA and Regulations thereunder were also considered in the IWWMP
Government Notice (GN) 921 dated 29 November 2013: List of Waste Management Activities that have, or are likely to have a detrimental Effect on the Environment		
GN 926 date 29 November 2013: National Norms and Standards for the Storage of Waste		
GN 332 dated 2 May 2014: Amendment to the List of Waste Management Activities that have, or are likely to have a detrimental Effect on the Environment		
GNR 633 dated 24 July 2015: Amendment to the List of Waste Management Activities that have, or are likely to have a detrimental Effect on the Environment		
GN 242 dated 11 March 2017: Amendment to the List of Waste Management Activities that have, or are likely to have, a detrimental Effect on the Environment		

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
GN 1094 dated 11 October 2017: Amendment to the List of Waste Management Activities that have, or are likely to have, a detrimental Effect on the Environment		
GNR 634 dated 23 August 2013: Waste Classification and Management Regulations		
GNR 635 dated 23 August 2013: National Norms and Standards for the Assessment of Waste for Landfill Disposal		
GNR 636 dated 23 August 2013: National Norms and Standards for Disposal of Waste to landfill		
GNR 632 dated 24 July 2015: Regulations regarding planning & management of residue stockpiles and residue deposits		
GNR 1147 dated 20 November 2015: Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations.	27	The financial provision for the project was calculated and is attached as Appendix 8.12.
GN 1314 dated 26 October 2016: Amendments to the Financial Provision Regulations, 2016		
GNR 452 dated 20 April 2018: Amendment to the Regulations Pertaining to the Financial Provision for Prospecting, Exploration, Mining or Production Operations		
GNR 991 dated 21 September 2018: Amendments to the Financial Provision Regulations, 2015		
Explosives Act 26 of 1956 and its amendments	11, 18, 19 and 20.1	A Blasting Impact Assessment was conducted for the project (refer to Appendix 8.11).
Explosives Regulations of 1972: GNR 1604, as amended.		
Mine Health and Safety Act 29 of 1996 and amendments		
GNR 584 dated 10 July 2015: Regulations Relating to Explosives		
GUIDELINES/POLICIES/STANDARDS/PLANS/TOOLS		
Guideline: National Freshwater Ecosystem Priority Areas (NFEPA)	10.1.1.7	The position of the proposed development in relation to NFEPA system was assessed.
Mpumalanga Biodiversity Sector Plan (MBSP)	10.1.1.10	The position of the proposed development in relation to the priorities set in the MBSP was assessed.

APPLICABLE LEGISLATION AND GUIDELINES USED TO COMPILE THE REPORT	REFERENCE WHERE APPLIED	HOW DOES THIS DEVELOPMENT COMPLY WITH AND RESPOND TO THE POLICY AND LEGISLATIVE CONTEXT
DWA Best Practice Guidelines (BPG), dated 2007	18	The BPGs were considered in developing water and waste management measures.
United States Bureau of Mines Guidelines for safe blasting	11, 18, 19 and 20.1	Refer to the Blasting Impact Assessment attached in Appendix 8.11
South African Water Quality Guidelines Volume 7: Aquatic Ecosystems, dated 1996	10.1.1.7	The current water quality of surface water resources was assessed against these guidelines and standards to describe the current status.
SANS 241-1:2015 Drinking water Part 1 – Microbiological, physical, aesthetic and chemical determinants	10.1.1.4 and 10.1.1.8	
SANS 10103:2008 The measurement and rating of environmental noise with respect to annoyance and to speech communication	18.9	Refer to the noise assessment attached in Appendix 8.2.
IFC General EHS Guidelines on Environmental Noise Management		
eMalahleni Local Municipality Spatial Development Framework, May 2015	7 10.1.1.11	These guidelines were considered in determining the need for the project, as well as assessing the social impact.
eMalahleni Local Municipality Final Integrated Development Plan 2017/18 – 2021/22	7 10.1.1.11	

7. NEED AND DESIRABILITY OF THE PROPOSED ACTIVITIES

Motivate the need and desirability of the proposed development including the need and desirability of the activity in the context of the preferred location.

Wolvekrans Colliery is an existing operational mine which employs 914 people and operates as an export mine. Opencast mining at the VDDC section has been identified as the area that is most likely to replace the operations at SKS and therefore to extend the life of mine and to ensure the fulfilment of the mine's existing export entitlement allocation.

In 2007, opencast mining at VDDC was approved in the amended EMPR. The mine lay-out and the required infrastructure to support the opencast mining has been optimised through a pre-feasibility investigation.

The following are of relevance when considering the impact of the proposed development on ecological integrity and the use of natural resources:

- The proposed infrastructure development is in support of opencast mining approved in 2007. The proposed VDDC opencast mine lay-out has been optimised through a pre-feasibility investigation and an area of approximately 196 hectares has been added to the previous approved opencast mining area;
- Existing infrastructure will be used as far as possible to support the opencast mining. This includes *inter alia* existing haul roads, water management measures (specifically Vleishaft PCD and the mechanical evaporator system established as part of the dewatering strategy) and coal processing facilities;
- Water requirements for the VDDC project will be sourced from the mine's existing allocation and sources. No additional provision is therefore required;
- The location for the proposed infrastructure development is largely within a brownfield site, indicating that disturbance has already taken place in the area;
- In terms of the MBSP, most of the VDDC section is categorised as heavily or moderately modified areas (HMAs) and other natural areas (ONAs);
- The Olifants River is located to the south and the west of the project area and has already been impacted as result of mining and agricultural activities in the area. The VDDC project area overlaps with non-Freshwater Ecosystem Priority Area (FEPA) wetland areas in the northern-, central- and southern portions. The central wetland areas (Vleishaft tributary) were authorised to be mined in 2007;
- The development of the proposed infrastructure, and the opencast mining not previously authorised, is unlikely to significantly alter the ecological integrity from its current state, provided that appropriate mitigation measures are implemented;
- Clean- and dirty water will be separated by means of berms and canals. Clean water will be diverted away from the mining area to prevent it from coming into contact with material with a pollution potential. Mine impacted water will be contained and will be evaporated at the proposed mechanical evaporators to be located on the SKS pit and surplus water will be treated in a modular WTP to an acceptable standard before it is discharged back into the Olifants River via a wetland system;
- The proposed infrastructure includes measures to ensure that the potential pollution sources generated by the opencast mining activities are managed in an environmentally responsible manner:

- o Overburden dumps will be developed for the stockpiling of material before it is used in the progressive rehabilitation of the opencast pit;
- o Slurry that has been disposed of in portions of the old No. 2 Seam underground workings, will be mined out with the remaining pillars and will be placed on mixed ROM coal and slurry stockpile areas before it is processed in the existing coal processing facility;
- o Management of mine-affected water will be done by means of mechanical evaporators and the proposed modular WTP, if required. Mechanical evaporators will be located on an old mining void;
- o Dust suppression will be implemented as per the mine's current dust control programme.

From a social perspective, the following considerations are of relevance:

- The proposed development is within the existing mining right area, with no direct impact on communities, or their dependency on ecosystem services;
- The proposed opencast extension and infrastructure development at VDDC will ensure the life extension of the Wolvekrans Colliery up to 2049. Although it is unlikely that new work opportunities will be available for locals, a temporary increase in work opportunities is anticipated during the construction phase of the project, which will contribute to the local and regional economy. It is therefore not expected that there will be any significant change to employment opportunities;
- The mine's current Environmental Awareness Programme and Health and Safety Programme will continue to ensure that the workers are informed of the risks and dangers associated with their work and the measures that need to be taken to ensure that they are adequately protected;
- Mining is the most prominent employment sector in the eMalahleni Local Municipality (ELM), within which the mine is located, with a contribution of 23% to the employment. The average annual economic growth rate for eMalahleni was at 2.4% over the period 1996 to 2015. The forecasted average annual gross domestic product (GDP) growth for eMalahleni for 2015-2020 is anticipated to be approximately 2% per annum, in line with national and provincial growth expectations. ELM experienced population growth rates higher than their economic growth rates, which has significant negative implications from a GDP per capita and an infrastructure, service delivery, and job creation point of view. Should the VDDC project not continue, authorised opencast mining will not be able to continue, and the coal reserves left in the old underground workings will not be accessible and coal will have to be sourced from elsewhere to meet the contractual requirements. This will result in job losses for the current employees of the mine and will have implications for the local economy;
- Continued operation of Wolvekrans Colliery and the export of coal will contribute to the country's GDP;
- The proposed development is within an existing mining area and therefore there are existing impacts on visual character, sense of place, noise levels;
- The opencast mining not previously authorised, will impact on a graveyard (GY02) containing 13 graves and these graves will have to be relocated before mining commences.

The proposed development is in support of mining that has been approved in 2007 in order to extend the life of mine of the Wolvekrans Colliery and sustain the existing workforce and contractual obligations. It is not expected to significantly alter the ecological integrity of the area since it will be in a brownfield area already impacted by mining and agricultural activities.

8. MOTIVATION FOR THE PREFERRED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE INCLUDING A FULL DESCRIPTION OF THE PROCESS FOLLOWED TO REACH THE PROPOSED DEVELOPMENT FOOTPRINT WITHIN THE APPROVED SITE

NB!! – This section is about the determination of the specific site layout and the location of infrastructure and activities on site, having taken into consideration the issues raised by interested and affected parties, and the consideration of alternatives to the initially proposed site layout

8.1 Details of all alternatives considered

With reference to the site plan provided as Appendix 4 and the location of the individual activities on site, provide details of the alternatives considered with respect to:

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

The proposed infrastructure development is shown on **Figure 5-4** and in **Appendix 5**. The position of the proposed infrastructure is limited in the sense that it is associated with the approved opencast mining at VDDC, as well as with existing infrastructure that will be used.

Alternatives were considered for the management of dirty water and the location of the topsoil stockpiles.

8.1.1.1. Dirty water management alternatives

Initially it was proposed to develop a PCD to the southwest of the existing PSS dump. The proposed dam was in close proximity to the Olifants River, and a section of the dam was located within the 1:100 year floodline. An alternative considered for the location of the PCD include extending the existing Bob Henry dam to accommodate the additional mine-affected water that would be associated with the opencast mining.

Following further investigation and concern regarding the proximity of the PCD to the Olifants River, the PCD initially proposed has been removed from the project lay-out. The dirty water make from the operations will be managed through mechanical evaporators to be located at the SKS void, with surplus water treated in a modular WTP with a treatment capacity of up to 20 Mℓ/day. Treated water from the modular WTP will be discharged back into the Olifants River via a wetland system.

8.1.1.2. Topsoil dump alternative

An alternative location was considered for the development of a topsoil dump, to the south of the existing LAC discard dump. The preferred location for the stockpiling of topsoil is an extension of the existing topsoil dump to the east of the proposed mining and infrastructure development, and has the following advantages:

- All topsoil stockpiled will be located within the same area;
- Lesser transport cost associated with hauling of topsoil to the stockpile, compared to a stockpile located in the far south;
- Not located within the vicinity of a natural watercourse, compared to the alternative in the south, which is located in close vicinity of the Olifants River.

The impact of vehicle movement, potential dust and erosion from the stockpile on the water quality of a watercourse is therefore expected to be less than the alternative option located next to the Olifants River.

The alternative topsoil locations are indicated on **Figure 8-2**.

During further investigations, the need for a topsoil stockpile between the ramps of the mining areas was also identified. This will be required should the existing 132 kV powerline that crosses the proposed topsoil stockpile area not be relocated before stockpiling of topsoil needs to take place (the application for authorisation for the relocation falls outside of the scope of this application).

8.1.2 The type of activity to be undertaken

Opencast mining has already been approved in the 2007 through the amendment of the EMPR. The 2007 approved EMPR, however, included limited additional infrastructure in support of the opencast mining operations as it was assumed at that stage that existing infrastructure will largely be used. Following a pre-feasibility investigation, the need for additional infrastructure was identified in conjunction with using existing infrastructure on the brownfield development. The proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation also differs from the mining area approved in the 2007 EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be opencast mined.

8.1.3 The design or layout of the activity

The layout and design of the proposed infrastructure development is limited in terms of its necessity to be in close proximity to the opencast mining approved in 2007. The changes made to the project lay-out since the project commenced are as follows:

- An additional topsoil stockpile between the ramps;
- The areas earmarked as “slurry paddocks” and “Run-of-Mine (ROM) stockpile” in the initial lay-out were retained, but both will be “Mixed ROM coal and slurry stockpile areas”. This is due to the fact that the mine will not be able to separate the ROM coal and slurry when mining takes place in the area that has been historically used for the disposal of slurry in the underground workings. The mixed material will rather be stockpiled on these areas and after it has been dewatered sufficiently, it will be transported to the processing plant;
- The final reject dump has been removed from the lay-out plan since it is a continuation of the existing authorised PSS dump that is used in the reclamation of the existing discard dumps. No material from the VDDC mining project will be disposed of in this area;
- Provision has been made for a modular WTP to the west, for the treatment of surplus mine water make which cannot be managed at the proposed evaporation sites, should it be required. Discharge of treated water will take place via a pipeline to the existing northern canal. A new section of pipeline will be required between the existing 450 mm diameter pipeline and the northern canal. This new section of pipeline will be approximately 700 m in length and will be constructed along the existing haul road. From the northern canal, water will be discharged via a wetland area to the Olifants River;

- The laydown area to the north of the project area, as well as the laydown area at the existing ROM stockpile as indicated in the initial layout plan are no longer required and have therefore been removed from the layout;
- The proposed PCD which was located in the south of the project area has been excluded;
- Exclusion of a second overburden dump in the south-east of the mining right area). This area has now been earmarked for the future development of a coal plant;
- No changes to the SKS workshop area will be required – thus the facilities will remain as is;
- Slight changes have been made to the lay-out of the Mixed ROM coal and slurry stockpile areas, SKS overburden dump, as well as topsoil areas;
- Addition of the No. 4 Seam and No. 5 Seam stockpile areas. This will be on areas that are currently used for stockpiling of discard;
- More details on haul and service roads proposed;
- Relocation of the explosives magazine to the north (at Pit 4).

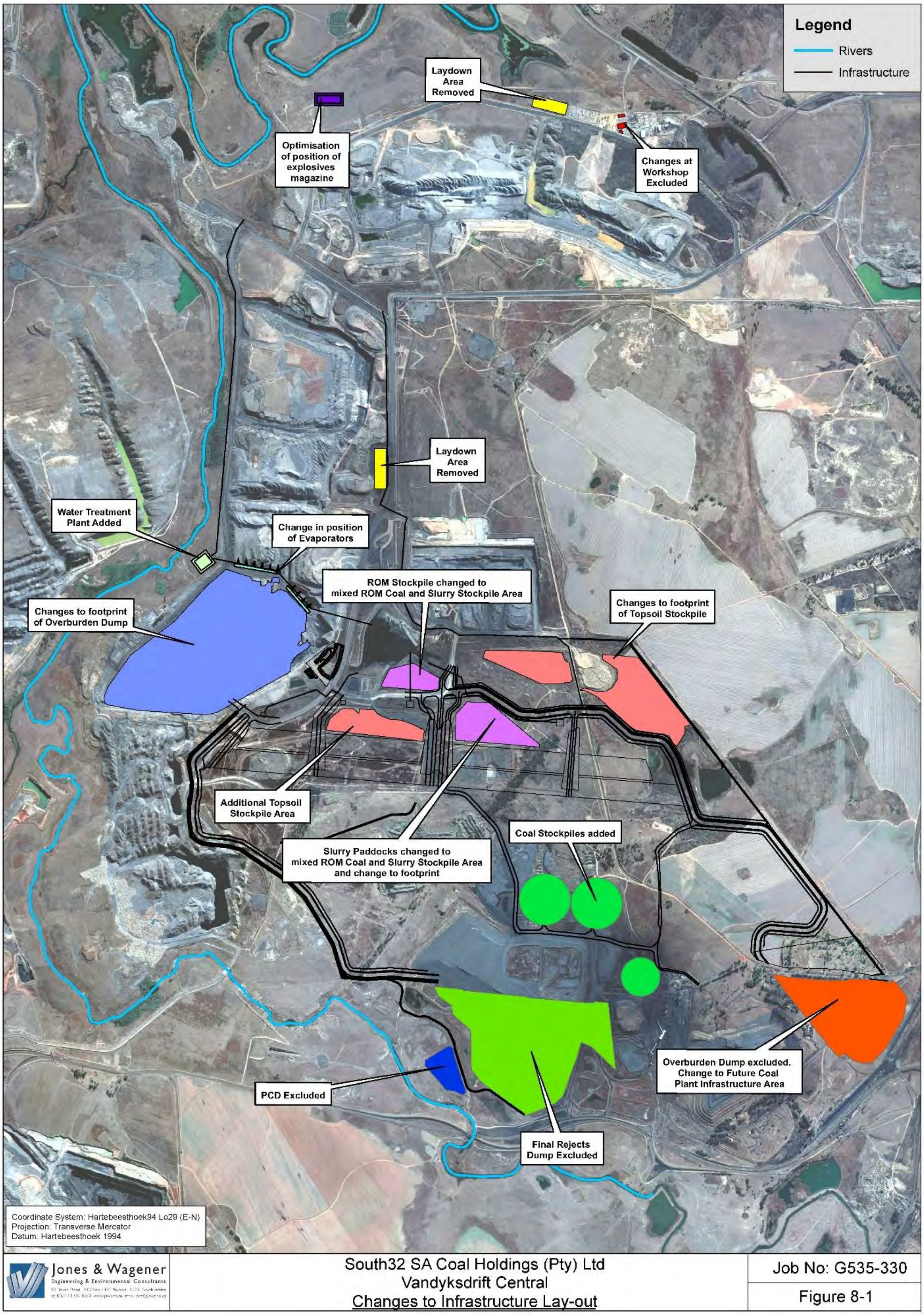


Figure 8-1: Changes to infrastructure lay-out from the initial site lay-out

8.1.4 The technology to be used in the activity

Technology alternatives considered that are as follows:

- The management of the mine water make will be done through mechanical evaporators. In addition, provision has been made for a proposed modular WTP for the treatment of surplus water, should it be required;
- Slurry stored in the underground workings will be mined with the ROM coal, and the mixed material will be allowed to dewater before it is transported to the existing SKS tip and processing at the existing South Plant. Although the initial project description considered the re-sale of dewatered slurry as an alternative option for the management of the slurry, this option is not feasible since the slurry cannot be pumped from the underground workings but will be mined with the ROM coal as a mixed material.

8.1.5 The operational aspects of the activity

The proposed infrastructure will be in use until the LoM is reached in 2049. The technological alternatives which will be applicable during operations are discussed above in section 8.1.4.

8.1.6 The option of not implementing the activity

Following a pre-feasibility investigation, it was identified that additional infrastructure is required to proceed with opencast mining. The alternative to not proceed with the proposed infrastructure development implies that opencast mining would not take place at VDDC. This will have a detrimental effect on the LoM of Wolvekrans Colliery, since mining of the VDDC area forms part of the LoM asset of the mine and mineral resources will be lost. The mine's contractual obligations will not be met, and more than 900 employees will lose their income. This will also have implications for the local economy, as well as the national economy due to loss of revenue.

If the project is not implemented, the land use will remain as is, i.e. mining until such time the area is rehabilitated to achieve the final land use status.

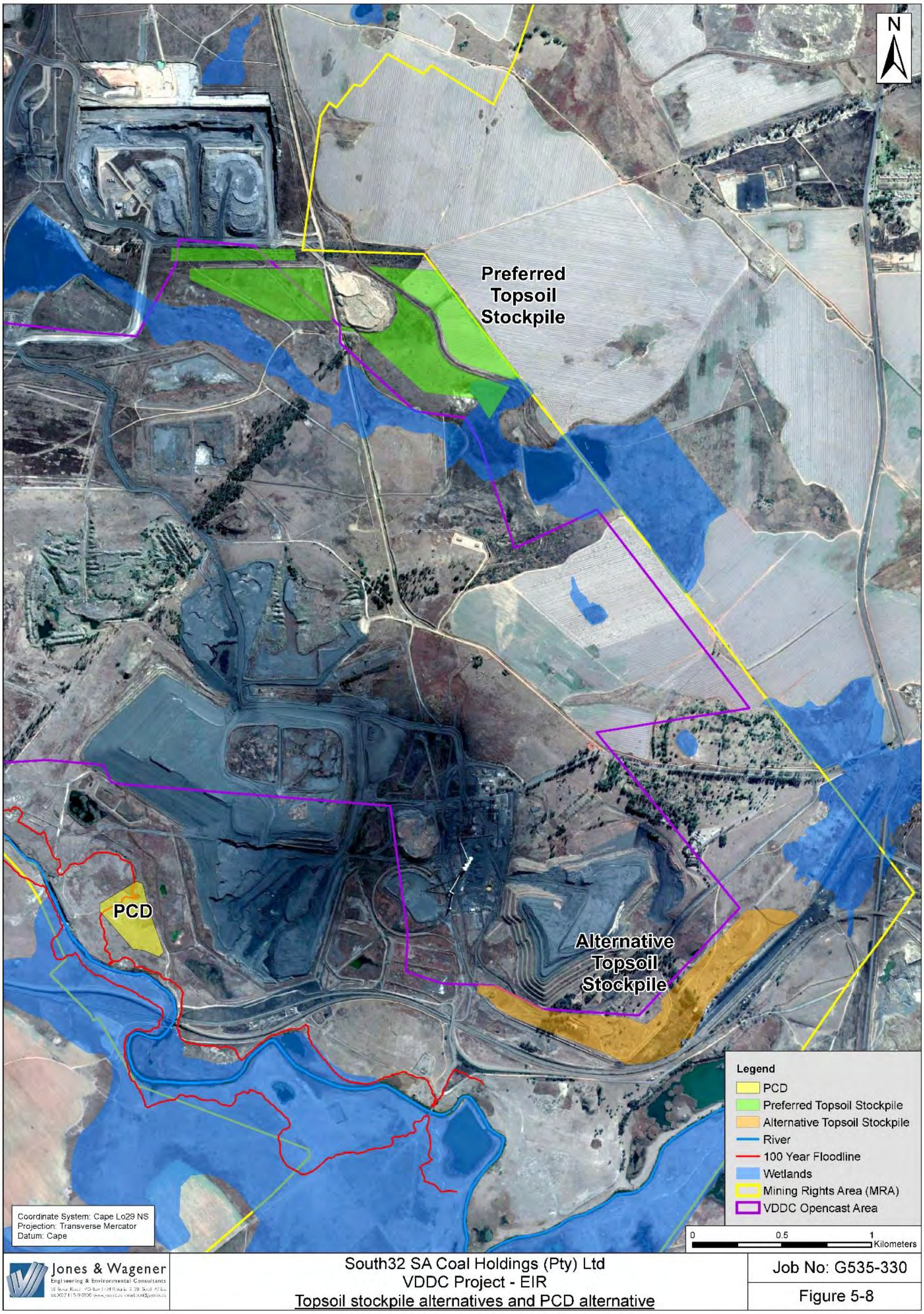


Figure 8-2: Alternative location of topsoil dump

9. DETAILS OF THE PUBLIC PARTICIPATION PROCESS FOLLOWED

Describe the process undertaken to consult interested and affected parties including public meetings and one on one consultation. NB the affected parties must be specifically consulted regardless of whether or not they attended public meetings. (Information to be provided to affected parties must include sufficient detail of the intended operation to enable them to assess what impact the activities will have on them or on the use of their land.

9.1 Public participation process followed

The public participation process is outlined below. Refer to **Appendix 7** for more details on the public participation process, including copies of the public participation documents (BID, site notices and advertisements) as well as proof of delivery.

9.1.1 Announcement of the project and notification of availability of CSR for Public Review

The existing stakeholder database used by the mine was reviewed and updated and maintained throughout the project. The identification of stakeholders and community representatives is important and has been done in collaboration with South32, the local municipality and other organisations in and around the study area. All comments and contributions from stakeholders are recorded and kept for the duration of the project and submitted together with the final reports to the DMR and the DWS (refer to **Appendix 7** for copies of the comments received).

Stakeholders captured on the database for the project include the following:

- The owners or persons in control of the land where the proposed mining is to be undertaken (if different than applicant);
- The occupiers of the property where the development is to be undertaken;
- The owners and occupiers of land adjacent to the mining area;
- Provincial and local government (relevant local and district municipalities);
- Organs of state, other than the authorising authority, such as the Department of Agriculture, Forestry and Fisheries (DAFF) or Department of Roads, having jurisdiction in respect of any aspect of the proposed project;
- Relevant residents' associations, rates payers' organisations, community-based organisations and NGOs;
- Environmental and water bodies, forums, groups and associations; and
- Private sector (business, industries) in the vicinity.

The project and the availability of the CSR was announced to the public by means of the following:

- Advertisements in the Witbank News newspaper on 5 October 2018;
- Distribution of Background Information Documents from 4 October 2018;
- Placement of site notices on and around the site;
- Telephonic notification to key stakeholders and landowners;
- Notification to landowners via registered mail; and
- Loading of notification documents on the J&W website.

The I&APs comments on the CSR have been captured in a Comments and Response Report (CRR).

9.1.2 Notification of availability of Revised CSR

The changes to the project and the availability of the Revised CSR was announced by means of the following:

- Distribution of notification to all I&APs registered on the stakeholder database on 2 August 2019;
- Advertisement in the Witbank News newspaper on 2 August 2019;
- Loading of notification documents on the J&W website.

The Revised CSR was made available for public review from 7 August to 9 September 2019. Proof of the delivery of the documents are provided in **Appendix 7**.

No comments were received on the Revised CSR and the CRR therefore remained unchanged.

9.1.3 Notification of availability of Final Scoping Report

Once the Final Scoping Report was compiled, it was made available to the public. This was done by means of:

- Emails to all I&APs registered on the stakeholder database; and
- Uploading the report on the J&W website.

Notifications regarding the availability of the Final Scoping Report was sent to registered I&APs on 27 September 2019 and the request made that any further comment be sent to the DMR directly, with a copy to the Public Participation office.

9.1.4 Public Review of Consultation Environmental Impact Assessment Report (EIAR) and Consultation Environmental Management Programme (CEMPr), as well as Draft IWULA and IWWMP

The Consultation EIAR/EMPr (which incorporates the waste management licence application), as well as the Draft IWULA and IWWMP will be made available for public comment by following the same procedure as for the Revised CSR:

- Distribution of notification to all I&APs registered on the stakeholder database;
- Advertisement in the Witbank News newspaper;
- Loading of notification documents on the J&W website.

The CEIAR and CEMPr will be available for public review from 2 December 2019 to 23 January 2020. The Draft IWULA and Draft IWWMP will be made available for an extended period, from 2 December 2019 to 24 February 2020.

9.1.5 Notification of availability of Final EIAR/EMPr

Once the Final EIAR/EMPr has been compiled, it will be made available to the public at the same time that it is submitted to the DMR for approval. This will be done by means of:

- Emails will be sent to all I&APs registered on the stakeholder database; and
- The report will be loaded on the J&W website.

9.1.6 Announcement of the authority's decision

Once a decision is reached by the Competent Authorities, I&APs will be notified of the decision and the appeal process to be followed.

9.2 Summary of issues raised by I&APs

(Complete the table summarising comments and issues raised, and reaction to those responses)

The list of I&APs consulted to date, and the issues raised, is provided in **Table 9-1**.

Table 9-1: Summary of issues and responses

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
AFFECTED PARTIES					
Landowner/s					
Ingwe Surface Holdings (Pty) Ltd	X				
Anglo Operations Pty Ltd	X	07/11/2018	Can you please confirm all activities and infrastructure that will occur, and be established, on Portions 9 and 14 of Kleinkopje 15 IS, as it is not clear from the maps, having to compare the detailed infrastructure map with the farm portions map.	Based on the final site layout, the infrastructure on Portions 9 and 14 of Kleinkopje 15 IS involves the following (refer to Figure 9-1): • The clean water diversion pipeline from Attenuation Dam 1 to the Northern Canal traverses the properties. In this area, the pipeline will be located along the existing haul road; • The existing pipeline which will be used for the conveyance of treated water from the modular WTP to the Northern Canal will traverse these properties. In terms of the initial site layout as presented in the CSR, the following would have been located on the mentioned properties, but are no longer applicable due to the change in layout as described in the Revised CSR: • A portion of the pipeline for the conveyance of mine impacted water from the Vleishaft PCD to the mechanical evaporator, will traverse the properties. • Mechanical evaporation of mine impacted	Figure 9-1

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
				water collected from the VDDC mining area, on the existing Steenkoolspruit pit, which will be backfilled with spoils.	
Lawful occupier/s of the land					
Landowners or lawful occupiers on adjacent properties					
Valco Boerdery	X				
Municipal councillor					
Municipality					
Nkangala District Municipality	X				
eMalahleni Local Municipality	X	26/10/2018	The Manager: Environmental Management and Compliance of Emalahleni Local Municipality registered as an interested and affected party and noted that comments will be provided during the impact assessment phase.	Mr Nkabinde was registered as an Interested and Affected Party. No further comments have been received to date.	Not applicable
Organs of state (Responsible for infrastructure that may be affected by Roads Department, Eskom, Telkom, DWS etc)					
Eskom	X	05/10/2018	Eskom noted that it is likely that their Dx Infrastructure is affected by the proposed project.	The infrastructure referred to by Eskom will be affected and South32 has entered into a self-build agreement with Eskom regarding the deviation of the powerline.	Section 5.2.2.1 Appendix 12

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
		08/10/2018	On which property is the proposed development as we would like to verify on our system if Eskom services are really affected.	The portion of the existing powerline that will be affected by the VDDC opencast mining is located on RE/3 of Vandyksdrift 19 IS. The preferred option for the realigned powerline is located on RE/3, Ptn 5 and Ptn 7 of Vandyksdrift 19 IS.	Section 4.3
Communities					
Dept. Land Affairs					
Traditional Leaders					
Dept. Environmental Affairs					
Mpumalanga Department of Agriculture, rural Development, Land and Environmental Affairs (MDARDLEA)	X				
Other Competent Authorities affected					
Mpumalanga Department of Public Works, Roads and Transport (PWRT)	X				
Department of Agriculture Forestry and Fisheries (DAFF) Directorate: Land Use and Soil Management	X	05/10/2018	The Department of Agriculture, Forestry and Fisheries registered as an interested and affected party and noted that they will comment at a later stage.	The Department of Agriculture, Forestry and Fisheries was registered as an Interested and Affected Party and will receive all correspondence with regards to the application.	Not applicable.

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
		06/02/2019	The applicant is advised to consider / address the following:	.	
			a) Compliance with the Conservation of Agricultural Resources Act, 1983 (Act 43 of 1983)	The largest portion of the area where the new infrastructure will be developed, will be mined out in future in terms of the mining approved in 2007. The rehabilitation plan for the mining area is attached in Appendix 10. The final land use is grazing. Measures to protect soils during the various phases have been proposed. Stormwater management to prevent water logging of soils have been proposed. The implementation of an invasive alien vegetation control programme has been recommended.	Sections 10.1.1.4 Table 18-6 to Table 18-8 Appendix 10
			b) A detailed rehabilitation plan on sensitive areas to be implemented during and after completion of the project	The largest portion of the area where the new infrastructure will be developed, will be mined out in future in terms of the mining approved in 2007. The rehabilitation plan for the mining area is attached in Appendix 10. The final land use is grazing.	Appendix 10
			c) Mitigation measures to be applied in order to minimise the negative impact	Mitigation measures have been compiled according to the specialist assessment of Soil, Land Use and Land Capability specialist report attached in Appendix 8.1.	Table 18-6 to Table 18-8 Appendix 8.1.
			d) Consider soils / lands with low to poor potential for the project	Opencast mining was approved in 2007 when the Douglas Colliery EMPR was amended. This amended 2007 EMPR included limited additional infrastructure in support of the opencast mining operations. The	10.1.1.4 8.1.3 18.1

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
				current application is for infrastructure associated with the mining approved in 2007, as well as changes to the mine lay-out. Alternative project locality is therefore limited to the previously approved mining area, since the proposed activities are directly linked with the approved opencast mining.	
			e) Conduct a detailed soil study of the proposed site	A detailed soil assessment was undertaken by J&W.	10.1.1.4 18.1 Appendix 8.1.
Department of Water and Sanitation (DWS)	X				
Department of Environmental Affairs (DEA)	X				
South African Heritage Resources Agency (SAHRA)	X	09/04/2019	SAHRA Archaeology, Palaeontology and Meteorites (APM) Unit requires a field-based assessment of palaeontological resources. The assessment must be undertaken by a suitably qualified palaeontologist who will undertake the Palaeontological Impact Assessment (PIA), as the development is underlain by very highly sensitive fossiliferous rocks that will be impacted by the proposed development. The PIA must contain a fossil finds procedure a monitoring programme for the long-term management of fossils that may be uncovered from mining activities.	The PIA was undertaken by Prof. Marion Bamford and is attached in Appendix 8.5. The PIA included a recommendation for a Chance-Find Protocol and this has been included in the EMPr, (refer to Part B).	Appendix 8.5. Part B: EMPr

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
			The buffer zone of the cemeteries in the HIA must be amended to allow for 100m. The PCD footprint must be amended to allow for the safe retention of the cemetery labelled GY01. A buffer zone of 100m around the perimeter of the cemetery must be maintained at all times, the cemetery must be fenced with an access gate. Social consultation must be undertaken to find the relatives of the graves in the cemetery, and to obtain permission for the fencing of the graves. These conditions must be included in the EMPr. SAHRA will comment further once the PIA is submitted to the case along with the EIA report and its appendices.	The PCD which would have been in close proximity to GY01 will no longer be constructed. None of the proposed infrastructure in the final layout will be in close proximity to GY01. However, the recommended bufferzone of 100 m is included, as well as the other recommendations by SAHRA GY02 will be destroyed by the proposed opencast mining which has not been authorised previously, and it has been recommended that this graveyard be relocated before mining commences in the area.	Section 8.1 Section 18 Part B: EMPr
Mpumalanga Tourism and Parks Agency (MTPA)	X	04/10/2018	The Mpumalanga Tourism and Parks Agency (MTPA) would like a hard copy of the Consultation Scoping Report.	A hard copy of the document was delivered to the office of the MTPA in Nelspruit.	Not applicable
		26/10/2018	The MTPA has no objection to the amended mining right but is concerned about the following conservation important species that has survived on the degraded areas. The Critically Endangered ground orchid – the Albertina Sisulu *Brachycorythis conica subs transvaalensis* was recently recorded on site and *Frithia humilus*. An unpublished report which was done by Glencore that emphasizes the importance of the conservation of this ground orchid species was included.	Note that the application does not include an application for an amendment to the mining right but is limited to the proposed infrastructure development and changes to the opencast mining area as approved previously. The biodiversity specialist assessed the information provided by the MTPA and also considered the findings of the field work undertaken as part of the investigation. These species were not recorded by the specialist during the dual season survey. However,	Sections 10.1.1.9 & 18

Interested and Affected Parties List the names of persons consulted in this column, and mark with an X where those who must be consulted were in fact consulted.		Date Comments Received	Issues raised	EAPs response to issues as mandated by the applicant	Section and paragraph reference in this report where the issues and or response were incorporated
			The MTPA requires that a thorough plant study in the growing season of this area is done. The plant study will inform authorities of which habitat needs to be conserved. Mitigation methods of possible subsidence and trampling are required.	there is a high confidence that the habitat identified as Moist Grassland and Wetlands is the only viable habitat left that these species may occur in. The habitat that these two species prefer was not observed or is still existing in any other habitat than Moist Grassland and Wetlands.	
OTHER AFFECTED PARTIES					
INTERESTED PARTIES					
Umcebowethu Supplies (Pty) Ltd	X	06/10/2018	Umcebowethu Supplies registered as an interested and affected party and requested an electronic copy of the Consultation Scoping Report.	Mr Sikhosana was registered as an Interested and Affected Party and an email was sent to him with a direct link to the website where the report was published.	Not applicable.
Mpumalanga AgriSA	X				
Mpumalanga Landbou/Agriculture Union	X				
Transvaal Agricultural Union of SA	X				
Wildlife and Environmental Society of SA (WESSA)	X				
Olifants River Forum	X				
National Union of Mine Workers	X				
ITT Water and Wastewater	X				

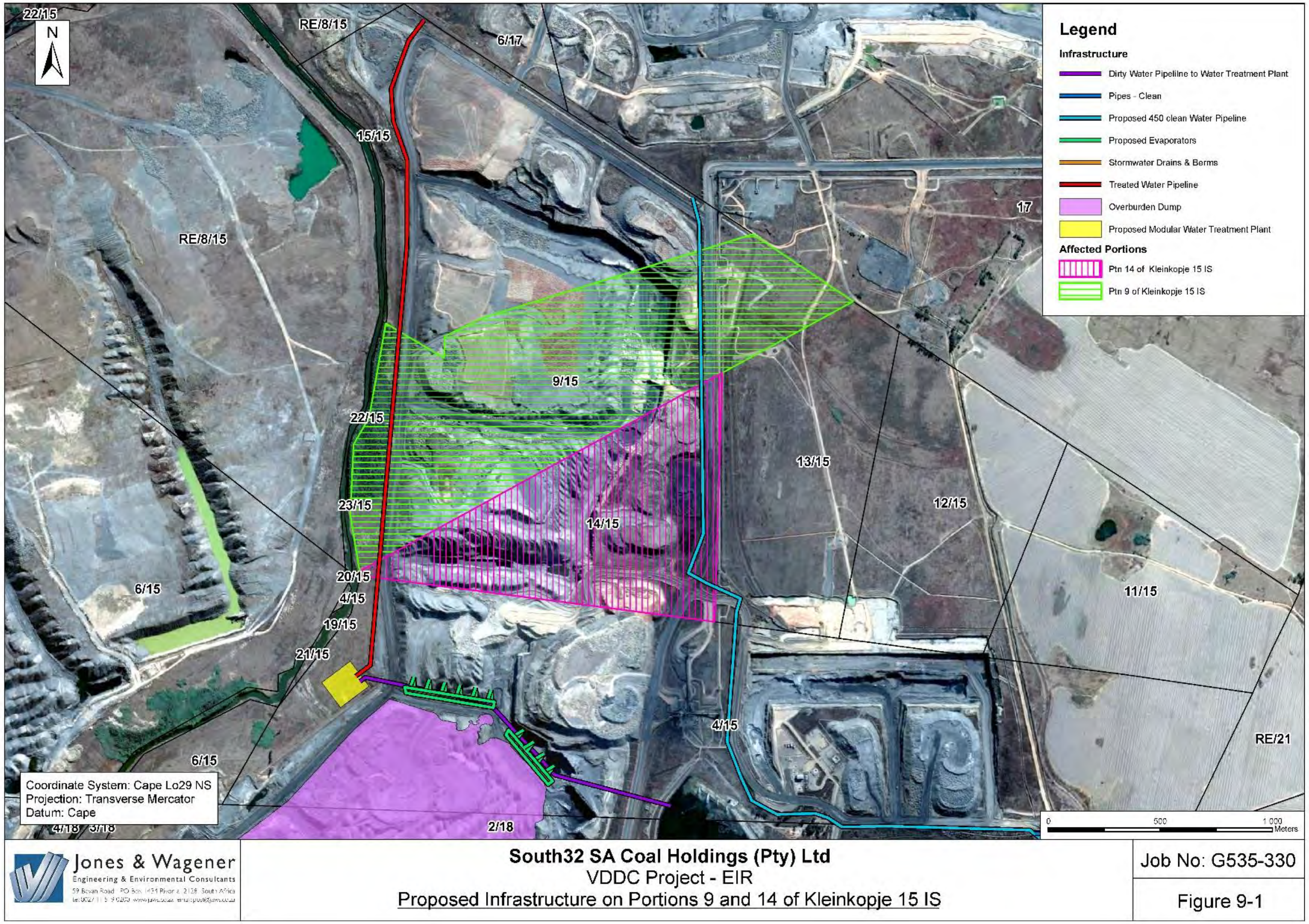


Figure 9-1: Proposed infrastructure on Portions 9 and 14 of Kleinkopje 15 IS

10. ENVIRONMENTAL ATTRIBUTES ASSOCIATED WITH THE DEVELOPMENT FOOTPRINT ALTERNATIVES

(The environmental attributes described must include socio-economic, social, heritage, cultural, geographical, physical and biological aspects)

10.1 Baseline Environment

10.1.1 Type of environment affected by the proposed activity

(Its current geographical, physical, biological, socio- economic, and cultural character)

10.1.1.1. Topography and drainage

The VDDC section is largely a brownfields area where the natural topography has been dramatically disturbed by mining related activities. The greater study area is characterised by a flat, slightly undulating topography at an elevation of between 1 625 and 1 505 metre above mean sea level (mamsl). The study area tends to slope from east to west at an angle of between 1% and 2%.

The proposed infrastructure and mining development project is situated within quaternary sub-catchment B11F, B11G and B11B of the Limpopo-Olifants primary drainage region.

The main river systems are indicated on **Figure 10-1**. The Olifants River is located to the south of the VDDC project area and further to the west, adjacent to the SKS section. Drainage is in the direction of the river systems. Prior to mining, the northern portion drained via the Vleishaft tributary to the Olifants River. This tributary has been partially mined through and the Vleishaft PCD that has been developed within the watercourse, currently serves as a PCD. Authorisation was granted in 2007 to mine the remainder of this tributary.

Downstream of the mine, the river flows to the Witbank Dam, then to the Loskop Dam and through the central part of the Kruger National Park to Mozambique. It joins the Limpopo River and discharges into the Indian Ocean on the east African coastline.

10.1.1.2. Climate

The VDDC project is in the Mpumalanga Highveld region where the climate is characterised as generally dry. Frost and mist are frequently experienced during the winter months on the Mpumalanga Highveld.

Temperature and evaporation

Summers are warm to hot with an average daily high temperature of approximately 27°C (with occasional extremes up to 35°C). Winters range from mild to cold with an average daily high of approximately 15°C (with occasional extreme minima as low as -10°C).

The annual evaporation rates range between 1 211 mm to 1 879 mm with a mean annual evaporation (MAE) of 1 476 mm. Average monthly evaporation rates range between 65 mm (June) to 164 mm (January and December) (J&W, 2019b).

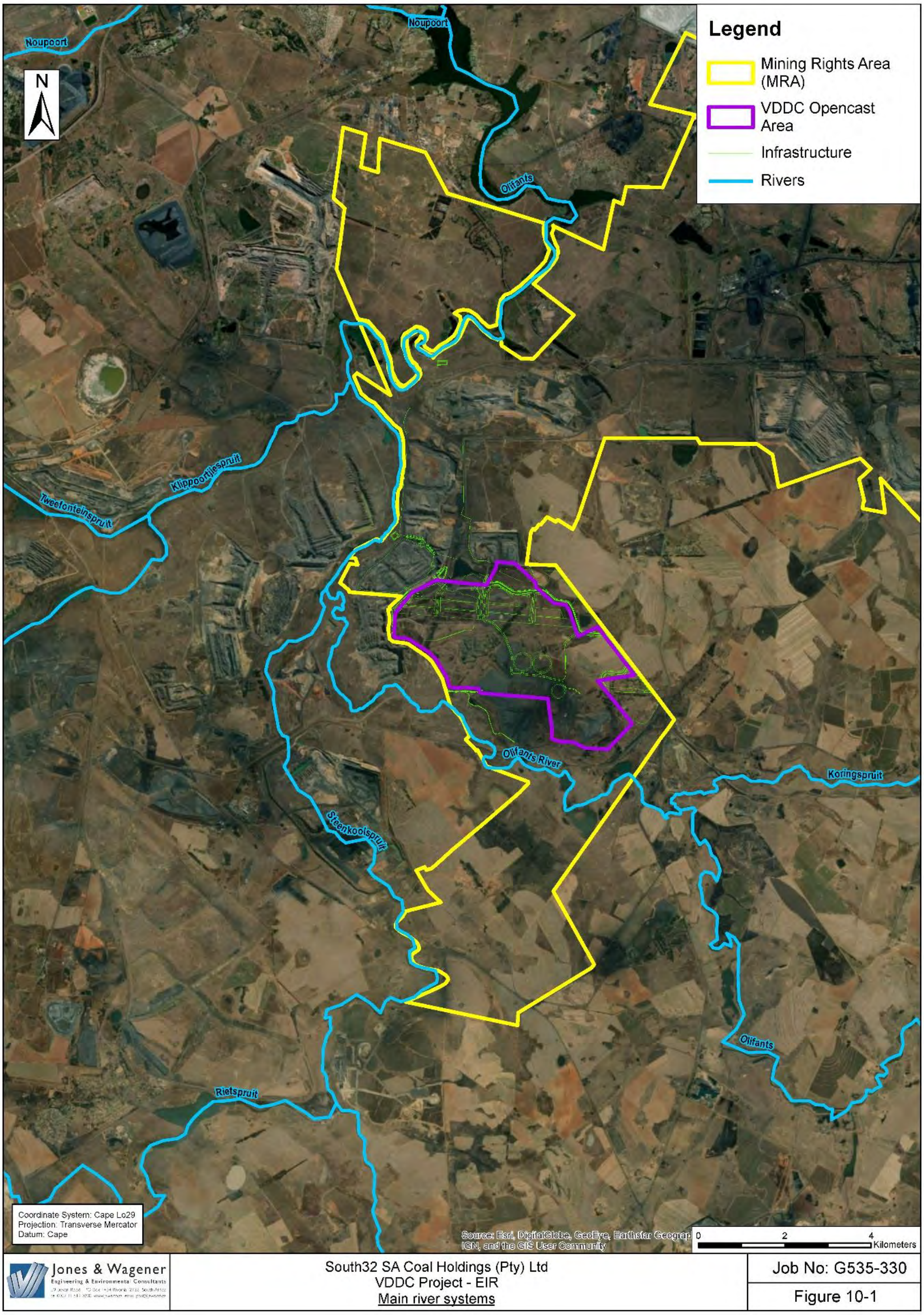


Figure 10-1: **Main river systems**

Precipitation

The average rainfall per year at the Vandyksdrift rainfall station (0478546 W) varies between 988 mm and 368mm, with the mean annual precipitation (MAP) being 705 mm. The higher rainfall months occur from October to March (summer) (J&W, 2019b).

Wind

The co-dominant wind directions, during the five-year period (2012 to 2017) under investigation, were east and north with a combined frequency of occurrence of approximately 26%. Winds from the south-south-east occurred for almost 8% of the period. Relatively infrequently winds occur from the northeast and southwest. Calm conditions (wind speeds <1 m/s) occur 8.9% of the time. Calm wind conditions (i.e. wind speeds <1 m/s) varied between 4.2% (2017) and 12.1% (2013).

Seasonal wind directions are illustrated in **Figure 10-2**. During summer months, winds from the east became more frequent; nearly 20%. The predominant wind directions in spring were from the north (20%) and east (13%). There is an increase in the frequency of calm periods during the autumn (12%) and winter months (12%). During springtime, winds are more likely to exceed 6.0 m/s, with calm conditions only 4.6% of the time (Airshed, 2019).

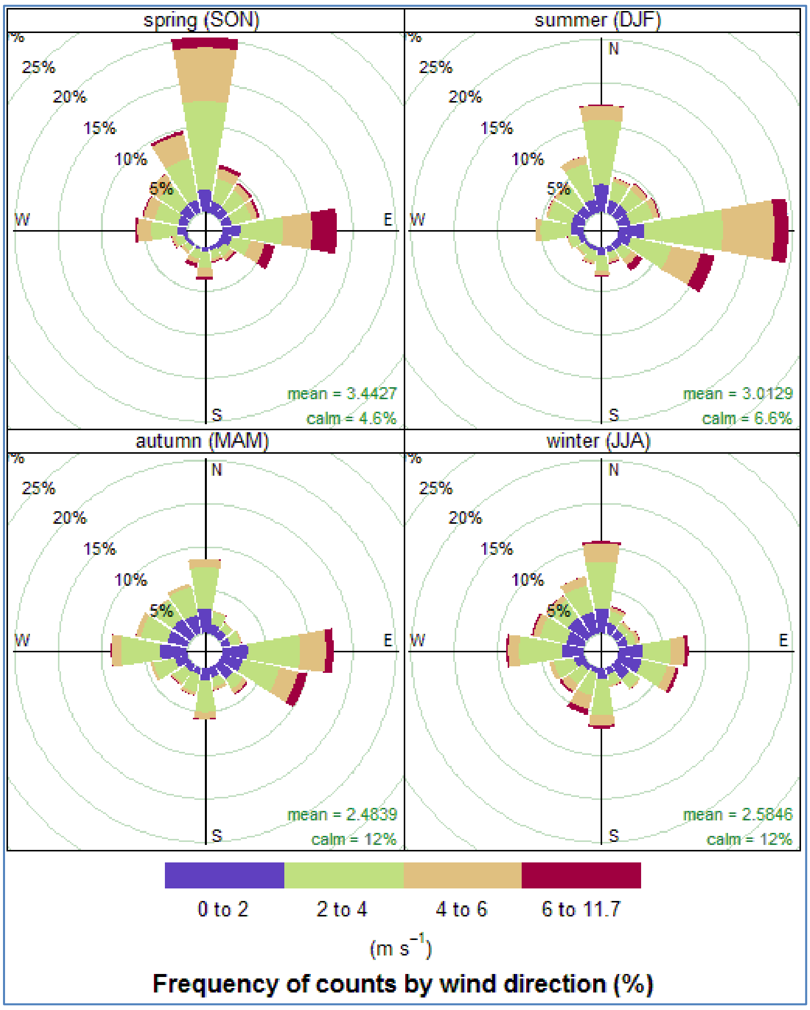


Figure 10-2: **Seasonal wind roses for eMalahleni SAWS data from 2012 – 2017 (Airshed, 2019a)**

10.1.1.3. Geology

Regional geology

The VDDC project area is situated in the Great Karoo Basin in South Africa, consisting of the Karoo Supergroup. Geologically, the Karoo Supergroup is the largest stratigraphic unit in southern Africa covering almost two thirds of the land surface. The basin hosts all the South African coal deposits and was formed in the great Gondwana basin which comprised parts of Southern Africa, India, Antarctica, Australia and South America.

The Karoo Supergroup comprises a sedimentary succession of sandstones, siltstones, shales and coal stratigraphic units. These stratigraphic units (from oldest to youngest) consist of the following:

- Dwyka Group – glacial marine deposit (comprising of diamictites and tillites) in the Carboniferous period;
- Ecca Group – fluvial deposition in the Permian period;
- Beaufort Group (terrestrial); and
- Stormberg Group (including basalts).

The majority of the coal deposits in South Africa are contained in the Vryheid Formation (part of the Ecca Group) of the main basin and are restricted to the north eastern area of terrestrial deposition on a gently subsiding shelf platform. The strata, mostly shale, sandstone and coal seams, formed in fluvial environments (J&W, 2019a). A 1:250 000 regional geological map indicating the location of the project area is shown in **Figure 10-3**.

Local geology

Locally, the study area falls within the Witbank Coalfield, which consists of sedimentary rocks of the coal-bearing Vryheid Formation of the Ecca Group. The Karoo sediments are underlain by diamictites and tillites of the Dwyka formation that form the basement of the Karoo Supergroup. Dolerite intrusions are common throughout the Karoo formation, the most significant in the study area being the Ogies Dyke which is a near vertical, west-east striking dyke situated to the north of the study area. Based on literature, this dyke is approximately 15 m thick. Coal on either side of the dyke has been devolitised.

There are five coal seams which underlie the weathered Karoo rocks in the study area, namely the No.1 to No.5 coal seams. The No.2 coal seam is the most prominent of the five coal seams and has widely been mined using bord-and-pillar methods. The interburden between the coal seams consist mainly of sandstones and mudstones with carbonaceous shale being present closer to the coal seams. The No.1 seam is also well developed in the study area.

The No.5 coal seam has largely been removed by weathering and is mostly present in the topographically higher eastern sections of the mining area. The No.4 seam is split into different upper and lower bands of which only the No.4 L is of economic importance. The No.3 seam, although of high quality, is thin and very irregular (J&W, 2019a). **Figure 10-4** illustrates the geological cross section of the study area.

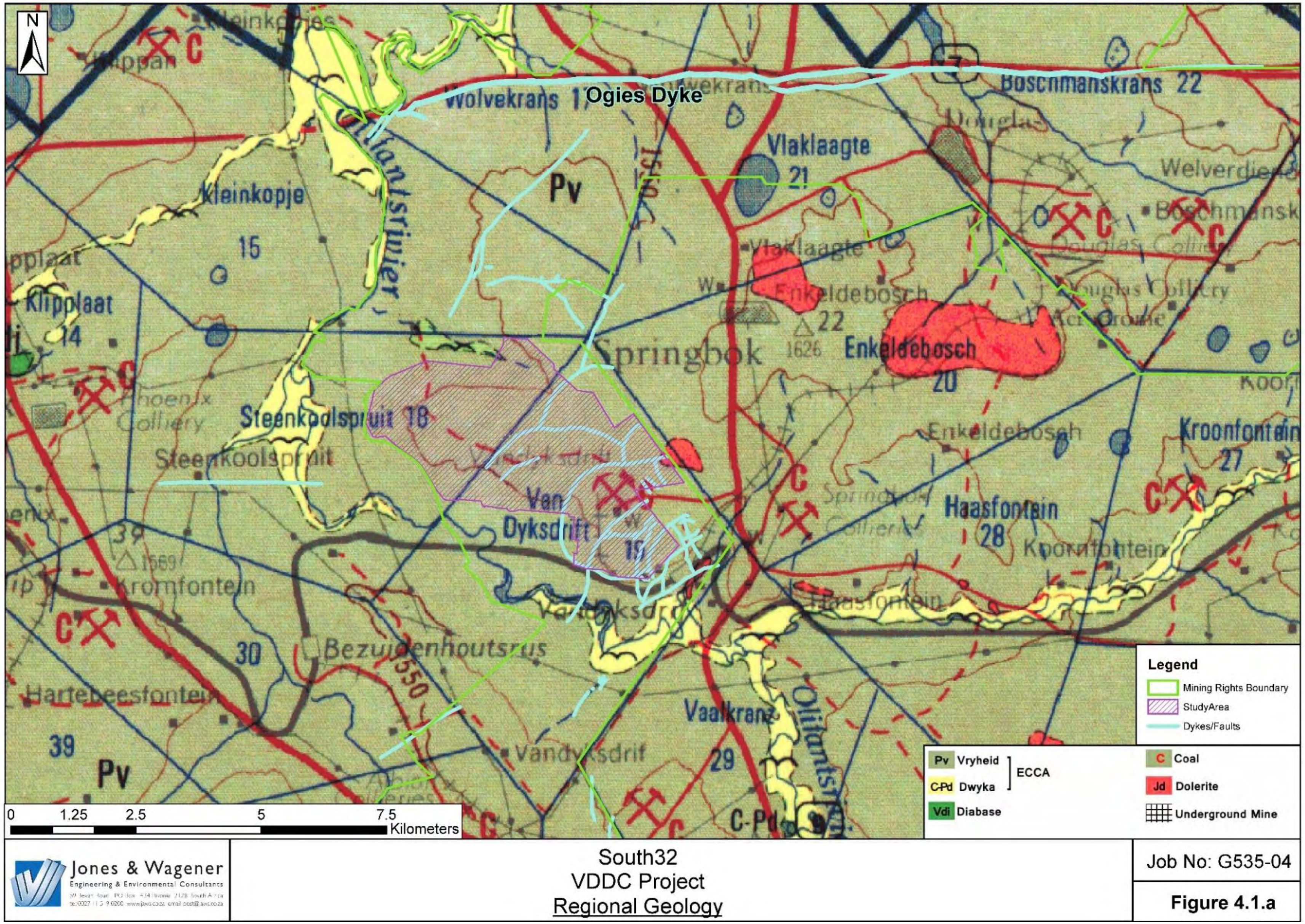


Figure 10-3: **Regional geology of the VDDC project area (J&W, 2019a)**

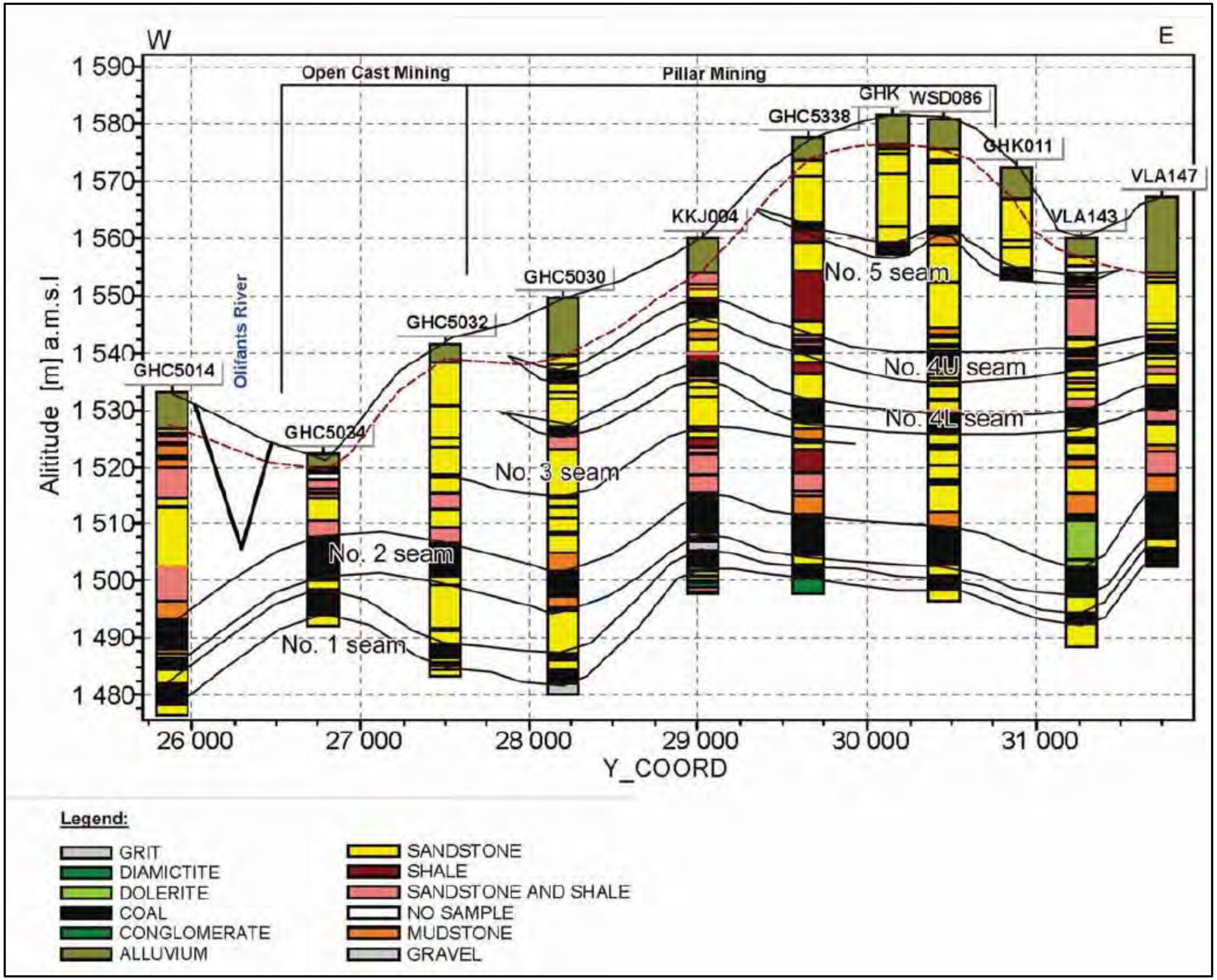


Figure 10-4: **Geological cross section (west – east) across the study area (J&W, 2019a)**

10.1.1.4. Soils, land use and land capability

A soils, land use and land capability assessment was done by J&W and a copy of the report is attached in **Appendix 8.1**.

Soils

The major soil forms are closely associated with the lithologies from which the soils are derived (in-situ formation) as well as the topography and general geomorphology of the site, with the effects of slope and attitude of the land forms and the pedogenetic processes involved affecting the soil formation and ultimately the soil forms mapped.

The dominant soil forms in the study area are indicated in **Figure 10-5.** The soils mapped range from shallow sub-outcrop and outcrop of hard plinthite and parent materials (sediments and intrusive dolerite) to moderately deep sandy loams and sandy clay loams.

The deeper and more sandy loam soils are considered High Potential materials and are distinguished by the better than average depth of relatively free draining soil to a greater depth (> 1 200 mm). This group are recognisable by the subtleness of the mottling (water within the profile for less than 30% of the season), the greater depth of mottling within the profile (>500mm), while the resultant land capability is rated as moderate intensity grazing and/or arable depending on their production potential. These soils are generally much lower in clay than the associated wet based soils and more structured colluvial derived materials, have a distinctly weaker structure and are deeper and better drained (better permeability). The ability for water to move through these profiles is significantly better. The more sandy texture of this soil group renders them more easily worked and of a lower sensitivity (depth >750 mm).

In contrast, the shallower and more structured materials are more sensitive and will require greater management if disturbed. This group of shallower and more sensitive soils (< 500 mm) are associated almost exclusively with the sub outcropping of the parent materials (Karoo Sediments) at surface or with a ferricrete (ouklip) layer, constituting a relatively large percentage of the overall study area. These materials play an important function in the sustainability of the overall biodiversity of the area.

The third group of soils comprises those that are associated with the hard pan ferricrete layer and perched soil water. This group of soils has a set of distinctive characteristics and nature that is separated out due to its inherently much more difficult management characteristics. These soils are characterised by relatively much higher clay contents (often of a swelling nature), poor intake rates, poor drainage, generally poor liberation of soil water and a restricted depth – often due to the inhibiting barrier within the top 700 mm of the soil profile. These soils are generally associated with a wet base. These soils will be more difficult to work in the wet state, store and re-instate at closure. This group of soils comprise the pan like structures and waterholes. Groundwater is generally relatively deep (> 15 m) for the majority of the area of study and is reported (hydrogeologists) to have little to no influence on the soil water and water found within the vadose zone. No perched aquifers (groundwater) are reported, albeit that a significant area of well-developed ferricrete was mapped within the vadose zone. The development of wet based soils and moist grassland environments are mapped in association with these soil forms (J&W, 2019d).

Again, it is noted as important to the baseline study, that these soil groupings are moderately extensive in spatial area and cover a moderately large and sensitive area in terms of the proposed development plan (both mining and its infrastructure encroach).

In addition, but not separated from the wet based structured soils are the group of soils that reflect wetness within the top 500 mm. These soils are easily recognised by the mottled red and yellow colours on low chroma background to the soil. These soils are regarded as high sensitive zones that will require authorisation/permission if they are to be impacted.

The concentrations of natural salts and stores of nutrients within these soils are again a sensitive balance due to the extremes of rainfall, wind and temperature. The ability of a soil to retain moisture and nutrients, and in turn influence the sustainability of vegetative growth and dependence of animal life is determined by the consistency and degree of soil moisture retention within the profile but also the influence of evaporation.

These conditions and associated sensitivities should be noted in terms of the overall biodiversity balance if the sustainability equation is to be managed and mitigation engineered. Pan structures and the associated shallow wet based soils is an important contributor to the ecological cycle.

All areas included in the study have been captured in a GIS format and mapped according to their soil classification nomenclature and soil depth (decimetres), while the similar soil forms have been combined and mapped as “dominant groupings” for ease of management.

Prior to mining, a total of twenty (20) soil forms were identified (**Table 10-1)** in the study area pre-mining (Douglas EMP, 2006). The percentage of Witbank (man-made) soils has since increased due to the growth of the existing south eastern discard dump and several other man-made features on site. The updated soil mapping is shown in **Figure 10-5**. The updated figures from the 2006 report, are shown in **Table 10-1**.

Table 10-1: Soils forms - updated from 2006 EMPR (J&W, 2019d)

Soil	Soil Form	Area (ha)	% of Area
Red apedal	Hutton Bainsvlei	117.6	4.6
Yellow-brown apedal	Avalon Glencoe Clovelly Griffin Pinedene	104.8	4.1
Neocutanic	Tukula Oakleaf	57.0	2.2
Shallow	Mispah Dresden	11.0	0.4
E-horizon (albic)	Longlands Wasbank Kroonstad Fernwood Vilafontes	33.6	1.3
Wetland	Westleigh Katspruit Champagne	365.3	14.4
Man-made	Witbank	1 425.3	56.3
Unknown	No-data	421.6	16.7
Total		2 536	100

Land capability

The area to be disturbed by mining and surface infrastructure development comprises a range of soil and geomorphological attributes with a resultant range of land capability classes. There are significant areas of friable and good grazing potential class soil and large contiguous areas of highly sensitive sites that returned wet based soils, while sites with good potential arable rating were less evident.

The colluvial derived soils are at best considered to have a low intensity grazing land potential or wilderness status due to either their strong structure and/or the presence of wetness within 500 mm of surface (wetland soils). The sites of potential infrastructure development/construction cover almost the full suite of soil sensitivities and land capability, with a significantly large spatial area of the highly sensitive wetland soil ratings included in the proposed development. It should be noted, that the ecological sensitivity will need to be considered along with these ratings if a meaningful understanding of the risk to the environment is to be achieved. The fauna and flora play a role in this equation.

The rivers and associated transition zone wet based soils, sensitive to moderately sensitive sandy loams and sandy clay loams associated with the middle and upper midslope positions and the more sensitive to high sensitivity shallow soils associated with the ridge slopes and erosive environment.

The land capability of the study area is summarised in **Table 10-2** and shown on **Figure 10-6**.

Table 10-2: Pre-mining land capability - updated from 2006 EMPR (J&W, 2019d)

Land Capability	Area (ha)	% of total area
Arable	117.6	4.6
Grazing	204.1	8.0
Wetlands	367.6	14.5
Wilderness / Disturbed Land	1 425.3	56.3
Water	110.3	4.3
Unknown areas (no data)	311.3	12.3
Total	2 536	100

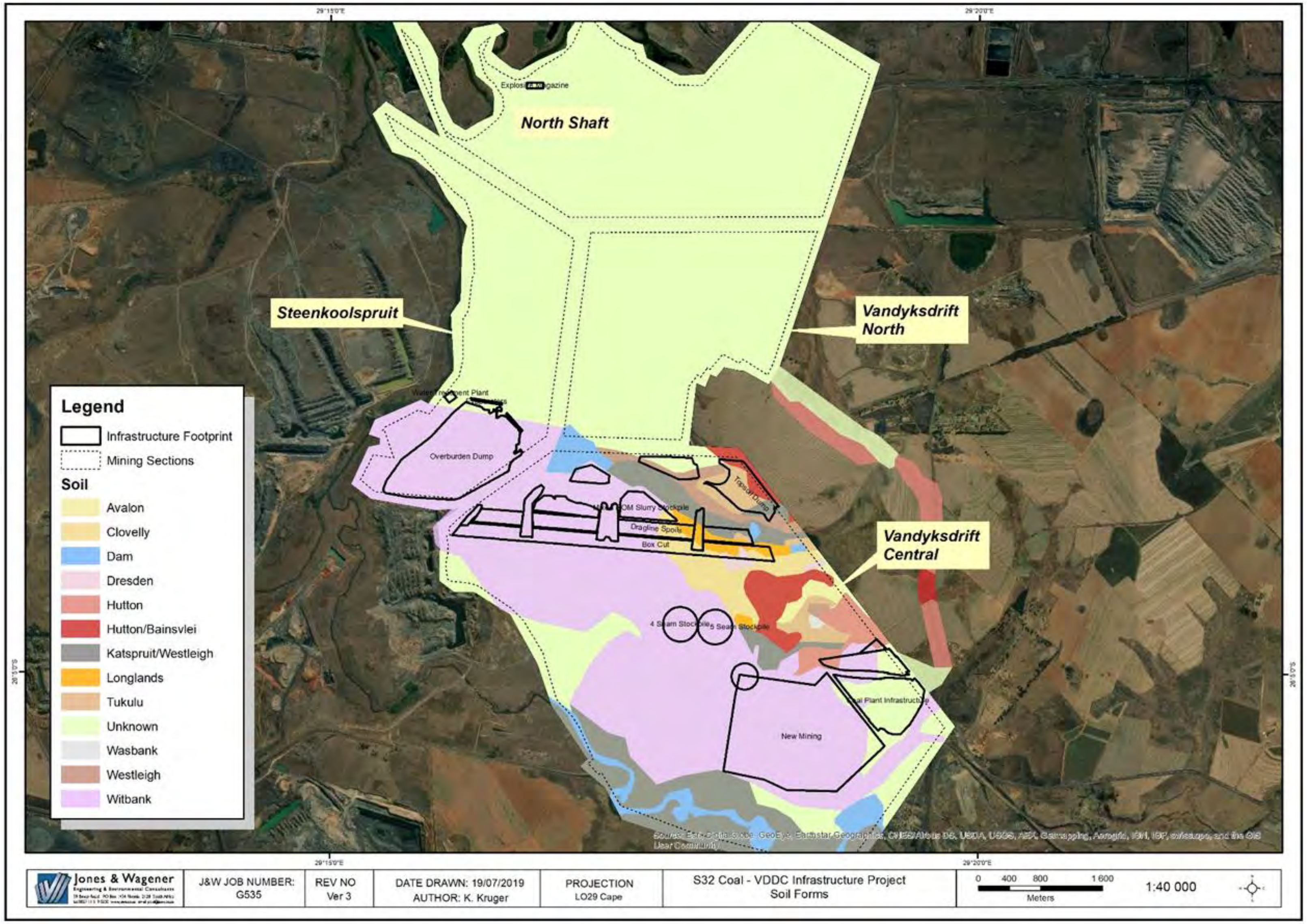


Figure 10-5: Soil forms identified in the VDDC study area (updated from the ESS 2013 study) (J&W, 2019d)

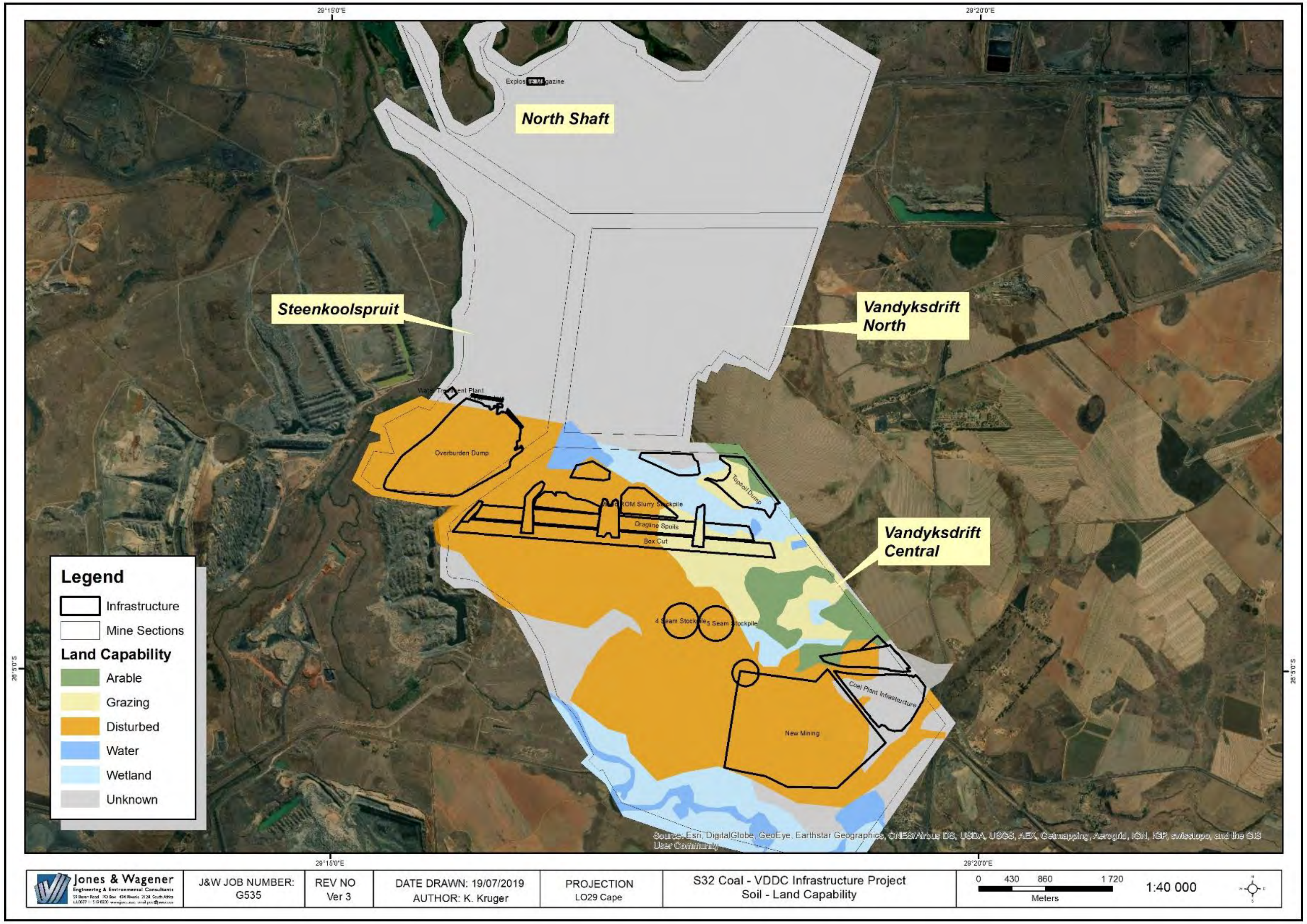


Figure 10-6: Current land capability for the VDDC area (J&W, 2019d)

Land use

The land use of the VDDC area is shown in **Figure 10-7** and listed in **Table 10-3**. The dominant land uses on site are mining and open grasslands. These are followed by wetlands, cultivation, bush and urban development. The minor land uses include water, shrubland, plantations, bare ground and mine buildings.

Table 10-3: Land use – updated from 2006 EMPR (J&W, 2019d)

Land Use	Ha	%
Water Seasonal	1.3	0.05%
Water permanent	3.7	0.14%
Wetlands	146.6	5.56%
Bush	80.7	3.06%
Grassland	721.2	27.37%
Shrubland	11.3	0.43%
Cultivation	182.0	6.91%
Plantations	14.6	0.55%
Mining	1 355.3	51.43%
Mine Water	33.2	1.26%
Mine Buildings	9.4	0.36%
Bare Ground	17.8	0.68%
Urban	58.1	2.21%
Total	2 635.2 *	100%

** The boundaries of the land capability and land use assessment differ slightly, hence the difference in the total hectares for each when comparing Table 10-1 andTable 10-2.*

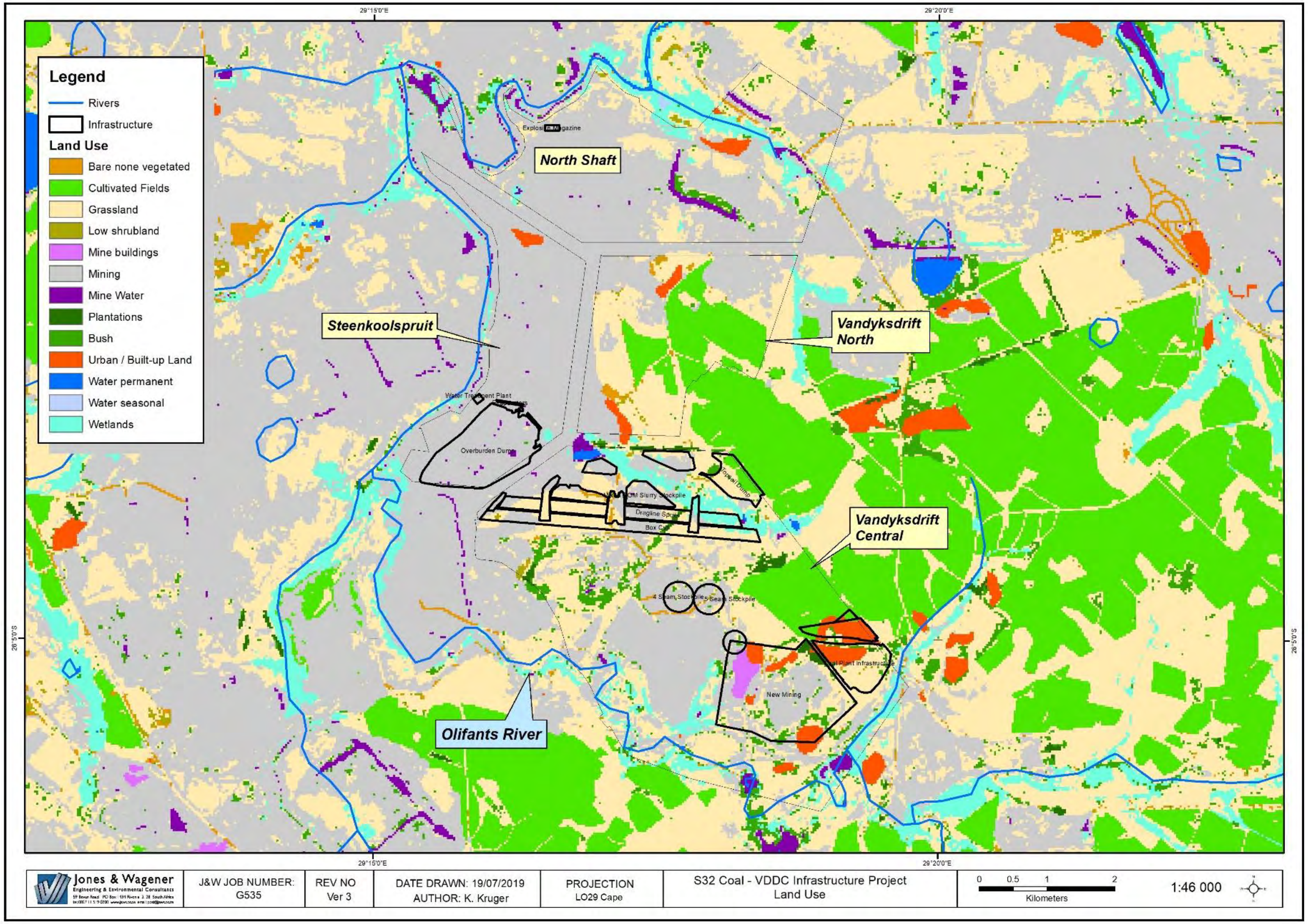


Figure 10-7: **Land use for the VDDC area (J&W, 2019d)**

10.1.1.5. Surface water

A detailed surface water assessment was undertaken by J&W and a copy of the report is attached in **Appendix 8.8**.

Water management area and catchments

The VDDC infrastructure development project is situated within the catchment area of the Olifants River. This catchment makes up part of the Witbank and Loskop Dam catchment. The proposed VDDC infrastructure development project is largely situated within quaternary sub-catchment B11F and B11B, with some infrastructure components located within B11G of the Limpopo-Olifants primary drainage region. The VDDC infrastructure development project in relation to the catchments are shown in **Figure 10-8.**

Mean annual runoff

The receiving water body for the VDDC project is the Witbank Dam. The use of this dam is motivated on the basis that:

- It is located downstream of the proposed development within the Olifants River catchment area;
- Beyond the Witbank Dam, the potential impacts become extremely small due to the water volumes in the catchment and dilution effects;
- Further, by the time the water reaches the Witbank Dam, it is required to be suitable for use for all of the expected uses (drinking water, agricultural, industrial and aquatic ecosystems). Thus, by achieving compliance in terms of these, no additional impacts are expected downstream of the Witbank Dam. The receiving water body is relevant only in so far as it defines the aerial extent of the catchment to be considered in the impact assessment and described in the baseline study;
- The use of the Witbank Dam is based on the relatively small size of the disturbed areas compared to the catchment for the dam.;
- The catchment for the Witbank Dam is reported as 579 km^2. The proposed VDDC infrastructure development area covers approximately 14.5 km^2. The mine area thus totals approximately 2.5% of the Witbank Dam catchment;
- The mean annual runoff (MAR) for Witbank Dam is 190 x 10^6 m^3, while the MAR for the proposed mining area is estimated at 0.45 x 10^6 m^3 (J&W, 2019b).

Simulated monthly flow records at various points were generated and the MAR is shown in **Table 10-4**.

Table 10-4: Computed Mean Annual Runoff (J&W, 2019b)

River	Measured at	MAR ($x10^6m^3$)	Percentage of MAR at Witbank Dam
Olifants River	Entrance to mine	59.5	46
Steenkoolspruit	Immediately before confluence with Olifants River	52.0	40
Olifants River	Exit from mine property	188.1	99
Witbank Dam	At dam	190	100

Note: Varying values on the MAR for Witbank Dam were found in the literature. This value of 190 x 10^6 m^3 is derived from the runoff values given for various measuring points in the Surface Water Resources of South Africa – 1990

Surface water use

The VDDC Project area is situated in a farming district, where water from the Olifants River and the Steenkoolspruit upstream of the mining area is used for irrigation, formal and informal domestic usage, as well as livestock watering. Other uses include domestic supply to villages and other amenities in the area.

The Witbank Dam is located downstream of the mining area and is used for municipal and industrial water supply, as well as recreational activities such as fishing and boating.

The aquatic ecosystem is also present as a downstream user (J&W, 2019b).

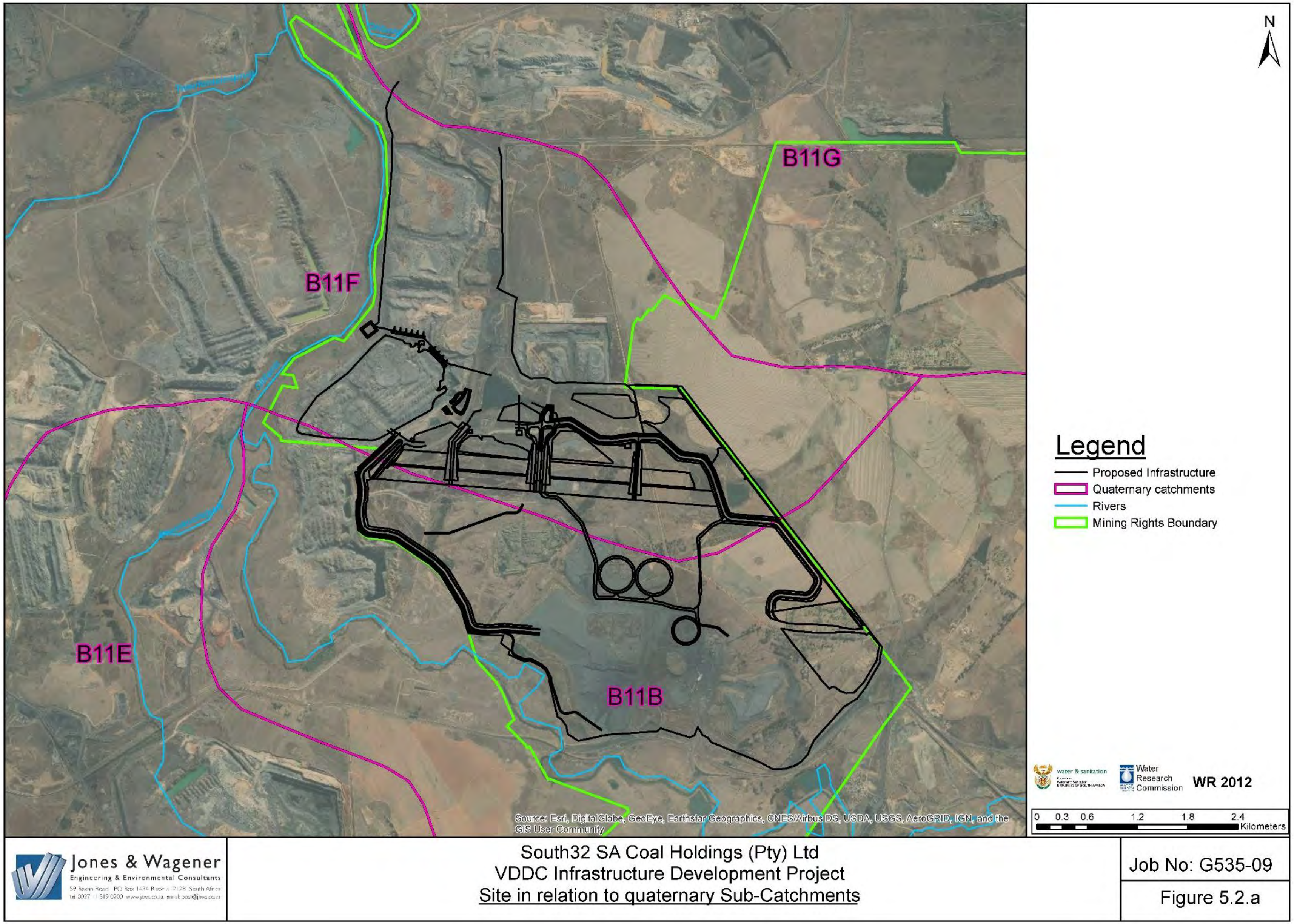


Figure 10-8: Proposed infrastructure in relation to quarternary catchments (J&W, 2019b)

Surface water quantity

The catchment areas upstream and downstream of the project area are given in **Table 10-5**.

Table 10-5: Catchment areas (J&W, 2019b)

River	Measured at	Catchment (km^2)
Olifants River	Upstream of Vandyksdrift (Entrance of mine property)	1 350
Olifants River	Downstream of mine property	3 309

Dry Weather Flow

A simulated stream flow record was generated at the downstream boundary of the mine. A flow-duration curve was then constructed for the simulated stream flow record. Based on the criterion that the dry weather flow is the flow in the stream that is equalled or exceeded 70% of the time, this flow was computed and corresponds to the flow during the winter months, shown for key points in **Table 10-6**.

Table 10-6: Dry weather flows (J&W, 2019b)

River	Measured at	Dry weather flow (m^3/s)	Nature of stream flow
Olifants River	Entrance to mine property	0.3	Perennial
Steenkoolspruit	Immediately before confluence with Olifants River	0.34	Perennial
Olifants River	Exit from mine property	0.71	Perennial

Flood Peaks and Volumes

The flood peaks for the 1:20, 1:50 and 1:100 year recurrence intervals were computed using the Rational Method (DWA implementation and Alternative implementation), Unit Hydrograph techniques, and the Regional Maximum Flood.

The volumes of the floods were based on the simplified hydrograph proposed by Kovacs, and the relationship between the Regional Maximum Flood and Mean Annual Runoff as derived from the measurement of various extreme flood events across South Africa documented in various Department of Water Affairs and Forestry (DWAF) publications.

Table 10-7 lists these flood peaks and the Regional Maximum Flood together with the corresponding flood volumes on the Olifants River and Steenkoolspruit.

Table 10-7: Computed flood peaks and volumes in the Olifants River, Steenkoolspruit and their tributaries affected by mining at VDDC (J&W, 2019b)

River	Measured at	Recurrence Interval	Flood Peak (m^3/s)	Flood Volume ($x10^6m^3$)
Olifants River	Entrance to mine property	20 year 50 year 100 year RMF	480 760 1150 350	26 41 58 196
Olifants River	Immediately before confluence with Steenkoolspruit	20 year 50 year 100 year RMF	490 780 1200 240	27 3 60 203
Steenkoolspruit	Immediately before confluence with Olifants River	20 year 50 year 100 year RMF	515 810 1250 2402	26 42 58 199
Olifants River	Exit from mine property	20 year 50 year 100 year RMF	823 1292 1837 3810	51 80 112 380

Floodlines

The 1:100 year recurrence interval pre-mining floodlines are shown on **Figure 10-9**. The floodlines are in the process of being updated.

Surface water quality

Wolvekrans Colliery is an existing mine and has a monitoring programme in place and therefore the available surface water quality data was used. Water quality data, for several locations around the site, extending from September to October 2012, July 2015 to November 2017 and January to February 2018, was received from South32. The position of the surface water monitoring locations are shown in **Figure 10-10.**

There are various standards and objectives in terms of surface water quality, depending on what the end use is to be. Some of these include the DWS South African Target Water Quality Guidelines (TWQG) for different uses (e.g. Aquatic Ecosystems and Agricultural use) that were published in 1996 and the SANS 241 Drinking Water Quality Standard (2015).

In some cases, however, there are more specific standards in terms of the catchment itself, as determined by the Catchment Management Agency. The DWS published in 2016 Classes and Resource Quality Objectives of water resources for the Olifants River catchment. One of the key elements of this document is Resource Quality Objectives (RQO) in the Olifants River catchment. In this document the catchment is divided into various Integrated Unit of Analysis (IUA) areas and Resource Units. Each IUA has a set of water quality constituents for which limits have been set. The proposed VDDC project is located within IUA 1, which is referred to as the Upper Olifants River catchment and within Resource Unit 11.

A summary of the different standards, guidelines and objectives is provided in **Table 10-8**.

For the purpose of this assessment, the 2016 RQO was used to describe the current status of the water resources in the catchment, since this is the most recent objectives set specifically for the catchment. Where no limits are provided for a specific constituent, the SANS 241 standards were used as a guideline to indicate the level of impact.

Although the TWQO were also considered, these were not used in the assessment of the current water quality status in the catchment. The guidelines provide target water quality objectives for the specific water use and is more stringent in most cases than the SANS 241 Drinking Water Quality Standard. The aquatic ecosystem is always present as a potential water user. In the case of VDDC, although some agriculture is practiced in the larger catchment area, the area immediately downstream of the VDDC section, is mining.

Table 10-8: Standards, objectives and guidelines considered for the baseline surface water quality assessment (J&W, 2019b)

Constituent	Unit	TWQG Agricultural Use: Irrigation (DWS, 1996)	TWQG Aquatic Ecosystems (DWS, 1996)	SANS 241: 2015 Drinking Water Standard	RQO for Olifants River IUA 1, Resource Unit 11 (2016)
Physical					
Electrical conductivity (EC) @ 25°C	mS/m			170	111
Chemical Oxygen Demand (COD)	mg/ℓ				-
pH	-	6.5-8.4	Background +/-0.50 pH units	5 to 9.7	-
Chemical, Inorganic					
Alkalinity	mg $CaCO_3$/ℓ				-
Boron (B)	mg/ℓ	≤ 0.5		2.4	-
Calcium (Ca)	mg/ℓ				-
Chloride (Cl)	mg/ℓ	≤ 100		300	-
Fluoride (F)	mg/ℓ	≤ 2	≤ 0.75	1.5	-
Magnesium (Mg)	mg/ℓ				-
Potassium (K)	mg/ℓ				-
Sodium (Na)	mg/ℓ	≤ 70		200	-
Sulphate (SO_4)	mg/ℓ			500	500
Total Dissolved Solids (TDS)	mg/ℓ	≤ 40	Background +/-10%	1 200	-

Constituent	Unit	TWQG Agricultural Use: Irrigation (DWS, 1996)	TWQG Aquatic Ecosystems (DWS, 1996)	SANS 241: 2015 Drinking Water Standard	RQO for Olifants River IUA 1, Resource Unit 11 (2016)
Metals, Dissolved					
Iron (Fe)	mg/ℓ	<= 5	Background +/-10%	2	-
Aluminium (Al)	mg/ℓ	≤ 5	≤ 0.005 for pH<6.5 and ≤ 0.01 for pH>6.5		-
Manganese (Mn)	mg/ℓ	≤ 0.02	≤ 0.18	0.40	-
Chromium VI (Cr VI)	mg/ℓ	≤ 0.1	≤ 0.007		-
Plant Nutrients					
Nitrate (NO_3)	mg/ℓ as N			11	4
Ammonium (NH_4)	mg/ℓ as N		≤ 0.007	1.5	0.1
Phosphate (PO_4)	mg/ℓ as P				0.125
Nickel (Ni)	mg/ℓ	≤ 0.2		0.07	-
Arsenic (As)	mg/ℓ	≤ 0.1	≤ 0.01	0.010	-
Antimony (Sb)	mg/ℓ			0.020	-
Barium (Ba)	mg/ℓ			0.70	-
Beryllium (Be)	mg/ℓ	≤ 0.1			-
Cadmium (Cd)	mg/ℓ	≤ 0.01		0.0030	-
Total Chrome (Total Cr)	mg/ℓ			0.050	-
Cobalt (Co)	mg/ℓ	≤ 0.05		0.50	-
Copper (Cu)	mg/ℓ	≤ 0.2		2.0	-
Lead (Pb)	mg/ℓ	≤ 0.2		0.010	-
Mercury (Hg)	mg/ℓ		≤ $4x10^{-5}$	0.006	-
Molybdenum (Mo)	mg/ℓ				-
Selenium (Se)	mg/ℓ	≤ 0.02	≤ 0.002	0.010	-
Tin (Sn)	mg/ℓ				-
Vanadium (V)	mg/ℓ	≤ 0.1		0.20	-
Zinc (Zn)	mg/ℓ	≤ 1	≤ 0.002	5.0	-

The summarised baseline water quality results, for the data provided by South32 for periods indicated in section 5.6 is shown in in **Table 10-9** as the average, maximum and minimum concentrations, together with the coefficient of variation. It is important to note that the 2016 RQO do not provide limits for all constituents and therefore the

SANS 241 guidelines were used in such cases. However, there are certain constituents for which no limitations are specified. values in highlighted in red indicate where the RQO for the Olifants River catchments or the SANS 241 guidelines are exceeded.

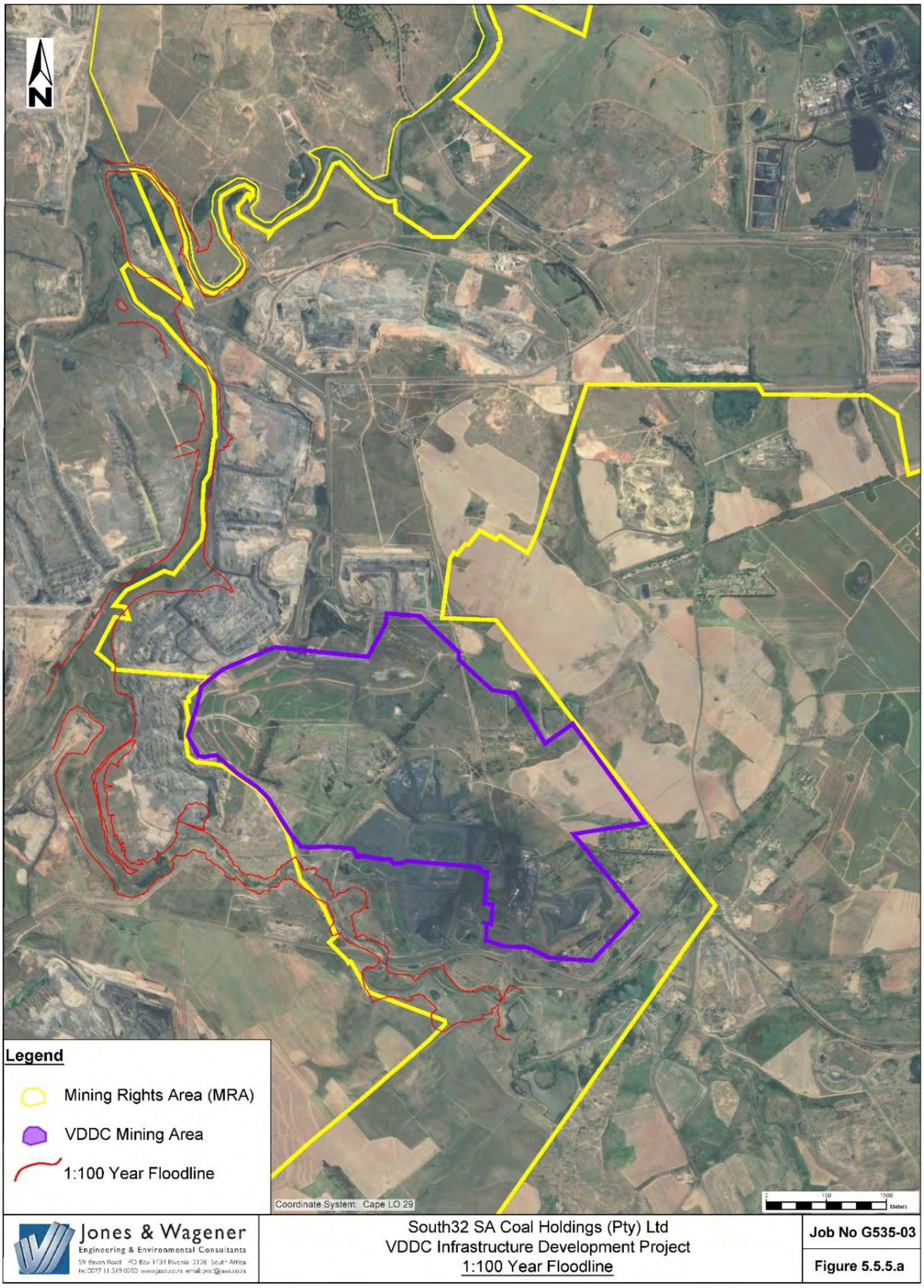


Figure 10-9: **Delineated 1:100 year floodlines of the VDDC infrastructure development project (J&W, 2019b)**

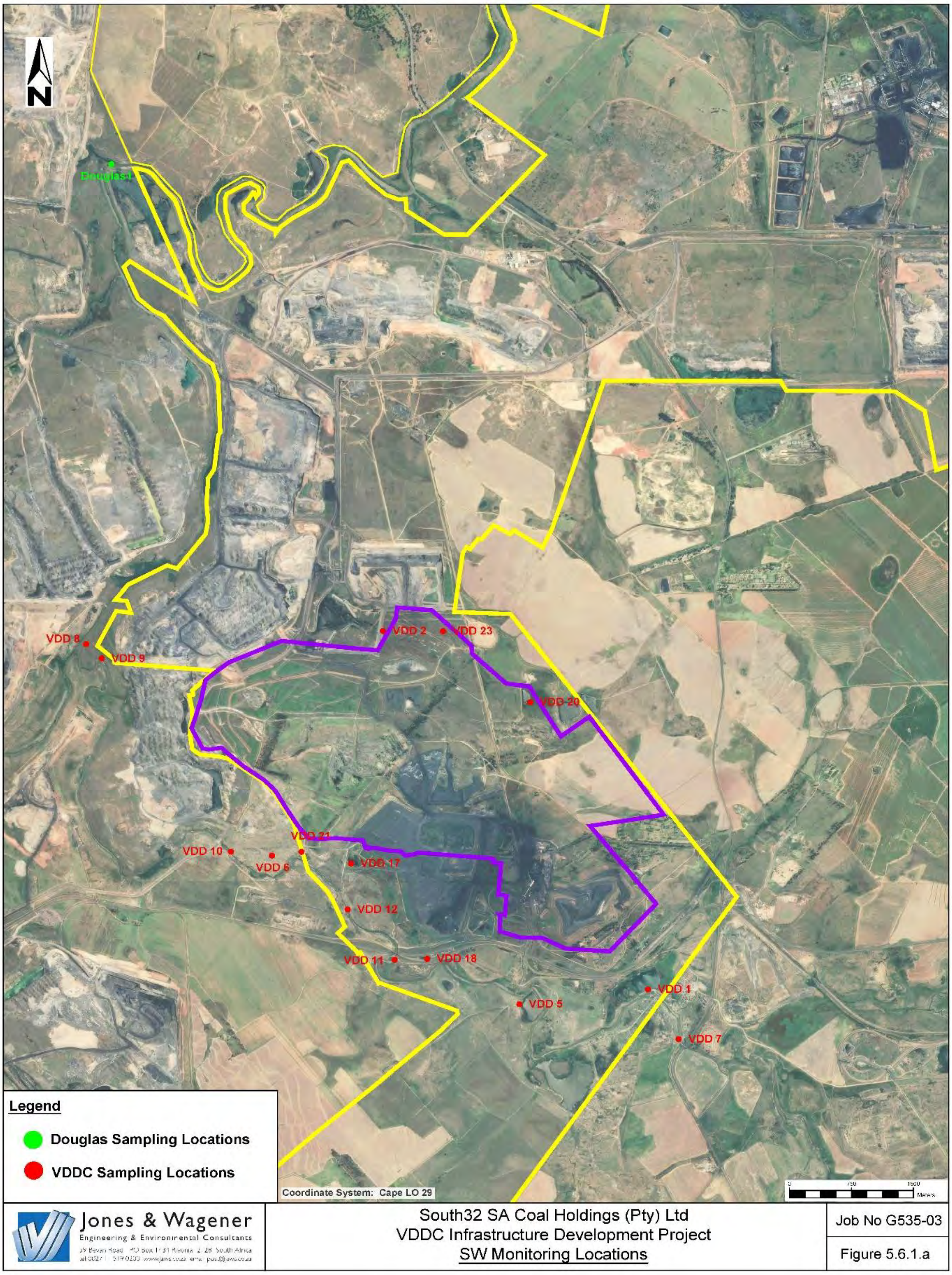


Figure 10-10: Surface water monitoring locations (J&W, 2019b)

Table 10-9: Surface water quality results for measurements taken in September to October 2012, July 2015 to November 2017, and January to February 2018 (J&W, 2019b)

Mine	Sample Location	RQO and SANS Guidelines	pH	EC mS/m	TDS mg/ℓ	SS mg/ℓ	Fe mg/ℓ	TALK	Ca mg/ℓ	Cl mg/ℓ	Mg mg/ℓ	NO_3 mg/ℓ	PO_4 mg/ℓ	K mg/ℓ	Na mg/ℓ	SO_4 mg/ℓ	Al mg/ℓ	F mg/ℓ	Mn mg/ℓ
		SANS 241 2015	5-9.7	170	1200	-	2	-	-	300	-	11	-	-	200	500	-	1.5	0.4
		Olifants IUA 1		111	-	-	-	-	-	-	-	4	0.125	-	-	500			
Mine	Sample Location																		
	VDD1	Average	7.71	121.59	999.33	24.61	0.08	87.50	108.02	23.11	85.78	0.16	0.00	9.43	49.27	581.80	0.08	0.91	0.25
		Maximum	8.80	268.00	2444.00	252.00	0.37	142.00	269.00	61.00	210.00	0.42	0.00	14.40	176.00	1481.00	0.20	1.37	1.43
		Minimum	6.05	42.40	326.00	3.60	0.01	17.00	39.00	8.13	25.50	0.00	0.00	6.15	15.90	187.00	0.02	0.60	0.01
		Coeff of Variation %	8.66	34.96	39.74	188.37	102.87	47.86	38.61	41.59	42.05	64.26		17.00	57.94	40.12	63.94	27.60	160.89
	VDD2	Average	7.71	325.45	3069.52	380.10	0.20	172.14	302.41	27.61	194.93	0.85		10.76	299.55	1900.83	0.09	0.61	1.17
		Maximum	8.23	523.00	5088.00	7900.00	1.86	316.00	516.00	53.50	340.00	5.68	0.00	31.00	542.00	3172.00	0.19	0.94	9.54
		Minimum	7.02	189.00	1548.00	4.00	0.02	57.00	150.00	3.50	87.10	0.10	0.00	1.85	112.00	895.00	0.01	0.34	0.01
		Coeff of Variation%	4.41	24.64	29.24	382.37	189.14	36.70	29.16	37.60	29.38	214.94		47.50	31.26	32.11	58.54	26.14	174.18
	VDD5	Average	8.05	90.21	674.87	26.84	0.08	115.53	72.38	24.51	50.39	0.15	0.10	9.12	54.92	342.48	0.13	0.69	0.04
		Maximum	8.74	175.00	1524.00	91.20	0.21	155.00	149.00	50.50	139.00	0.24	0.10	13.00	110.00	863.00	0.50	1.10	0.20
		Minimum	6.99	39.60	280.00	0.40	0.01	60.00	28.90	12.50	16.80	0.10	0.10	6.11	24.50	95.90	0.01	0.49	0.01
		Coeff of Variation%	4.61	39.71	46.26	74.25	71.79	22.35	44.61	37.26	59.82	40.77		18.88	39.15	57.17	96.43	22.63	112.14
	VDD6	Average	7.47	132.66	1097.11	754.44	0.31	137.33	122.56	42.48	82.91	0.25	0.32	23.29	65.15	581.52	0.19	0.63	1.84
		Maximum	8.31	295.00	2506.00	10450.00	1.31	297.00	266.00	136.00	221.00	0.88	0.38	186.00	147.00	1439.00	1.13	1.36	11.80
		Minimum	6.48	26.60	182.00	1.60	0.01	32.00	18.20	9.66	9.30	0.10	0.23	4.88	10.60	63.80	0.01	0.47	0.01
		Coeff of Variation%	6.45	59.85	65.54	330.16	107.64	49.81	57.81	79.31	74.48	94.59	25.19	187.13	65.47	70.80	141.59	30.74	161.30
	VDD7	Average	7.90	209.01	2070.13	22.67	0.23	120.07	215.58	25.53	177.13	1.93		14.47	97.61	1288.03	0.52	0.66	2.63
		Maximum	8.44	478.00	5406.00	64.40	1.04	163.00	569.00	38.80	504.00	5.24	0.00	43.70	241.00	3480.00	9.08	0.96	14.10
		Minimum	7.43	32.60	230.00	2.80	0.01	69.00	23.40	11.80	13.40	0.17	0.00	5.35	21.40	60.00	0.01	0.43	0.01
		Coeff of Variation%	3.31	80.55	93.56	76.77	104.45	23.41	89.12	32.85	100.94	78.60		67.06	68.30	100.98	319.32	25.45	154.23
	VDD8	Average	7.85	51.76	373.10	43.78	0.29	99.00	39.27	20.07	25.63	0.93	0.14	6.88	33.97	152.21	0.41	0.41	0.10
		Maximum	8.90	113.40	842.00	82.00	1.42	149.00	99.20	37.60	64.50	3.18	0.21	10.30	62.10	436.00	2.32	0.63	0.51
		Minimum	7.32	31.10	208.00	14.40	0.02	68.00	20.40	14.10	13.10	0.10	0.10	5.06	22.80	59.10	0.02	0.25	0.01
VDDC		Coeff of Variation%	3.85	41.54	46.72	45.78	101.19	19.80	51.00	28.04	59.79	85.19	43.45	21.61	32.44	70.37	118.22	24.37	131.86
	VDD9	Average	7.96	74.41	565.20	24.97	0.25	110.90	60.62	22.75	40.87	0.46		8.06	45.95	269.03	0.29	0.51	0.05
		Maximum	8.53	158.00	1410.00	54.40	0.93	158.00	150.00	46.20	115.00	1.06	0.00	13.60	98.70	780.00	1.63	0.74	0.26
		Minimum	7.35	30.30	240.00	1.60	0.02	61.00	25.30	12.40	14.50	0.20	0.00	5.74	21.60	90.00	0.01	0.32	0.01
		Coeff of Variation%	3.49	41.88	49.35	67.18	100.47	21.24	51.81	32.04	59.89	48.01		21.80	39.03	62.06	121.21	17.12	140.19
	VDD10	Average	7.87	96.47	761.40	33.74	0.23	115.20	81.99	24.31	59.98	0.25		9.80	52.21	400.72	0.21	0.67	0.14
		Maximum	8.58	248.00	2232.00	537.00	0.73	179.00	217.00	72.00	206.00	0.41	0.00	17.00	165.00	1284.00	0.77	1.12	0.98
		Minimum	6.53	31.30	248.00	0.80	0.01	60.00	25.40	9.76	14.80	0.10	0.00	5.71	12.00	80.10	0.01	0.39	0.01
		Coeff of Variation%	6.53	56.70	65.31	285.22	100.97	31.65	59.11	50.76	77.87	49.49		28.55	61.04	75.02	117.26	29.94	180.85
	VDD11	Average	7.87	107.67	873.72	13.30	0.23	121.69	92.54	26.92	64.28	1.05		9.63	66.07	457.89	0.24	0.59	0.33
		Maximum	8.50	231.00	2058.00	41.20	0.92	175.00	223.00	61.70	167.00	8.50	0.00	15.90	146.00	1210.00	1.31	0.83	3.88
		Minimum	6.78	31.20	244.00	0.80	0.01	63.00	24.50	12.80	14.20	0.00	0.00	5.68	22.40	76.10	0.01	0.42	0.01
		Coeff of Variation%	4.78	51.73	59.03	86.29	110.38	25.88	57.87	46.23	64.31	250.95		26.62	54.28	67.34	135.13	18.36	266.42
	VDD12	Average	8.14	101.19	797.33	25.55	0.33	112.04	78.44	26.67	60.93	0.24	8.96	10.85	71.85	412.65	0.18	0.65	0.10
		Maximum	9.04	195.40	1590.00	246.00	3.00	182.00	132.00	44.50	143.00	0.57	8.96	34.30	246.00	939.00	0.64	0.92	0.36
		Minimum	7.12	31.10	248.00	1.20	0.01	63.00	25.10	13.20	14.40	0.10	8.96	5.76	21.60	0.05	0.01	0.41	0.01
		Coeff of Variation%	5.97	47.80	52.78	186.92	186.54	25.13	46.74	39.02	61.42	68.01		50.28	65.81	65.37	107.70	23.34	109.48
	VDD18	Average	6.51	29.78	217.43	69.78	1.23	35.44	22.25	7.44	12.10	1.48		6.10	17.55	110.98	0.15	0.44	0.66
		Maximum	7.72	74.50	614.00	320.00	4.90	187.00	70.80	28.10	31.90	4.28	0.00	20.60	41.70	347.00	1.16	0.65	3.83
		Minimum	4.69	5.57	36.00	1.60	0.02	5.00	2.57	1.90	1.17	0.10	0.00	1.17	1.11	14.50	0.02	0.23	0.01
		Coeff of Variation%	13.26	62.85	67.07	144.92	131.63	157.31	79.54	79.58	74.08	128.16		74.87	54.46	81.19	166.20	28.45	171.58

Mine	Sample Location	RQO and SANS Guidelines	pH	EC mS/m	TDS mg/ℓ	SS	Fe mg/ℓ	TALK	Ca mg/ℓ	Cl mg/ℓ	Mg mg/ℓ	NO_3 mg/ℓ	PO_4 mg/ℓ	K mg/ℓ	Na mg/ℓ	SO_4 mg/ℓ	Al mg/ℓ	F mg/ℓ	Mn mg/ℓ
		SANS 241 2015	5-9.7	170	1200	-	2	-	-	300	-	11	-	-	200	500	-	1.5	0.4
		Olifants IUA 1		111	-	-	-	-	-	-	-	4	0.125	-	-	500			
VDDC	VDD20	Average	7.82	48.66	339.19	814.15	0.63	101.07	27.74	24.83	15.86	0.41	0.31	11.49	52.22	114.71	0.37	1.42	0.66
		Maximum	9.75	131.00	856.00	8264.00	1.91	424.00	125.00	130.00	42.40	1.55	0.76	28.50	251.00	412.00	3.24	6.54	3.21
		Minimum	6.36	6.09	52.00	0.40	0.06	6.00	3.31	2.92	1.02	0.12	0.00	3.40	3.20	4.39	0.01	0.43	0.01
		Coeff of Variation%	10.43	79.84	83.74	214.13	76.37	84.40	98.74	105.14	74.61	98.62	130.65	68.85	111.83	140.07	169.67	82.04	157.00
	VDD21	Average	8.05	261.64	2370.00	74.46	0.15	112.57	248.21	93.71	204.29	0.17		14.39	173.10	1500.71	0.08	0.56	0.17
		Maximum	8.59	552.00	4840.00	590.00	0.55	202.00	503.00	338.00	559.00	0.31	0.00	53.80	644.00	4118.00	0.54	1.36	1.28
		Minimum	7.06	168.00	1322.00	3.20	0.01	16.00	145.00	31.50	101.00	0.00	0.00	7.85	72.60	762.00	0.02	0.31	0.01
		Coeff of Variation%	5.14	36.89	38.16	205.82	118.56	46.71	38.49	79.70	56.89	76.39		81.74	82.26	54.47	165.44	47.92	230.24
	VDD22	Average	7.26	59.70	496.50	976.90	0.21	46.75	48.53	16.57	39.80			4.57	31.60	286.45	0.12	0.73	0.65
		Maximum	8.31	168.00	1456.00	3685.00	0.39	119.00	145.00	31.50	126.00	0.00	0.00	11.50	72.60	881.00	0.27	1.36	2.21
		Minimum	6.57	20.40	150.00	4.80	0.07	11.00	15.60	9.20	9.89	0.00	0.00	1.30	11.60	60.00	0.05	0.39	0.01
		Coeff of Variation%	10.24	121.00	128.89	185.07	77.96	104.62	132.55	62.95	144.42			105.09	87.95	138.55	87.73	59.94	162.41
	VDD23	Average	7.44	182.67	1654.56	126.02	0.20	155.56	167.32	23.87	94.80	0.33	0.26	12.17	166.74	942.44	0.09	0.89	1.03
		Maximum	8.34	433.00	4482.00	1245.00	1.07	381.00	516.00	48.90	293.00	0.98	0.35	53.40	418.00	2839.00	0.33	1.94	8.00
		Minimum	6.20	35.40	256.00	10.80	0.02	10.00	30.60	5.56	17.50	0.11	0.12	0.30	23.60	70.20	0.01	0.33	0.01
		Coeff of Variation%	6.28	80.06	89.35	209.30	129.45	56.12	87.60	53.72	87.50	77.42	38.22	92.64	89.02	101.80	84.58	37.63	228.71
	Douglas 1	Average	7.80	47.01	340.13	42.19	0.36	85.63	34.04	18.13	21.77	0.64	0.00	6.62	31.74	140.74	0.31	0.45	0.06
		Maximum	8.23	69.80	526.00	178.00	1.35	113.00	45.60	23.80	32.70	1.22	0.00	8.83	61.90	229.00	1.65	0.60	0.43
		Minimum	7.49	28.30	224.00	4.80	0.02	65.00	22.90	13.20	13.70	0.21	0.00	5.24	22.10	75.90	0.03	0.29	0.01
		Coeff of Variation%	2.70	22.01	23.55	107.37	131.92	13.72	21.72	14.71	26.72	45.93		14.93	30.33	32.94	137.12	18.52	223.21

Interpretations of the surface water quality monitoring results summarised in **Table 10-9** are discussed below:

pH

The pH of natural waters is a measurement of the acidity/alkalinity and is the result of complex acid-base equilibrium of various dissolved compounds. The pH of most raw water sources is within the range of 6.5 to 8.5 (DWAF, 1996). A decrease in the pH of water in a mining area will be an indication of acid mine drainage (AMD).

On average, all the monitoring points are within the required pH range of 5 to 9.7, as illustrated in **Figure 10-11**.

Minimum recorded levels of pH which fell out of the required pH range, and lower than the required 5.0 was at monitoring point VDD18 (2569 VW Olifants tributary from PSS dump pollution control dam). A decrease in the pH level may be due to mining activities.

Maximum recorded levels of pH which fell out of the required pH range, and higher than the required 9.7 was at monitoring point VDD20 (2603 Attenuation dam1) which may be due to agricultural activities.

Sulphate (SO_4)

Sulphate is a key indicator of water affected by coal mining and the average SO_4 concentrations exceed the acceptable limit at a number of monitoring points as indicated in **Table 10-9** and **Figure 10-12**.

For maximum recorded sulphate concentrations, all of the monitoring points exceed the required SO_4 concentration limit of 500mg/l with the exception of VDD8, VDD20, VDD18 and Douglas1.

The monitoring data indicates that the water upstream of the VDDC mining section shows an impact as a result of the land use activities. The elevated sulphate concentrations at these locations may be attributed to mining activities in the area.

Electrical Conductivity (EC)

Electrical conductivity is a measure of salinity or total salt content of water. Accumulation of salts can influence the potential to use the water downstream by water users, such as irrigation for agriculture, as well as livestock watering. In **Table 10-9** and **Figure 10-13**, elevated EC levels were noted for monitoring points VDD1 VDD2, VDD6, VDD7, VDD21 and VDD23.

The monitoring data shows an impact on the water resources upstream of the VDDC mining area as a result of the land use activities.

Iron (Fe)

Iron (Fe) is the fourth most abundant element, constitutes 5% of the earth's crust and is found in many minerals. An important mineral in the context of this investigation is pyrite (FeS), which is often associated with coal formations. Iron can be present in water as dissolved ferric iron (Fe III), as ferrous iron (Fe II) or as suspended iron hydroxides. The concentration of dissolved iron in unpolluted surface water is typically in the range of 0.001 - 0.5 mg/ℓ (DWAF, 1996). There are no limits provided in the RQO for iron. The SANS 241 guidelines for iron is set as 2 mg/ℓ.

The results indicate on average, iron concentrations for all monitoring locations are within the guideline limits. Maximum recorded iron concentrations which were marginally elevated were noted at VDD2 and VDD18. Elevated iron concentrations may be due to mining and/or agricultural activities in the surrounding area.

Aluminium (Al)

Aluminium occurs in water either as suspended aluminium minerals or as dissolved aluminium species. The concentration of dissolved aluminium in unpolluted water at neutral pH is typically 0.005 mg/ℓ or less. In water with a low pH, or where soluble aluminium complexes are present, the dissolved aluminium concentration can rise to high values (DWAF, 1996).

There are no limits set for Al in the SANS 241 guidelines or the RQO for the catchment. Therefore, the TWQO for irrigation and aquatic ecosystems was used to assess Al and are not displayed in **Table 10-9**.

The TWQO for irrigation for Al is 5 mg/ℓ or less and the TWQO for aquatic ecosystems are as follows:

- For pH <6.5 the Al concentration limit is 0.005 mg/ℓ or less.
- For pH >6.5 the Al concentration limit is 0.01 mg/ℓ or less.

On average, all monitoring locations are within the TWQO for irrigation, with a maximum recorded Al concentration of 9 mg/ℓ noted at VDD7.

On average all monitoring locations have a pH > 6.5, and all monitoring locations exceed the TWQO for aquatic ecosystems of 0.01 mg/ℓ or less.

Elevated aluminium concentrations may be due to agricultural activities in the surrounding area.

Manganese (Mn)

Manganese (Mn) is a relatively abundant element which constitutes 0.1% of the earth's crust. The median concentration in fresh water is 8 µg/ℓ, with a range of 0.02 to 130 µg/ℓ (DWAF, 1996).

On average, elevated manganese concentrations were noted at monitoring locations. VDD2, VDD6, VDD7, VDD18, VDD20, VDD22 and VDD23.

Elevated manganese concentrations may be due to agricultural activities and mining activities in the surrounding area.

Other constituents

Analysis of other constituents in **Table 10-9** indicates the following:

- On average, sodium (Na) concentrations at the majority of locations was within range when compared to the SANS241 guidelines, except for VDD2, which can be attributed to mining in the area;
- The maximum recorded Nitrate (NO_3) concentrations were elevated at monitoring points VDD2, VDD7, and VDD11, when compared to the RQOs, which may be attributed to mining activities in the area;
- Phosphate (PO_4) concentrations on average, as well as maximum recorded, at monitoring points VDD6, VDD8, VDD12, VDD20 and VDD23 were elevated when compared to the RQOs, which may be attributed to farming activities in the area;
- Although there are no guideline limitations provided for suspended solids, several points show on average elevated suspended solids and highly elevated suspended solids for the maximum recorded at the monitoring points VDD2, VDD6, VDD20, VDD22 and VDD23. These are all within the mining area and therefore may be attributed to mining in the area.

Therefore, in terms of surface water quality within the study area there are visible impacts associated with mining activities. This is also observed in the surface water quality upstream of the VDDC section indicating an existing impact as a result of land use activities.

South32 has developed the Middelburg Water Treatment Plant at the Ifalethu Colliery to address impacts as a result of their mining activities. Similarly, provision has been made for the development of a modular WTP for the treatment of surplus mine impacted water to the RQO before it is discharged back into the Olifants River system, should it be required.

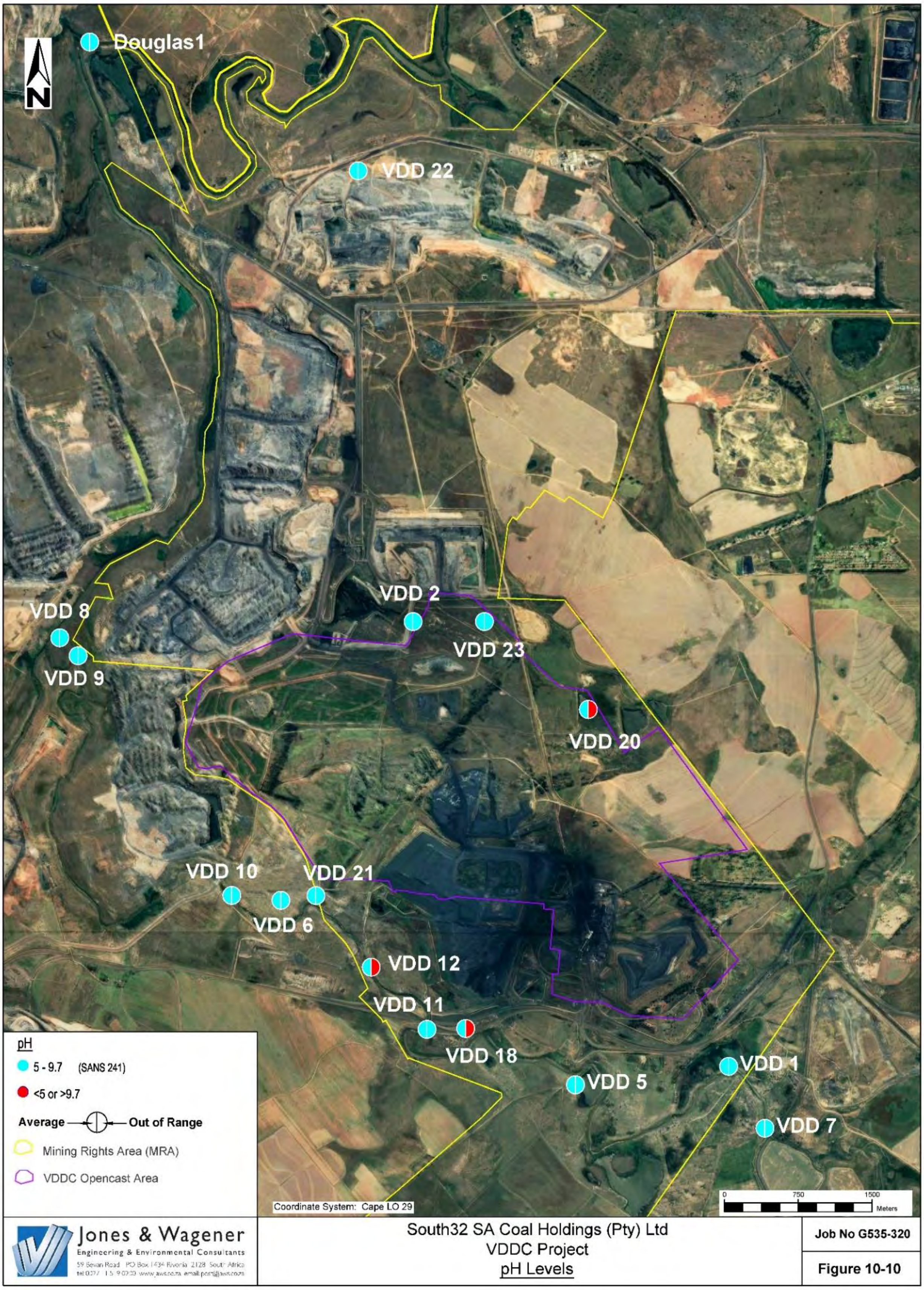


Figure 10-11: pH levels measured at surface water monitoring locations (J&W, 2019b)

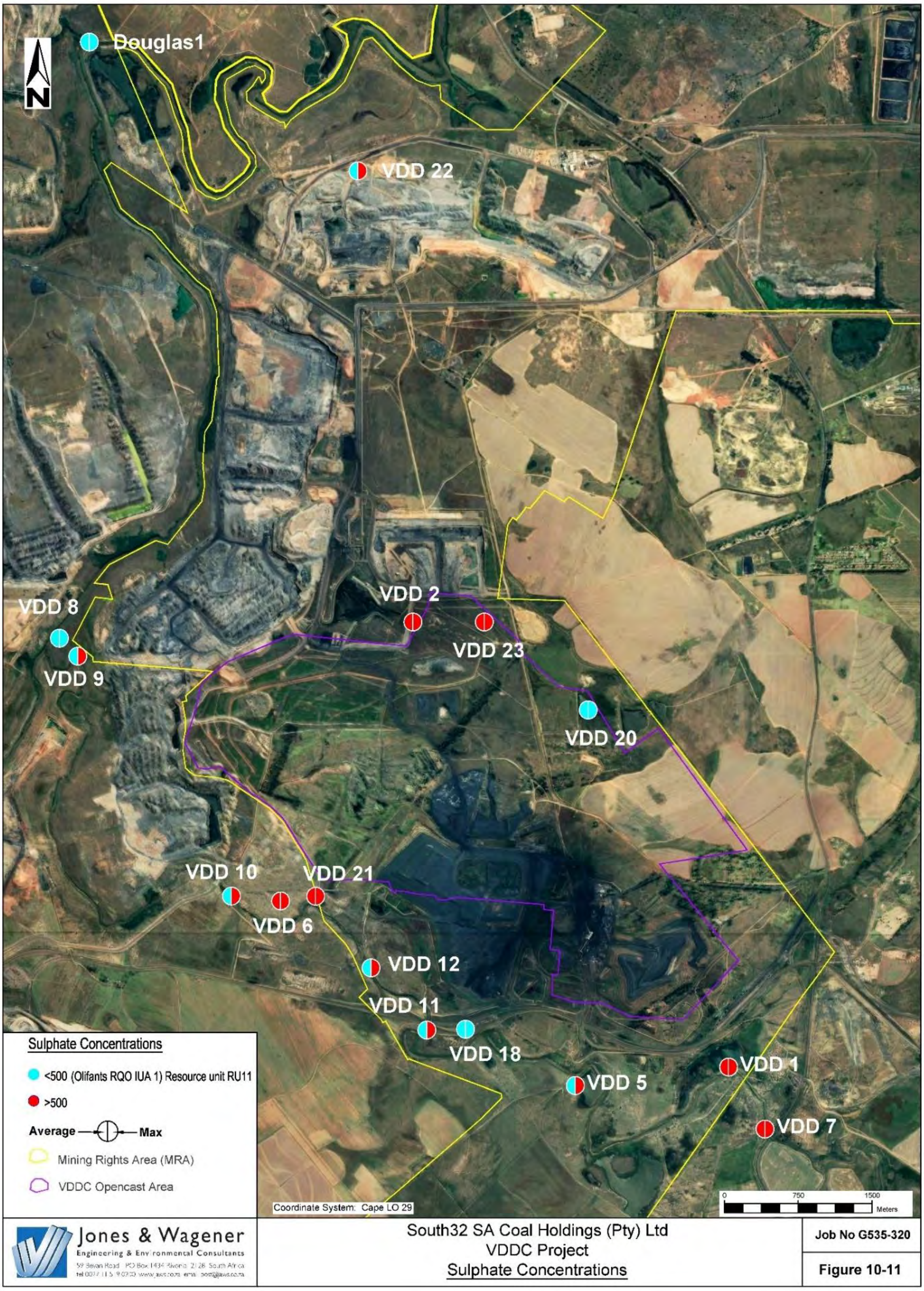


Figure 10-12: **Sulphate (SO_4) concentrations measured at surface water monitoring locations (J&W, 2019b)**

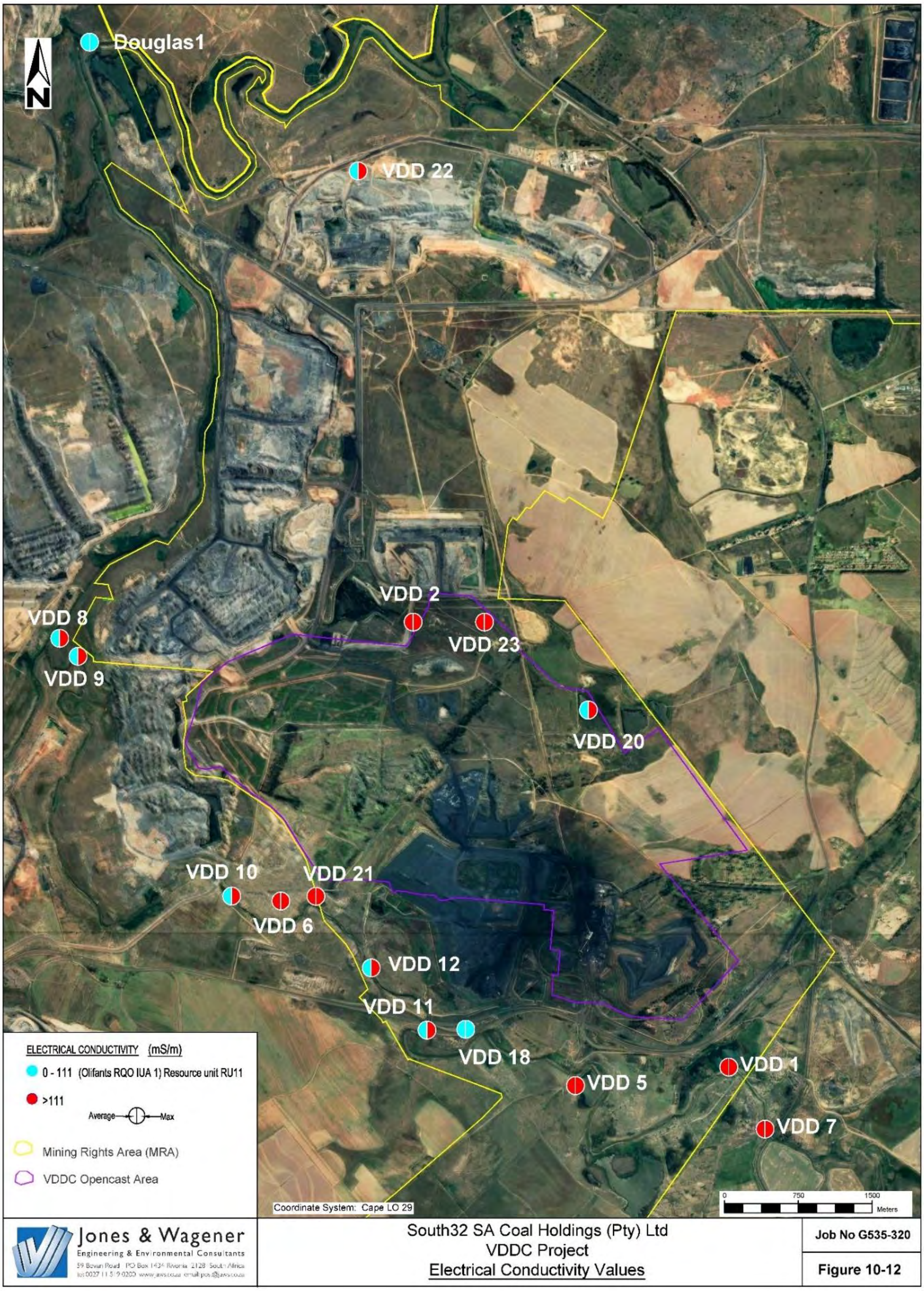


Figure 10-13: Electrical conductivity (EC) levels measured at surface water monitoring locations (J&W, 2019b)

10.1.1.6. Wetlands

An assessment was done by The Biodiversity Company (TBC) of the wetland systems that will either be directly impacted on by the proposed project or are at risk due to the systems being downslope of the project area[8]. A copy of the report is attached in **Appendix 8.7.**

Delineated wetlands

The following wetland hydrogeomorphic (HGM) units have been identified on site:

- Riparian area
- Channelled Valley Bottom;
- Unchannelled Valley Bottom;
- Hillslope Seep;
- Depression (Pan).

In addition to the abovementioned delineations and classifications, the following systems were identified, delineated and have been defined according to the following:

- *Artificial systems:* These systems are artificial systems, man-made and are associated with pollution control dams or stormwater ponds. These systems are often characterised by hydrophytes but are not natural wetland systems;
- *Dams:* These are man-made structures within channelled systems which have contributed to the modified status and functioning of these systems. Dams are considered as a driver of change for the respective system;
- *Previously mined:* These areas have been mined in the past. These areas are now waterlogged, and are also not considered to be natural wetland systems;
- *Remnant wetland:* This system is no longer considered to be a wetland and has been directly impacted on by mining and lost as a result. This remnant system was associated with the flooding features of the Olifants River, but owing to the diversion channel that was constructed the remnant system was isolated from the river with wetland drivers being removed as a result.

The extent of delineated wetlands is indicated on **Figure 10-14**.

The ecological assessment for this project only considered the natural wetland systems that would be directly impact on by the proposed project and the associated features (i.e. excluding the artificial system, remnant wetlands, dams and previously mined watercourses), which comprise of the following wetland systems:

- HGM1: Channelled valley bottom wetland along Olifants River;
- HGM2: Unchannelled valley bottom wetland representing the system previously known as the Vleishaft tributary, which now forms part of the dirty water management system at the mine;
- HGM3: Hillslope seepage wetland to the east, feeding into HGM2
- HGM4: Seepage wetland to the southeast

[8] The riparian area has been delineated for the project, and an ecological assessment of the Olifants River included in the aquatic assessment component of the project.

- HGM5: Small depression (pan) to the west of HGM4;
- HGM6: Depression to the north of the VDDC area into which treated water from the modular WTP will be discharged.

Wetland Present Ecological State (PES)

The wetlands have all been impacted on by the historical and current (predominantly) mining operations in the area, with local agricultural activities also impacting on the systems, specifically the systems associated with the Olifants River. The mining operations have altered the topography of the landscape, resulting in altered flow dynamics of the catchment areas. To manage water in these areas, watercourses have been diverted, trenches dug to intercept flows, and dams constructed to attenuate flows, all having an impact on the hydrology of these systems. The development of the catchment area and the altered hydrology have modified the geomorphology of these systems. These modifications include encroachment of wetland, reducing the system extent, and increased wetland area extent due to storm water inputs. Vegetation has also been altered, largely due to vegetation being cleared and the establishment of alien vegetation in the area.

A summary of key aspects that have contributed to the impacted state of the wetlands includes the following:

- The operation, decommissioning and rehabilitation of mining areas within the project area;
- Agricultural cultivation on the periphery of the project area, and south of the Olifants River;
- Infrastructure development within the catchment area, including roads, dams and crossings;
- The water management measures within the project area, including diversions, storm water management and dams; and
- The establishment of alien vegetation (TBC, 2018).

The PES ratings are indicated in **Table 10-10** and shown on **Figure 10-16**. The PES of wetlands that may be impacted as a result of the proposed infrastructure development is rated as category C (moderately modified) to category D (largely modified).

Table 10-10: Wetland PES for the assessed systems (TBC, 2019)

Wetland	Hydrology		Geomorphology		Vegetation	
	Rating	Score	Rating	Score	Rating	Score
Channelled Valley Bottom (HGM 1)	C: Moderately Modified	3.5	C: Moderately Modified	3.0	C: Moderately Modified	3.8
Overall PES Score	3.4		Overall PES Class		C: Moderately Modified	
Unchannelled Valley Bottom (HGM 2)	D: Largely Modified	4.7	D: Largely Modified	5.2	C: Moderately Modified	3.5
Overall PES Score	4.5		Overall PES Class		D: Largely Modified	
Hillslope Seep (HGM 3)	C: Moderately Modified	3.5	C: Moderately Modified	2.2	C: Moderately Modified	2.6
Overall PES Score	2.9		Overall PES Class		C: Moderately Modified	
Hillslope Seep (HGM 4)	E: Seriously Modified	6.5	C: Moderately Modified	2.8	E: Seriously Modified	7.2
Overall PES Score	5.6		Overall PES Class		D: Largely Modified	
Depression (Pan) (HGM 5)	C: Moderately Modified	3.5	C: Moderately Modified	2.5	C: Moderately Modified	3.5
Overall PES Score	3.2		Overall PES Class		C: Moderately Modified	
Depression (Pan) (HGM 6)	D: Largely Modified	4.7	C: Moderately Modified	2.8	C: Moderately Modified	2.5
Overall PES Score	3.5		Overall PES Class		C: Moderately Modified	

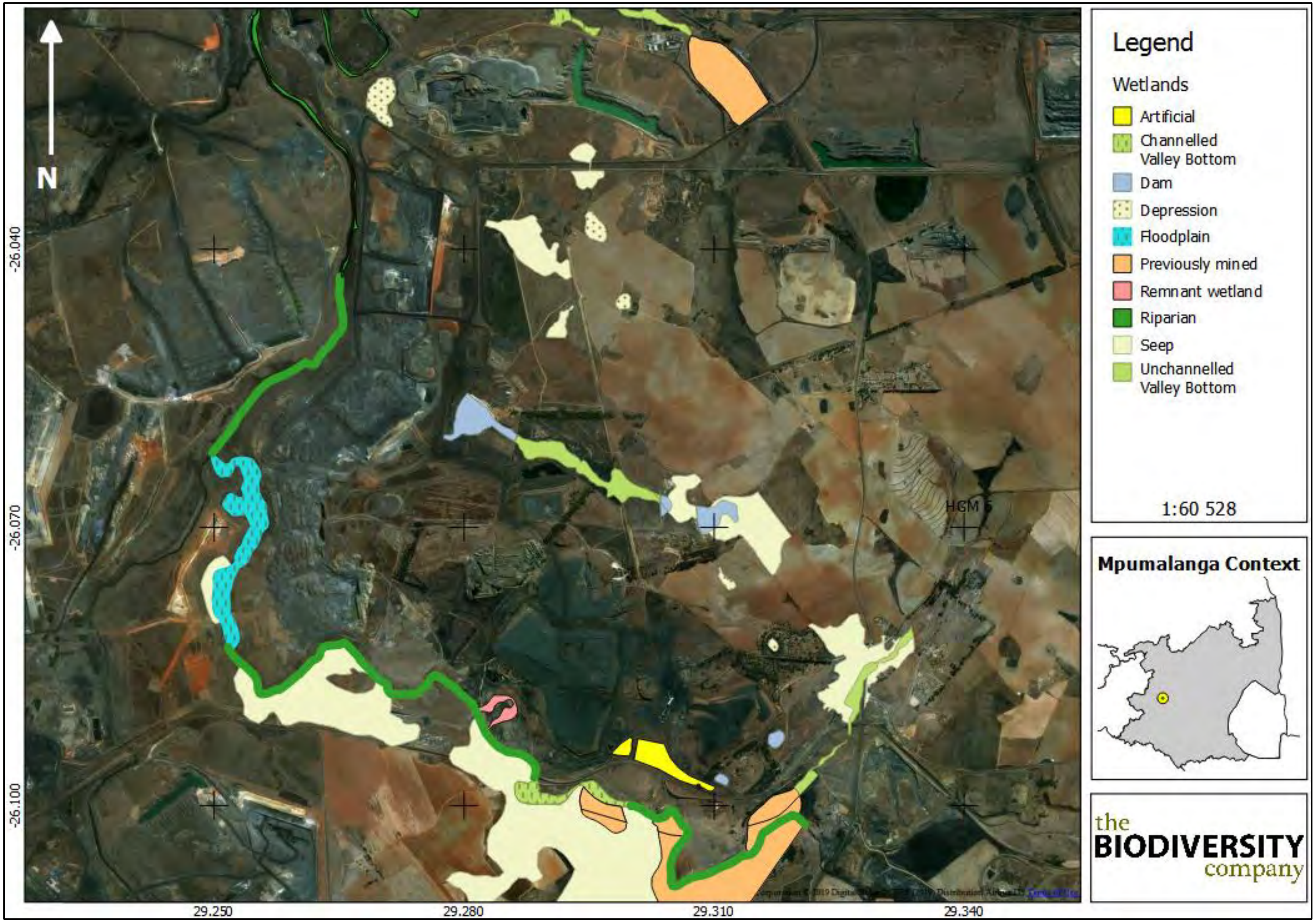


Figure 10-14: **Potential wetlands identified on site (TBC, 2019)**

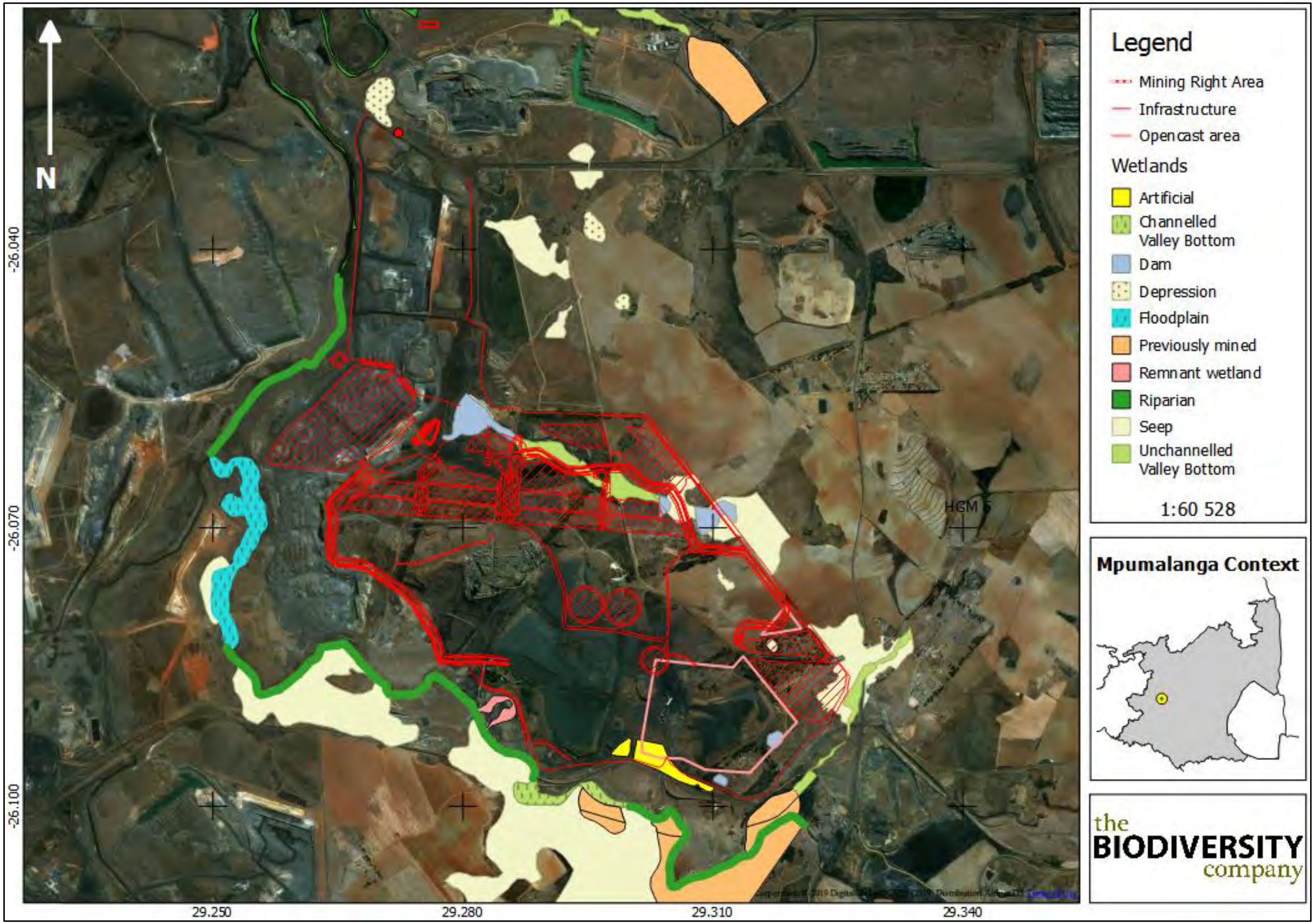


Figure 10-15: Wetland areas in relation to the VDDC Project infrastructure (TBC, 2019)

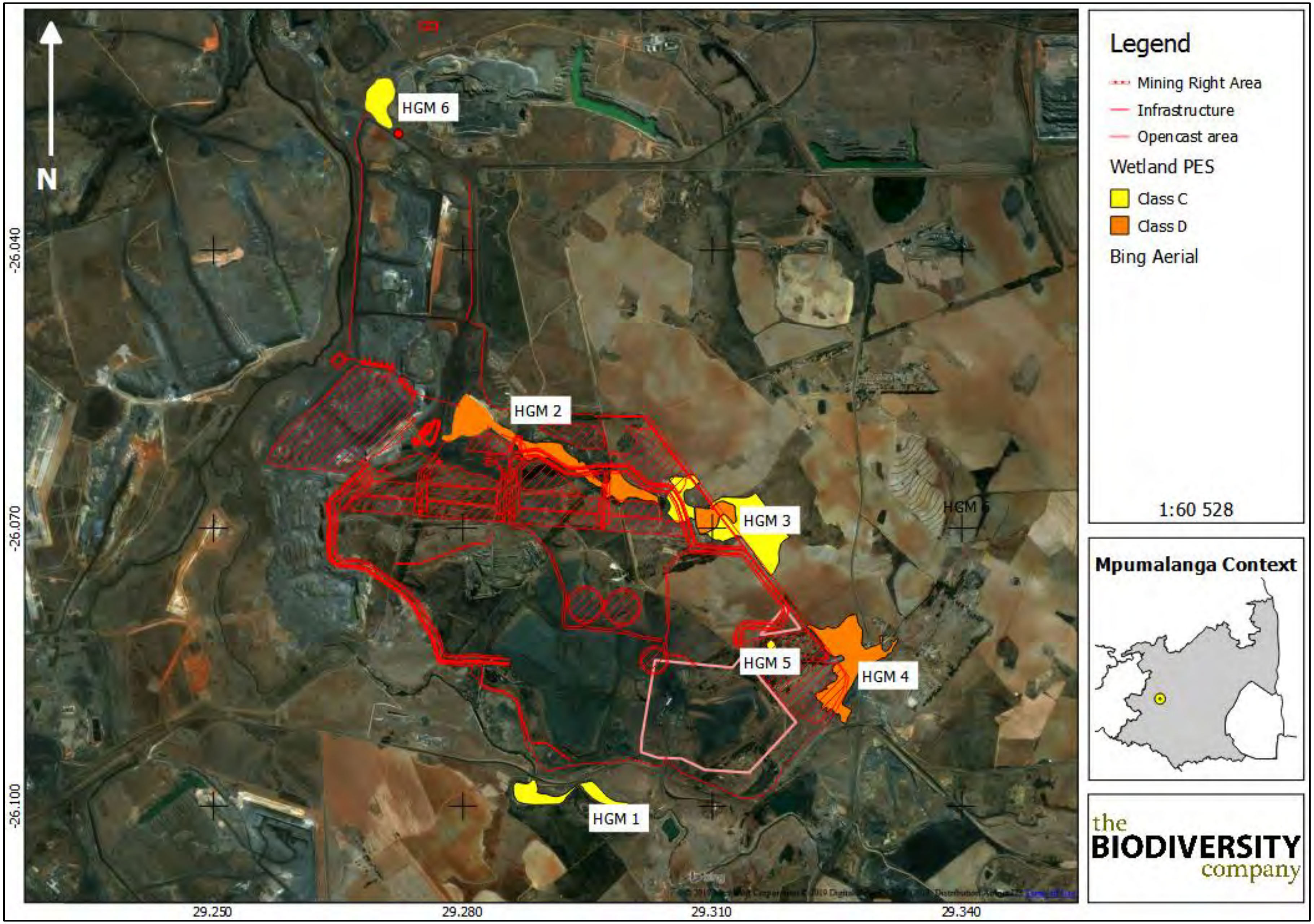


Figure 10-16: **Present Ecological State (PES) of wetlands (TBC, 2019)**

Wetland Ecosystem Services

The assessment of the ecosystem services supplied by the identified wetlands was conducted per the guidelines as described in WET-EcoServices. An assessment was undertaken that examines and rates the services according to their degree of importance and the degree to which the services are provided in **Table 10-11**.

Table 10-11: Classes for determining the likely extent to which a benefit is being supplied (TBC, 2019)

Score	Rating of likely extent to which a benefit is being supplied
< 0.5	Low
0.6 - 1.2	Moderately Low
1.3 - 2.0	Intermediate
2.1 - 3.0	Moderately High
> 3.0	High

All of the wetland units scored an overall intermediate service rating, with the unchanneled valley bottom (HGM 2) and northernmost depression (HGM 6) system having an overall moderately low service rating. The highest ratings (moderately high) for all the HGM units is associated with the indirect benefits, specifically for the enhancement of water quality, streamflow regulation and the enhancement of biodiversity. No services provided by the wetlands provide a high level of benefit, as can be seen in **Table 10-12**.

Table 10-12: Level of ecosystem benefits provided by the assessed wetland units

Wetland Unit					HGM1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecosystem Services Supplied by Wetlands	Indirect Benefits	Regulating and supporting benefits	Flood attenuation		1.7	2.1	1.1	1.4	1.3	1.6
			Streamflow regulation		2.1	2.2	2.8	1.3	2.7	1.4
			Water Quality enhancement benefits	Sediment trapping	1.5	1.8	2.4	1.4	2.5	1.5
				Phosphate assimilation	1.3	1.7	2.5	1.8	2.4	1.6
				Nitrate assimilation	1.3	1.7	2.8	1.7	2.7	1.6
				Toxicant assimilation	1.4	1.6	2.6	1.8	2.6	1.7
				Erosion control	1.1	1.6	2.2	1.4	1.5	1.5
			Carbon storage		1.5	1.3	1.7	1.6	0.7	1.4
	Direct Benefits	Biodiversity maintenance			1.2	1.1	3.0	2.0	1.8	2.0
		Provisioning benefits	Provisioning of water for human use		1.8	0.6	1.8	0.8	1.6	0.6
			Provisioning of harvestable resources		1.1	0.2	0.8	1.0	0.8	0.8
			Provisioning of cultivated foods		1.5	0.0	1.8	0.2	1.8	0.0

Wetland Unit				HGM1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
		Cultural benefits	Cultural heritage	1.1	0.0	0.0	0.0	0.0	0.0
			Tourism and recreation	1.6	0.0	0.9	0.8	1.0	0.6
			Education and research	1.7	0.0	0.8	1.1	0.8	0.5
Overall				21.9	15.9	27.1	20.2	23.9	16.8
Average				1.5	1.1	1.8	1.3	1.6	1.1

Ecological Importance and Sensitivity

The method used for the Ecological Importance and Sensitivity (EIS) determination was adapted from the method as provided by DWS (1999) for floodplains. The method takes into consideration PES scores obtained for WET-Health as well as function and service provision to enable the assessor to determine the most representative EIS category for the wetland feature or group being assessed. A series of determinants for EIS are assessed on a scale of 0 to 4, where 0 indicates no importance and 4 indicates very high importance. The mean of the determinants is used to assign the EIS category as listed in **Table 10-13**.

Table 10-13: Description of Ecological Importance and Sensitivity categories (TBC, 2019)

EIS Category	Range of Mean	Recommended Ecological Management Class
Very High:	3.1 to 4.0	Wetlands that are considered ecologically important and sensitive on a national or even international level. The biodiversity of these systems is usually very sensitive to flow and habitat modifications. They play a major role in moderating the quantity and quality of water of major rivers
High	2.1 to 3.0	Wetlands that are considered to be ecologically important and sensitive. The biodiversity of these systems may be sensitive to flow and habitat modifications. They play a role in moderating the quantity and quality of water of major rivers.
Moderate	1.1 to 2.0	Wetlands that are considered to be ecologically important and sensitive on a provincial or local scale. The biodiversity of these systems is not usually sensitive to flow and habitat modifications. They play a small role in moderating the quantity and quality of water of major rivers.
Low Marginal	< 1.0	Wetlands that are not ecologically important and sensitive at any scale. The biodiversity of these systems is ubiquitous and not sensitive to flow and habitat modifications. They play an insignificant role in moderating the quantity and quality of water of major rivers.

The EIS assessment was applied to the wetland units in order to assess the levels of sensitivity and ecological importance of the systems. The results of the assessment are shown in **Table 10-14** and **Figure 10-17**. Authorisation was granted in 2007 for the mining of HGM 2. The EIS for the two (2) valley bottom systems and HGM 3 were rated as high. The EIS of the remaining wetland systems were rated as moderate.

The high EIS rating is partially attributed to the location of the project area within the Olifants River catchment. The catchment is under stress due to mining, power stations, urbanisation and agriculture, and due to the ability of these systems to contribute towards water quality enhancement and regulation, a high importance and conservation value is placed on these systems. The following findings were also considered for the EIS classification:

- According to the Mpumalanga Highveld Wetlands (MPHG) dataset, the wetlands associated with the project area are predominantly in a moderately to largely modified state. In addition to this, no true ecological priority wetland systems are expected for the area;
- The moist grassland is regarded as having a high sensitivity due to its role as being the only remaining habitat, foraging source and migratory corridor for various faunal species present;
- None of the birds were species of conservation concern (SCC). Based on the various wetland habitats encountered in the area, the likelihood that bird SCC occur there is rated as moderate to high;
- Overall, mammal diversity in the project area was moderate to high, with eight (8) mammal species being recorded during a survey conducted in August 2018. Two (2) mammal SCC were recorded in the project area;
- One (1) amphibian species was recorded in the project area during the August 2018 survey based on visual observations.
- The hydrological and direct human benefits were rated as moderately low for all the wetland units (TBC, 2019).

Table 10-14: EIS for the assessed wetland units (TBC, 2019)

Wetland Importance and Sensitivity	HGM 1	HGM 2	HGM 3	HGM 4	HGM 5	HGM 6
Ecological Importance & Sensitivity	2.2	2.3	2.3	1.6	1.7	1.7
Hydrological / Functional Importance	1.5	1.8	2.3	1.6	2.0	1.6
Direct Human Benefits	1.4	1.6	1.1	1.6	1.0	0.4

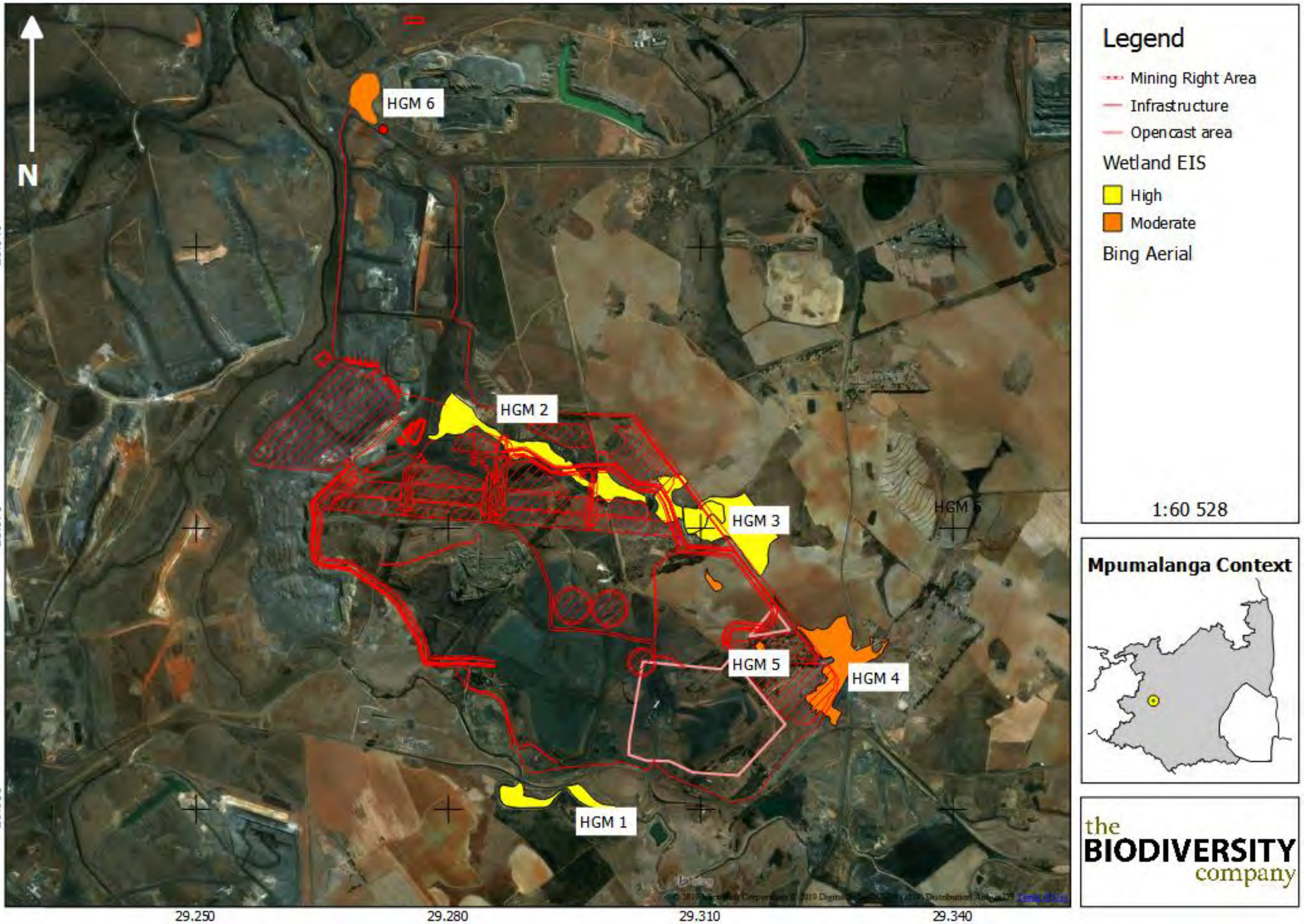


Figure 10-17: Ecological Importance and Sensitivity (EIS) of wetlands (TBC, 2019)

10.1.1.7. Aquatic Ecosystems

In-situ water quality

In situ water quality analysis results from the August 2018 survey are provided in **Table 10-15.** The sampling sites selected were located upstream (O1) to downstream (O5) of VDDC on the Olifants River and are shown in **Figure 10-18.**

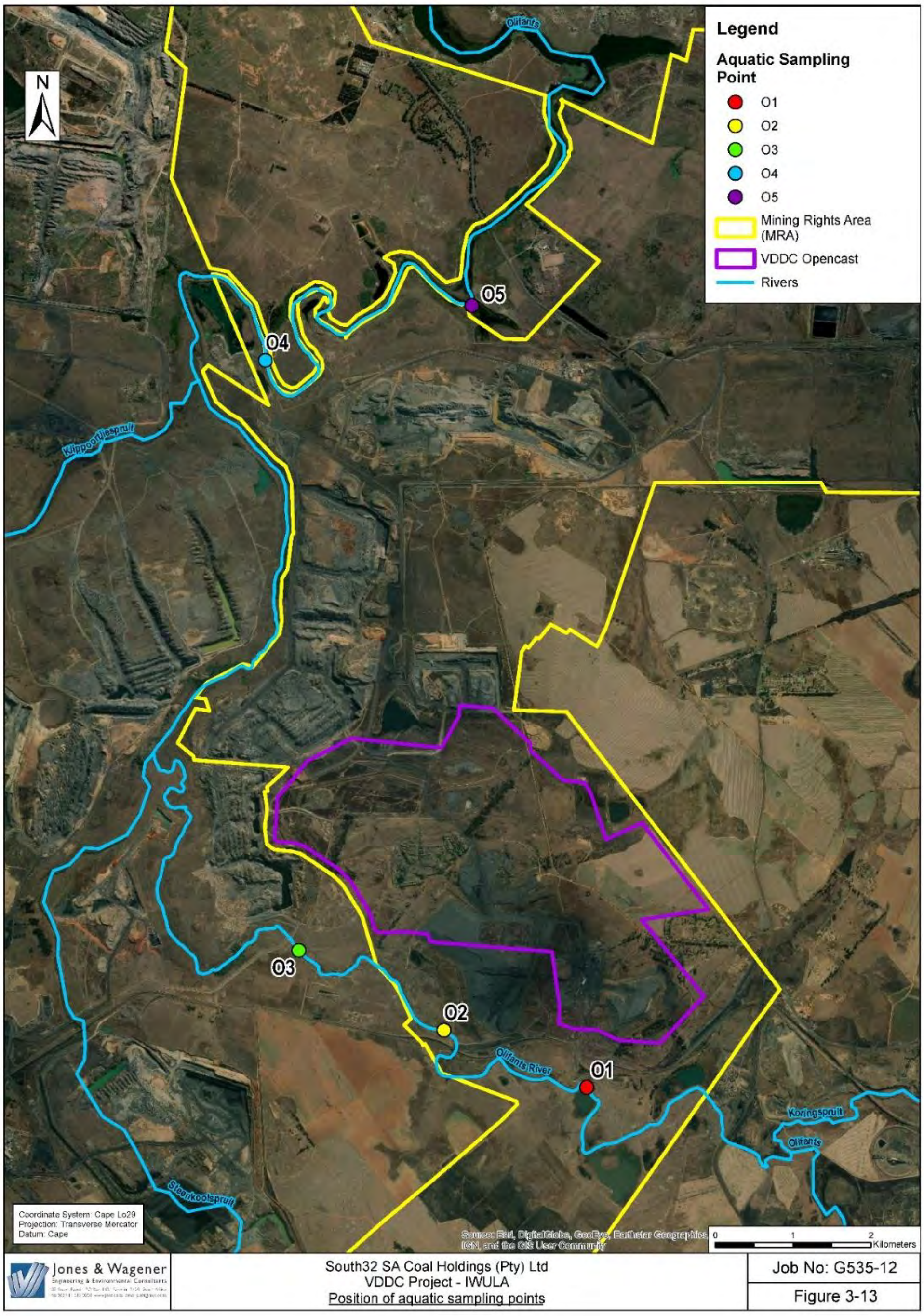


Figure 10-18: Position of aquatic sampling points used in baseline assessment (J&W, 2019g)

Table 10-15: In situ Water Quality Results of August 2018 sampling (TBC, 2018)

Site		pH	EC (mS/m)	Dissolved Oxygen (mg/ℓ)	Temperature (°C)
TWQR*		6.5-9.0	N/A	>5.00	5-30
O1	On Olifants River, upstream	7.8	97	5.6	15
O2	On Olifants River	7.9	90	6.4	15
O3	On Olifants River	8.0	113	6.8	14
O4	On Olifants River, adjacent/downstream	8.3	76	6.1	18
O5	On Olifants River, downstream	7.4	79	6.4	17
*TWQR – Target Water Quality Range for Aquatic Ecosystems					

The results of the *in situ* water quality assessment indicated pH ranges from 7.4 at O5 to 8.3 at O4. The levels of pH were within the recommended guidelines values for aquatic ecosystems of between 6.5-9.0. These guideline values were selected considering their direct applicability to local aquatic ecology. The levels of EC were recorded to range from 76 mS/m at O4 to 113 mS/m at O3 indicating the level of dissolved solids. Although no limits have been prescribed for the concentration of dissolved solids and their effect on aquatic ecology, elevated concentrations of dissolved solids are indicative of catchment land use modification. The alteration of land use in the catchment exposes soils and various minerals to increased weathering which typically results in an increase in dissolved solid concentrations in watercourses. Based on the geomorphological layout of the considered watercourse and the extensive coal mining and power generation activities within the catchment area, the levels of dissolved solids would be considered to be in excessive concentration. The spatial trends of dissolved solids indicated a decrease downstream of the confluence with the Steenkoolspruit (B11F-1273) at the monitoring point O4. The decrease can be attributed to a water transfer scheme from an unknown origin. The levels of dissolved oxygen were found to range from 5.6 mg/ℓ at O1 to 6.8 mg/ℓ at O3. The levels of dissolved oxygen would not present an adverse condition to aquatic ecology. The water temperatures were found to range from 14 °C at O3 to 18 °C at O4. The water temperatures observed during this study would not negatively impact on local aquatic ecology (TBC, 2019).

Intermediate Habitat Integrity Assessment

The results of the Intermediate Habitat Integrity Assessment (IHIA) for the Olifants River indicated seriously modified (class E) instream habitat. The degree of modification can be attributed to several factors including flow, bed and channel modification. The modification of the various components of the instream habitat can be attributed to historical activities such as river diversions for open pits and incline shafts adjacent to the river channel. Riparian habitats in the Olifants River reach were found to be largely modified (class D). Stands of alien invasive *Populus alba* (Poplar) were observed in several areas in proximity to the river reach. In addition, stands of alien invasive *Myriophyllum aquaticum* (Parrots feather) were also observed in the marginal zones of the Olifants River (TBC, 2018). Results for the instream intermediate habitat integrity assessment are indicated in **Table 10-16.**

Table 10-16: Instream Intermediate Habitat Integrity Assessment for the Olifants River (TBC, 2018)

Criterion	Average Score	Score
Instream		
Water abstraction	5.00	2.80
Flow modification	21.67	11.27
Bed modification	20.00	10.40
Channel modification	21.67	11.27
Water quality	15.00	8.40
Inundation	20.00	8.00
Exotic macrophytes	13.33	4.80
Exotic fauna	10.00	3.20
Solid waste disposal	5.00	1.20
Total Instream Score		38
Instream Category		class E
Riparian		
Indigenous vegetation removal	13.33	6.93
Exotic vegetation encroachment	15.00	7.20
Bank erosion	11.67	6.53
Channel modification	18.33	8.80
Water abstraction	5.00	2.60
Inundation	16.67	7.33
Flow modification	16.67	8.00
Water quality	15.00	7.80
Total Riparian Score		44
Riparian Category		class D

Macroinvertebrate Community Assessment

The results of the macroinvertebrate assessment using the South African Scoring System Version 5 (SASS5) for the sites located in the Olifants River are presented in **Table 10-17**. The results indicated SASS5 scores which ranged from 55 at site O5, to 103 at site O3. The number of taxa obtained at the sites ranged from 13 at site O5, to 22 at site O3. The average score per taxon (ASPT) values obtained at the sites ranged from 4.2 at sites O2 and O4, to 4.6 at site O3. The ecological classes were found to range from class D (largely modified) at sites O1, O4 and O5, to class B at site O3 (TBC, 2019).

Table 10-17: Macroinvertebrate Assessment Results Recorded in the Olifants River (TBC, 2018)

Site	SASS5	Taxa	ASPT	*Class (Dallas, 2007)
O1	61	14	4.3	class D*
O2	76	18	4.2	class C
O3	103	22	4.6	class B
O4	64	15	4.2	class D*
O5	55	13	4.3	class D*
*Highveld Lower Ecoregion **SASS5 Interpretation Not Applicable due to Impoundment Conditions				

A small component of the taxa sampled during the assessment were moderately sensitive to water quality impairment, these included *Atyidae*, *Aeshnidae* and *Ecnomidae*. However, the invertebrate assemblage at the sites were largely tolerant to water quality impairment. There were no taxa sampled which would represent sensitive families during the survey. It is noted that the SASS5 interpretation is not applicable at sites classified as impoundments. Therefore, the SASS5 interpretations at O1, O4 and O5 are not applicable. Despite this, the standard methods can still serve to effectively monitor the watercourse for future monitoring assessments. The results of the reach based Macroinvertebrate Response Assessment Index (MIRAI) is presented in **Table 10-20**.

Table 10-18: Macroinvertebrate Response Assessment Index for the Olifants River reach based on results obtained in August 2018 (TBC, 2018)

Invertebrate Metric Group	Score Calculated
Flow Modification	47
Habitat	43
Water Quality	28
Ecological Score	39
Invertebrate Category	class D/E

The results of the reach based MIRAI indicate a largely/seriously modified (class D/E) ecological category. The primary driver for the impaired conditions can be attributed to water quality modification. This result confirms the water quality results obtained during this study. It is likely that diffuse runoff from extensive coal mining activities compounded by urban and agricultural runoff has negatively impacted on the water quality of the Olifants River. Further, habitat quality in the watercourse was also determined to be negatively impacted. This has cumulatively impacted on the local invertebrate assemblage in that littoral habitats such as marginal vegetation in current has been lost due to inundation. This has resulted in the reduced Frequency of Occurrence of invertebrate families across the considered river reach (TBC, 2018).

Fish community

No listed fish species are expected in the considered river reach. Of the thirteen expected indigenous fish species in the river reach, eight have been captured in the river reach since 2001 (TBC, 2018).

Overall Present Ecological Status of the Olifants River

The results of the PES assessment derived seriously modified (class E) conditions in the Olifants River reach considered in this assessment. Instream habitat modification has resulted in modified biological responses. Instream habitat modification can be attributed to extensive coal mining and power generation activities in the Olifants River catchment compounded by diffuse agricultural and urban runoff. The results of the PES assessment for the Olifants River are provided in **Table 10-19.**

Table 10-19: Present Ecological Status of the Olifants River assessed in the August 2018 survey (TBC, 2018)

Aspect Assessed	Ecological Category
Instream Ecological Category	38
Riparian Ecological Category	44
Aquatic Invertebrate Ecological Category	39
Ecostatus	class E

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). 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, 2004 (NEM:BA) biodiversity goals.

Figure 10-19 shows the location of the VDDC study area in relation to wetland and river FEPAs. It can be seen that the study area overlaps with wetland areas in the northern-, central- and southern portions. No FEPA rivers are located within the VDDC project area.

The central wetland area (Vleishaft tributary) is shown as a non-FEPA river. This system was authorised to be mined in 2007 and has been partially mined through at the SKS section. The southern portion of the VDDC project area and the infrastructure footprint area, are situated adjacent to two perennial rivers – the Olifants and the Koringspruit. However, these rivers are classified as non-FEPA rivers (TBC, 2019).

Mpumalanga Biodiversity Sector Plan Freshwater Assessment

The Mpumalanga Biodiversity Sector Plan (MBSP) Freshwater Assessment outlines priority areas for freshwater biodiversity in Mpumalanga. The resulting features are predominantly derived from the NFEPA products and layers include:

- Critical Biodiversity Area (CBA) Rivers, which is based on FEPA and free-flowing rivers;
- CBA Wetlands, which is based on FEPA wetlands;
- CBA Aquatic species, relating to Odonata & crab taxa of conservation concern only;
- Ecological Support Area (ESA) Wetland Clusters, which is based on FEPA wetland clusters; and
- ESA Wetlands, relating to all other non-FEPA wetlands.

The larger VDDC study area in relation to the MBSP Freshwater Assessment is indicated **Figure 10-20** and overlaps with the following areas:

- ESA: Wetlands;
- Heavily Modified Areas (HMAs); and
- Other Natural Areas (ONAs) (TBC, 2019).

It is important to note that the ESA wetlands in the MBSP are based on non-FEPA wetlands. The central wetland area (Vleishaft tributary) is indicated as an ESA: Wetlands. This system has however been partially mined based on previous authorisations.

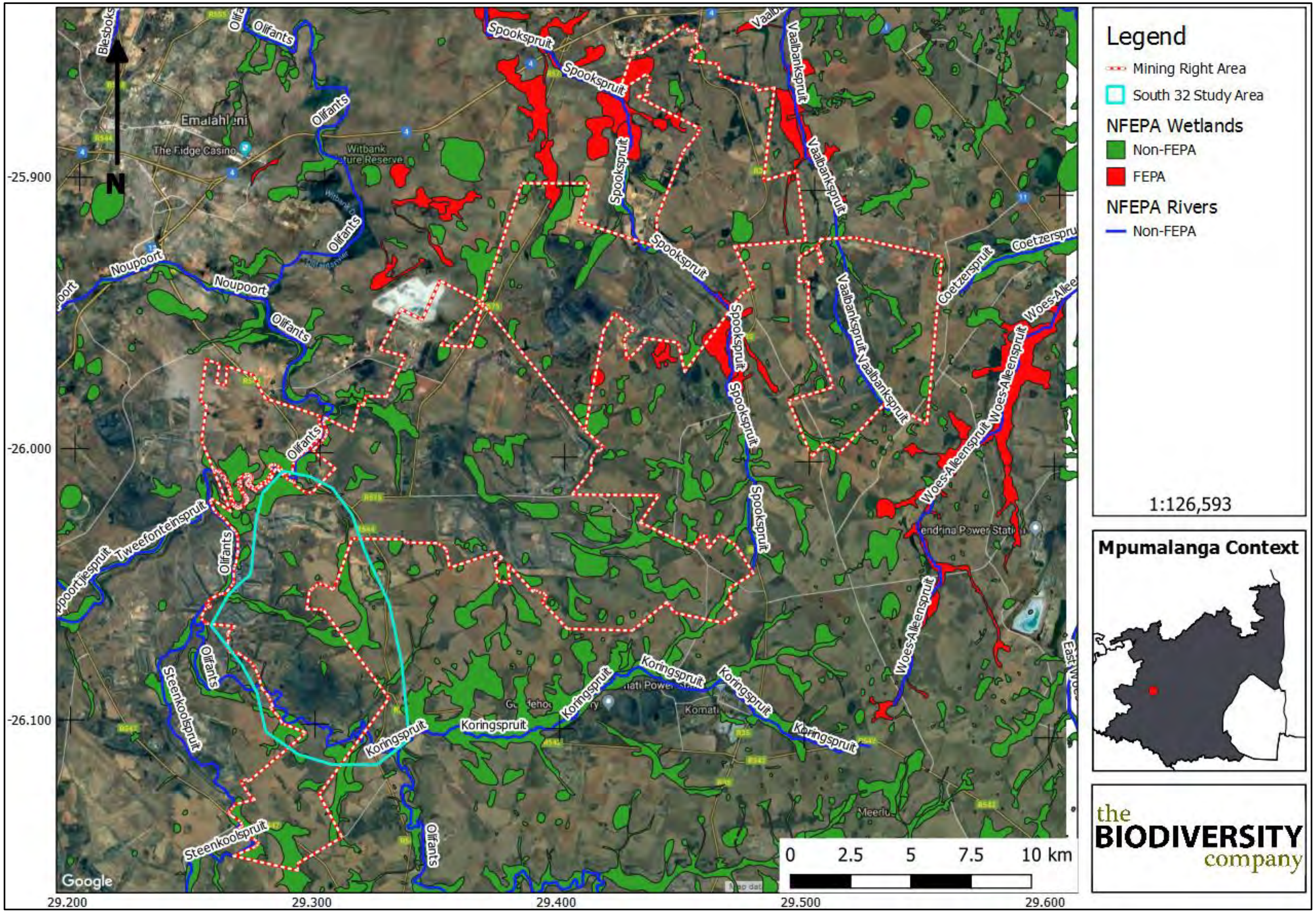


Figure 10-19: VDDC project area in relation to the National Freshwater Ecosystem Priority Areas (TBC, 2019)

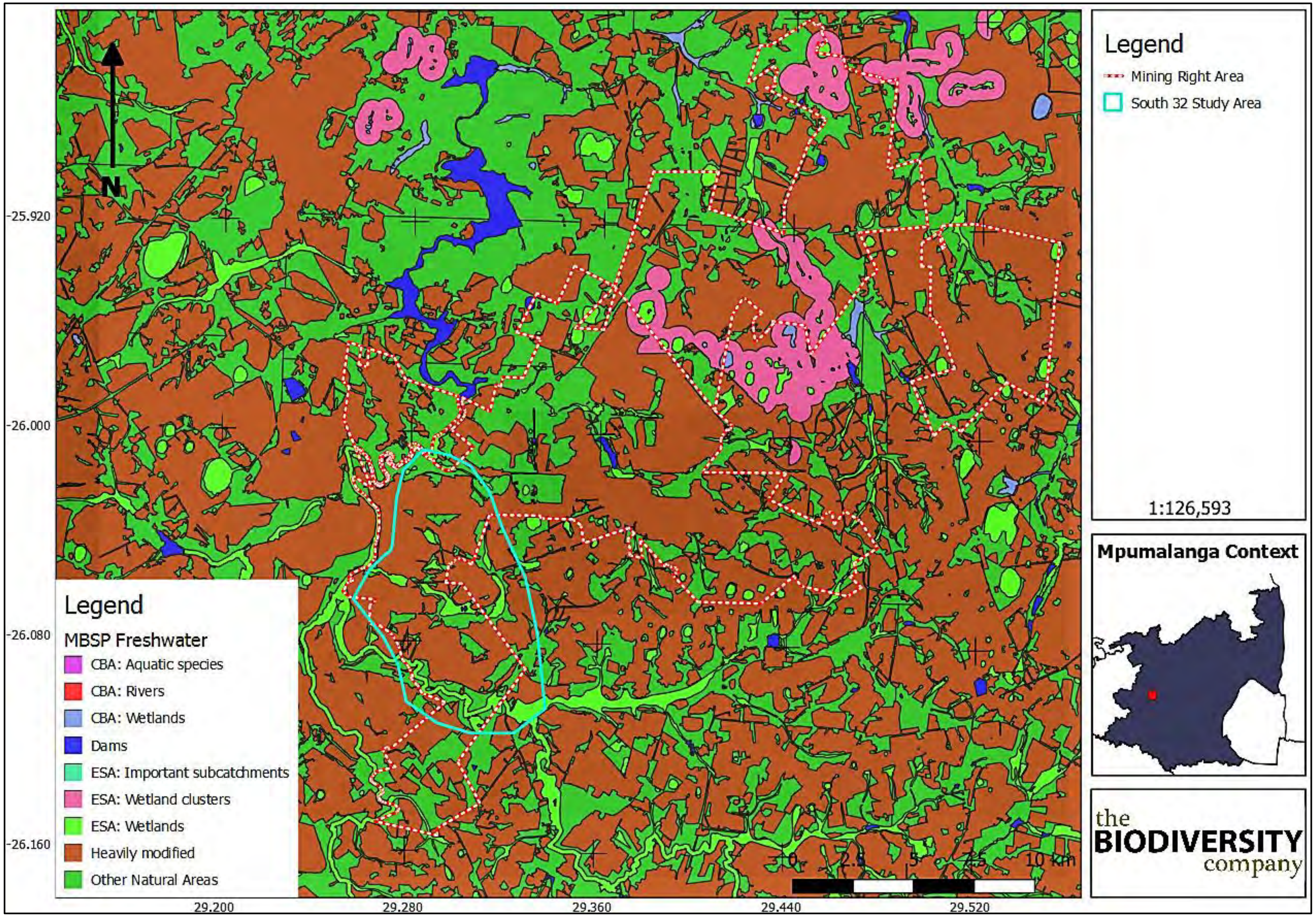


Figure 10-20: VDDC Project area in relation to the MBSP Freshwater Assessment (TBC, 2019)

10.1.1.8. Groundwater

A detailed groundwater assessment was undertaken by J&W and a copy of the report is attached in **Appendix 8.9**.

Aquifer types

Three aquifers typically underlie the project area. These are:

- A shallow perched aquifer in the lower lying areas or depressions where a low, permeable, clayey ferricrete layer is overlain by alluvium and transported hillwash material. Wetlands commonly occur in these areas;
- A weathered aquifer, which extends to depths of approximately 20 metres below surface (mbs), depending on the depth of weathering. In the study area, this aquifer is expected to be clay-rich, with comparatively low aquifer parameters. This aquifer is therefore not considered to be a major aquifer, although it does play a role in recharge to the deeper hard-rock aquifer; and
- A deeper fractured rock aquifer, which is characterised by fractures, faults and contact zones with dolerite intrusions in the Karoo sediments. This aquifer underlies the weathered aquifer and extends down to the bottom of the No.2 coal seam (J&W, 2019a).

Aquifer classification

Based on information collected during the hydrocensus it can be concluded that the aquifer system in the study area can be classified as a "Minor Aquifer System", as the local population is not dependent on groundwater.

Aquifer parameters

The calculated mean aquifer parameters for the boreholes tested are presented in **Table 10-20.** Transmissivity values of less than 1.0 m^2/day are typical of Karoo rocks. Within these aquifers, the groundwater can either be found in fractures or it can exist as inter-granular groundwater.

Table 10-20: Mean aquifer parameters measured for boreholes in 2016 (J&W, 2019a)

Estimated Mean Parameter	Transmissivity (T)	Hydraulic Conductivity (K)	Storativity
	(m^2/day)	(m/day)	-
Weathered Aquifer			
Geometric Mean (2015)	1.0	0.080	N/A
Harmonic Mean (2015)	0.65	0.050	N/A
Calculated J&W Mean	0.83	0.070	N/A
JMA Slug Tests (2011)	-	0.040	-
Fractured Aquifer			
Geometric Mean (2015)	1.1	0.030	N/A
Harmonic Mean (2015)	0.73	0.020	N/A
Calculated Mean	0.92	0.030	N/A

Estimated Mean Parameter	Transmissivity (T)	Hydraulic Conductivity (K)	Storativity
	(m^2/day)	(m/day)	-
JMA Slug Tests (2011)	-	0.0040	-

Groundwater vulnerability

Aquifer vulnerability indicates the likelihood for contamination to reach a specified position in the groundwater system after introduction at a location above the uppermost aquifer. The groundwater vulnerability was calculated to be 53%, which is considered a medium vulnerability (natural factors provide some protection to shield groundwater from contamination at the land surface, but mitigation measures will be required to prevent any surface contamination from reaching the groundwater table).

Aquifer protection

A Groundwater Quality Management Index of 4 was estimated for the study area from the ratings for the Aquifer System Management Classification. A medium-level groundwater protection is required for the aquifer. Reasonable and sound groundwater protection measures based on the modelling will therefore be recommended to ensure that no cumulative pollution affects the aquifer, even in the long term.

Groundwater levels

As groundwater levels follow topography, it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions. Locally, and in general, groundwater flows from east to west towards the topographically low Olifants River at 1 505 mamsl.

Groundwater flow

Groundwater levels generally follow topography; therefore, it can be assumed that groundwater flow takes place under unconfined to semi-confined conditions. Locally, and in general, groundwater flows from east to west towards the topographically low Olifants River at 1 505 mamsl as indicated on **Figure 10-21**.

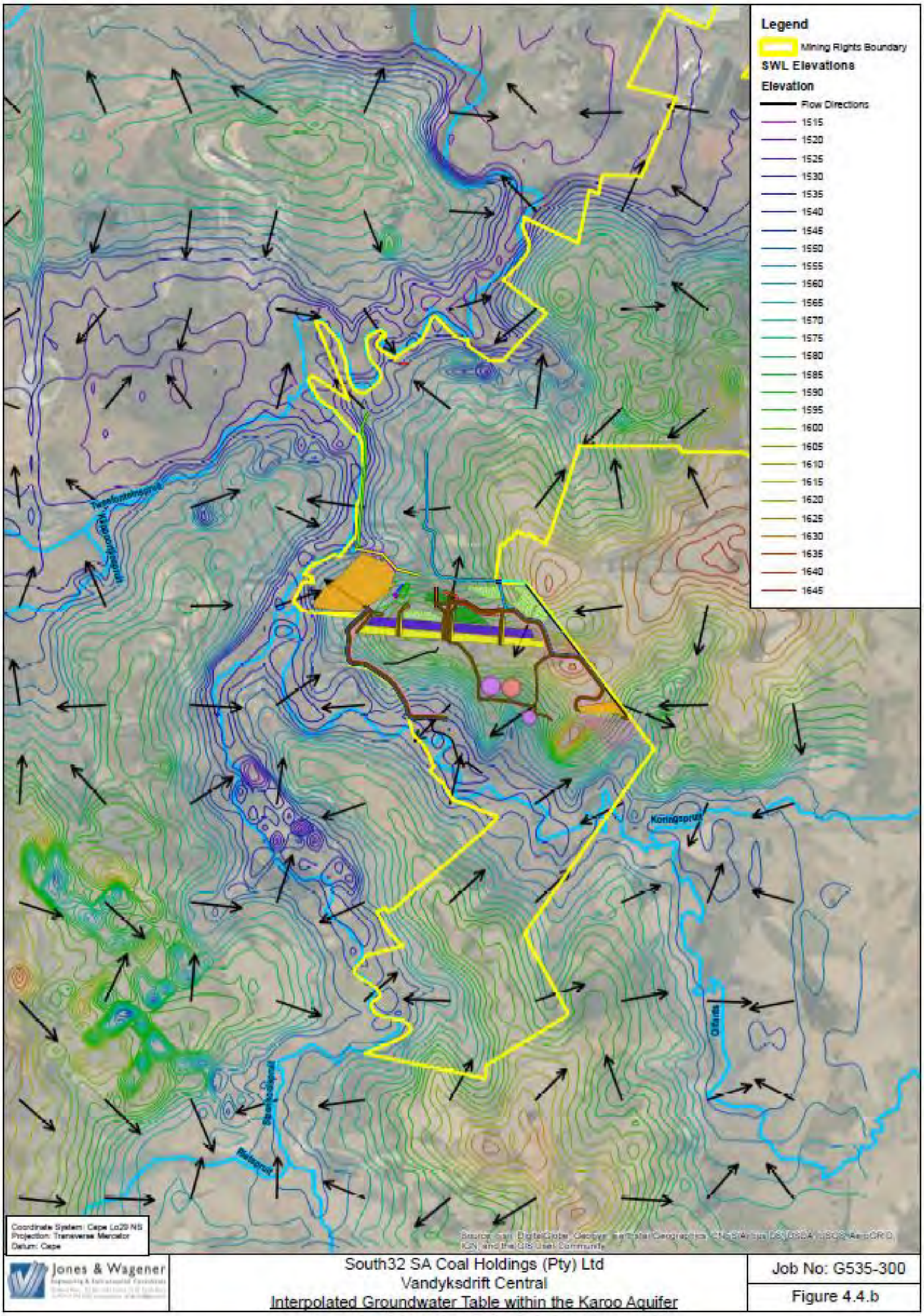


Figure 10-21: Interpolated groundwater table within the Karoo Aquifer (J&W, 2019a)

Groundwater recharge

The recharge in Karoo aquifers is generally in the range of between 2.0 – 5.0 % of the mean annual precipitation, which is approximately 705 mm/a in the VDDC project area. The groundwater recharge in the study area is estimated to be 3.5 % of the MAP, which is equal to 25 mm/a.

Groundwater quality

The more recent (January 2018) groundwater quality results are displayed in **Table 10-21** and **Table 10-22**. According to these results, elevated sulphate concentrations in boreholes SKS BH1 and NDB 6, as well as low pH in SKS BH1 were recorded. The position of the monitoring boreholes is indicated in **Figure 10-23**.

The Piper diagram shown in **Figure 10-22** indicates that most samples have been affected by mining activities which is illustrated by the samples plotting in the top quadrant of the quadrilateral diamond. Samples unaffected by mining activities but plotting in the bottom and right quadrants of the quadrilateral diamond indicate water that is older and has undergone ion-exchange within the aquifer.

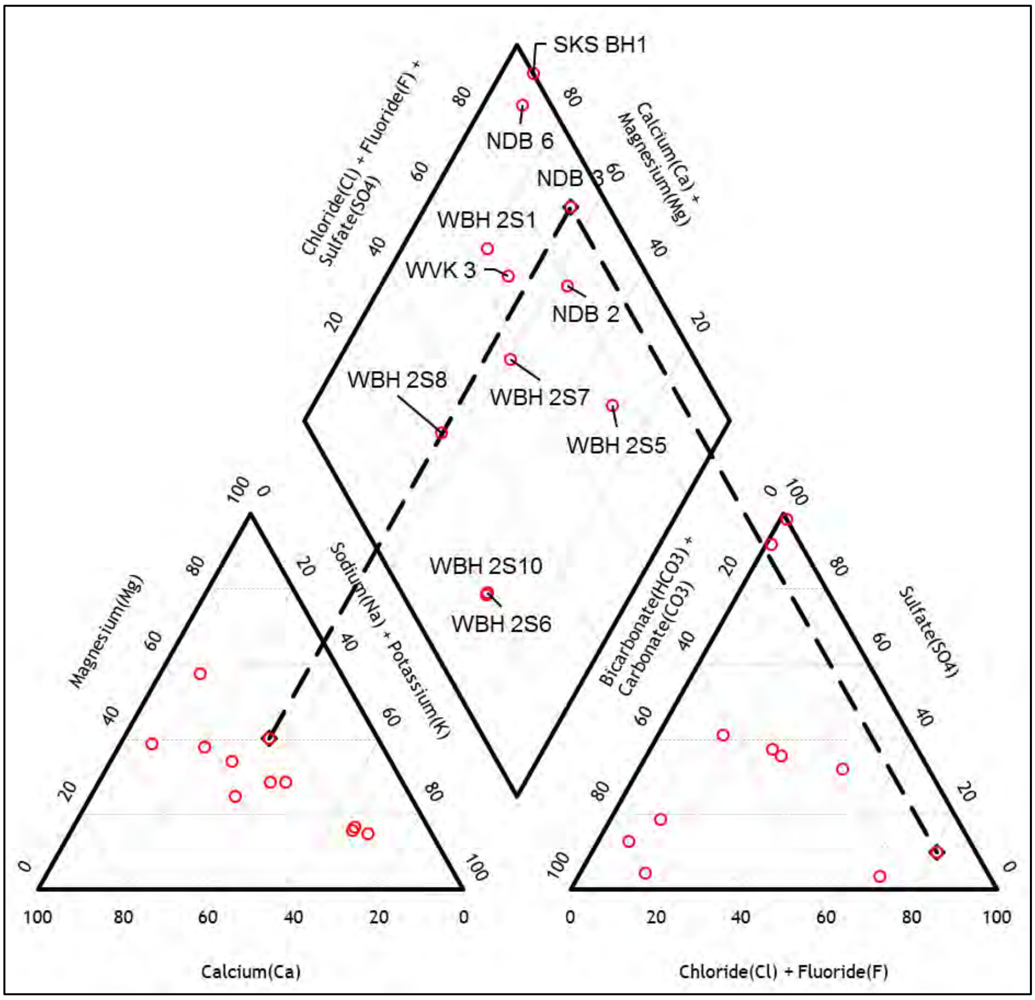


Figure 10-22: Piper diagram constructed using groundwater sample chemistry (J&W, 2019a)

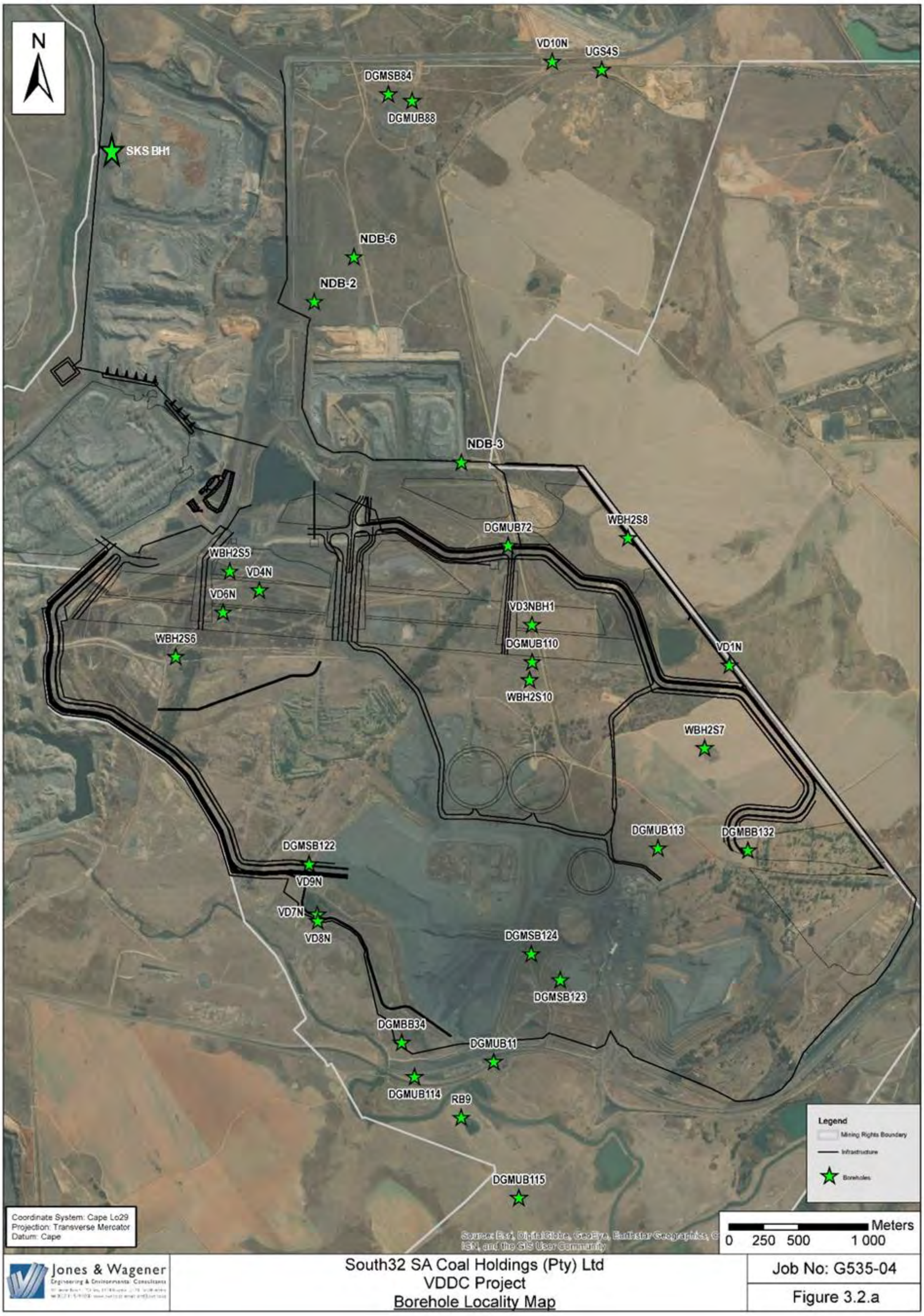


Figure 10-23: Position of monitoring boreholes used in baseline assessment (J&W, 2019a)

Table 10-21: Groundwater qualities compared to SANS 241-1:2015 guidelines for human consumption (dataset 1) (J&W, 2019a)

Parameter		Unit	SANS 241: 2015 Recommended Limits	Risk	Results					
					WBH 2S1	WBH 2S5	WBH 2S6	WBH 2S7	WBH 2S8	WBH 2S10
Physical & Aesthetic Determinants										
Electrical conductivity at 25C	EC	mS/m	**≤ 170**	Aesthetic	39.7	22.4	45.5	64.8	18.9	15.1
Total Dissolved Solids	TDS	**mg/ℓ**	**≤ 1200**	Aesthetic	252	116	278	424	104	82
pH at 25C		pH units	**≥ 5 to ≤9.7**	Aesthetic	7.04	6.88	7.78	7.58	7.35	7.31
Chemical Determinants - Macro Determinants										
Nitrate as N	NO_3	**mg/ℓ**	**≤ 11**	Acute Health	20.2	0.46	0.93	6.48	0.58	0.97
Sulphate	SO_4	**mg/ℓ**	**Acute Health ≤500; Aesthetic ≤250**	Acute Health/Aesthetic	36.1	3.26	28.8	125	15.5	2.69
Fluoride	F	**µg/ℓ**	**≤1500**	Chronic Health	0	0	1 290	420	0	340
Chloride	Cl	**mg/ℓ**	**≤ 300**	Aesthetic	20.1	46.6	11.7	33.8	7.34	7.02
Sodium	Na	**mg/ℓ**	**≤ 200**	Aesthetic	13.5	27.2	66.4	53.9	11.7	18.3
Total Iron	Fe	**mg/ℓ**	**Acute Health ≤ 2; Aesthetic ≤0.3**	Acute/Aesthetic	0	0	0.01	0.04	0	0.01
Total manganese	Mn	**mg/ℓ**	**Acute Health ≤0.4; Aesthetic ≤0.1**	Acute/Aesthetic	0	0	0	0.01	0	0
Aluminium	Al	**µg/ℓ**	**≤ 300**	Operational	10	0	20	10	30	50
Concentrations which exceed the guidelines for acceptable health risk for lifetime consumption as per the Drinking Water Standards (SANS 241)										

Table 10-22: Groundwater qualities compared to SANS 241-1:2015 guidelines for human consumption (dataset 2) (J&W, 2019a)

Parameter		Unit	SANS 241: 2015 Recommended Limits	Risk	Results				
					SKS BH1	WVK 3	NDB 2	NDB 3	NDB 6
Physical & Aesthetic Determinants									
Electrical conductivity at 25C	EC	mS/m	**≤ 170**	Aesthetic	140	22.7	9.73	42.2	430
Total Dissolved Solids	TDS	**mg/ℓ**	**≤ 1200**	Aesthetic	956	148	64	286	4206
pH at 25C		pH units	**≥ 5 to ≤9.7**	Aesthetic	3.19	6.55	5.81	6.08	7.1
Chemical Determinants - Macro Determinants									
Nitrate as N	NO_3	**mg/ℓ**	**≤ 11**	Acute Health	2	13.8	2.14	30.8	1.67
Sulphate	SO_4	**mg/ℓ**	**Acute Health ≤500; Aesthetic ≤250**	Acute Health/Aesthetic	652	17.7	12.2	7.48	2778
Fluoride	F	**µg/ℓ**	**≤1500**	Chronic Health	0	0	0	0	430
Chloride	Cl	**mg/ℓ**	**≤ 300**	Aesthetic	6.9	11.6	13.4	44.7	25.4
Sodium	Na	**mg/ℓ**	**≤ 200**	Aesthetic	16.5	10.8	7.34	19.8	127
Total Iron	Fe	**mg/ℓ**	**Acute Health ≤ 2; Aesthetic ≤0.3**	Acute/Aesthetic	2.06	0	0.31	0.01	0
Total manganese	Mn	**mg/ℓ**	**Acute Health ≤0.4; Aesthetic ≤0.1**	Acute/Aesthetic	1.42	0.02	0.06	0.1	8.62
Aluminium	Al	µg/ ℓ	**≤ 300**	Operational	6260	30	440	40	20
Concentrations which exceed the guidelines for acceptable health risk for lifetime consumption as per the Drinking Water Standards (SANS 241)									

10.1.1.9. Terrestrial Floral Biodiversity

The VDDC Project area is situated within the grassland biome. This biome is centrally located in southern Africa, and adjoins all except the desert, fynbos and succulent Karoo biomes. 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.

Grasslands are dominated by a single layer of grasses. The amount of cover depends on rainfall and the degree of grazing. The grassland biome experiences summer rainfall and dry winters with frost (and fire), which are unfavourable for tree growth. Thus, trees are typically absent, except in a few localized habitats. Geophytes (bulbs) are often abundant. Frosts, fire and grazing maintain the grass dominance and prevent the establishment of trees (TBC, 2019).

Vegetation types

The grassland biome comprises many different vegetation types. The Project area is situated predominantly within one vegetation type; namely the Eastern Highveld Grassland. This vegetation type occurs on slightly to moderately undulating planes, including some low hills and pan depressions. The vegetation is a short dense grass land dominated by the usual highveld grass composition (*Aristida, Digitaria, Eragrostis, Themeda, Tristachya* etc.) with small scattered rocky outcrops with, wiry sour grasses and some woody species (TBC, 2019).

Conservation status

The Eastern Highveld Grassland vegetation type is classified as Endangered. The national target for conservation protection for both these vegetation types is 24%, but only a few patches are statutorily conserved in Nooitgedacht Dam and Jericho Dam Nature Reserves and in private reserves (Holkranse, Kransbank, Morgenstond).

Some 44% of this vegetation type has already been transformed primarily by cultivation, plantations, mines, urbanisation and by building of dams. Cultivation may have had a more extensive impact, indicated by land-cover data. No serious alien invasions are reported, but *Acacia mearnsii* (black wattle) can become dominant in disturbed sites (TBC, 2019).

Plant species of conservation concern

Based on the Plants of Southern Africa (BODATSA-POSA, 2016) database, 233 plant species are expected to occur in the area. Of these, three species are listed as being Species of Conservation Concern (SCC). Although care was taken to traverse as much of the suitable habitat during the fieldwork in search for these SCC, the effort failed to record any of these species. The fieldwork did, however, reveal the disturbed nature of most of the habitats on the study area, largely due to existing mining activities in the area. Based on the field observations, the likelihood of occurrence of any of the SCC plant species is low to medium and repeated field surveys throughout the phenological cycles of these plant SCC may yield observations of this species within the study area.

According to a previous assessment by Scientific Aquatic Services conducted in 2013, four habitat units were observed during their wet season survey, the habitats were identified as transformed habitat, wetland and riparian habitat, rocky ridges and less disturbed habitat. The majority of the study area was covered by transformed habitat, while the wetland and riparian habitat comprised of two wetlands, a partially artificial wetland and the Olifants river. The grassland habitat as well as the rocky ridge is found adjacent to the river. The grassland habitat as well as the rocky ridge is found adjacent to the river. Dominant plant species found in the project area during the study include *Pinus* spp., *Populus alba, P. canescens, Quercus robur, Eucalyptus camaldulensis, Celtis Africana, Searsia lancea. Typha capensis, Phragmites australis, Cyperus marginatus, C. esculentis and C. ruprestis, Imperata cylindrica, Eragrostis gummiflua, Juncus effusus* and *Leersia hexandra* (TBC, 2019).

Habitat types

The main habitat types identified across the project area were initially identified largely based on aerial imagery. These main habitat types were visited during the field surveys to confirm and identify the species compositions of these areas. The habitat types identified are shown in **Figure 10-24**.

Emphasis was placed on limited timed meander searches within the areas regarded as most natural and therefore habitats with a higher potential of hosting SCC. Timed meander searches were therefore limited to the Mesic grassland mainly due to this being the dominating Veld type within the area. The remaining habitats were surveyed briefly, and time was mostly spent looking for obvious variation and/or areas of interest within these habitats, such as wetland areas. Each of the habitats identified are discussed in the sub-sections below.

The list of plant species recorded to date is therefore by no means comprehensive, and repeated surveys during phenological periods not covered, may likely yield up to 30% additional flora species for the project area (TBC, 2019).

Moist Grassland and Wetlands

This habitat type is found mostly in areas that have not been mined and in many cases, are also linked to aquatic habitats (i.e. wetlands and open water) found within the study area. These habitats range from being disturbed, to entirely intact (natural). This habitat type is regarded as primary grassland in many areas and therefore natural. It is slightly disturbed due to grazing by livestock, but in most cases, disturbance is as a result of the current mining activities.

Although care was taken to cover as much of this habitat during the timed meanders as possible, none of the expected IUCN-listed species were recorded within this habitat. This could be attributed to the phenological season of the sampling where these plants are dormant but could also be attributed to grazing practices and other disturbances. However, several species that are protected by the Mpumalanga Schedule 11 was recorded.

Despite this, and due to its limited distribution in the landscape, this habitat is regarded as having a high sensitivity due to its role as being the only remaining habitat, foraging source and migratory corridor for various faunal species present (TBC, 2019).

Disturbed Grassland

The condition of these grasslands ranges from heavily disturbed (largely due to previous and current mining activities) to moderately disturbed grassland. These areas are considered to have a low-medium sensitivity due to the fact that these areas are being used as a migration corridor and in many cases, form a barrier between the moist grassland and the current mining activities (TBC, 2019).

Transformed Grassland

This habitat consists of areas where agriculture and invasive tree clumps has completely altered the state of the area from its original condition. A low-medium sensitivity was given to this area as this section still provide foraging habitat for species (TBC, 2019).

Mining Areas

This habitat units represent the current coal mining portions (predominantly opencast) which are present across the VDDC Project area. Due to the extremely altered nature of this habitat, it is regarded as having a very low sensitivity.

This habitat type represents all areas of mining and the existing infrastructure and includes houses, parking, camps, roads etc. (TBC, 2019).

Plant species highlighted by MTPA

The MTPA indicated concern regarding two plant species, *Frithia humilis* and the ground orchid *Brachycorythis conica* subs *transvaalensis*. More detail on these species are provided in **Table 10-23**. According to the MTPA, these species were identified in a study at the Glencore Impunzi Complex, located to the south-west of the VDDC project area. Although these species were not recorded by the specialist in the VDDC study area during their surveys, the habitat identified as Moist Grassland and Wetlands is the only viable habitat left within the VDDC area that these species could potentially occur in. The habitats that these two species prefer as listed in **Table 10-23**, was not observed or is still existing in any other habitat than Moist Grassland and Wetlands within the VDDC study area.

Table 10-23: Plant species highlighted by MTPA (TBC, 2019)

Family	Taxon	IUCN status	Habitat preference	Likelihood of occurrence
Orchidaceae	*Brachycorythis conica (subsp. Transvaalensis)*	CR	Short, open grassland and wooded grassland, on sandy gravel overlying dolomite, sometimes also on quartzite, 1 000 – 1 705 m.	Moderate
Aizoaceae	*Frithia humilis*	EN	Very shallow soils derived from coarse sediments, Irrigasie Formation of the Ecca group.	Moderate

10.1.1.10. Terrestrial Faunal Biodiversity

Terrestrial fauna that are likely to occupy the area are associated with the habitat in which they occur. Many fauna identified during the survey are typically found in wetland ecosystems, as well as the grassland biome.

Avifauna

Ninety-one (91) bird species were recorded in the study area during the August 2018 survey based on either direct observations, or the presence of visual tracks and signs.

During the November 2018 wet season survey, 31 additional species were added to the list.

None of the birds observed in the August or November 2018 surveys were species of conservation concern. However, based on the various wetland habitats encountered in the study area, the likelihood that bird SCC could occur there is rated as moderate to high. Some roosting and nesting sites were noted during the surveys around wetland and marsh areas (TBC, 2019).

Mammals

Eight (8) mammal species were recorded during the August 2018 survey based on either direct observation, camera trap photographs or the presence of visual tracks and signs. Two SCC were observed, namely *Aonyx capensis* (Cape Clawless Otter) and *Leptailurus serval* (Serval). Family groupings of *Aonyx capensis* were observed in the northern portion of the project area and it is believed this species is therefore breeding in this area.

During the November 2018 survey, various individual *Leptailurus serval* were again recorded, and it is believed there are healthy populations of these species within the project area. In total, five (5) mammal species were recorded during the summer season surveys Multiple individuals of this species were observed within the proposed infrastructure development areas (TBC, 2019).

Herpetofauna (Reptiles and amphibians)

Three (3) reptile species and one (1) amphibian species were recorded in the study area during the August 2018 survey based on visual observations. Reptile diversity was considered to be low in the study area. This was attributed partly due to current disturbances (mining activities) and also the time of year that the survey was conducted.

Three (3) reptile species were recorded in the wet season survey, and three (3) amphibian species were recorded in the wet season survey. None of the recorded species were SCC (TBC, 2019).

Insects

Invertebrates are animals that neither possess nor develop a vertebral column (commonly known as a backbone or spine), derived from the notochord. Invertebrates play an important role in the ecosystem, they function as pollinators, food for other species, pest control, decomposers and aerators of soil.

The African Monarch (*Danaus chrysippus*) and brown-veined White (*Belenois aurota)* butterflies were observed during the November 2018 survey (TBC, 2019).

Mpumalanga Biodiversity Sector Plan: Terrestrial

The key output of a systematic biodiversity plan is a map of biodiversity priority areas. The MBSP uses the following terms to categorise the various land used types according to their biodiversity and environmental importance:

- **Critical Biodiversity Areas (CBA)** are terrestrial and aquatic areas of the landscape that need to be maintained in a natural or near-natural state to ensure the continued existence and functioning of species and ecosystems and the delivery of ecosystem services. CBAs are areas of high biodiversity value and need to be kept in a natural state, with no further loss of habitat or species. Thus, if these areas are not maintained in a natural or near natural state, then biodiversity targets cannot be met. Maintaining an area in a natural state can include a variety of biodiversity compatible land uses and resource uses. These areas are therefore incompatible with opencast mining developments.

The MBSP specifies two different CBA areas:

- *Irreplaceable CBA*, which include (i) areas required to meet targets and with irreplaceability biodiversity values of more than 80%; (ii) critical linkages or pinch-points in the landscape that must remain natural; or (iii) critically Endangered ecosystems;
- *Optimal CBAs* which represents those areas with the best localities (out of a potentially larger selection of available planning units) that are most optimally located to meet biodiversity targets and satisfy other criteria. These areas have an irreplaceability (or frequency selection score) of less than 80%.

- **Ecological Support Area (ESA)** are not essential for meeting biodiversity targets but play an important role in supporting the ecological functioning of CBAs and/or in delivering ecosystem services. Critical Biodiversity Areas and Ecological Support Areas may be terrestrial or aquatic (SANBI-BGIS, 2017).
- **Other Natural Area (ONA)** consist of all those areas in good or fair ecological condition that fall outside the protected area network and have not been identified as CBAs or ESAs. A biodiversity sector plan or bioregional plan must not specify the desired state/management objectives for ONAs or provide land-use guidelines for ONAs;
- **Protected Area (PA)** protected areas recognised in terms of the NEM:PAA, that are considered to meet biodiversity targets in the MBSP;
- **Moderately or Heavily Modified Areas (MMA of HMA):** sometimes referred to as ‘transformed’ areas, these are areas that have been heavily modified by human activity so that they are by-and-large no longer natural, and do not contribute to biodiversity targets. Some of these areas may still provide limited biodiversity and ecological infrastructural functions but, their biodiversity value has been significantly, and in many cases irreversibly, compromised.

The TBC study area in relation to the MBSP categories is shown in **Figure 10-25**. Within the mining right area, the land use categories include CBAs, HMAs, MMAs and ONAs. Most of the VDDC project area is classified as HMAs or ONAs. Some CBAs are present across the north-western corner of the mining right area, and a protected area (PA) occurs across the northern portion of the mining right area in the Hartebeesfontein section of Ifalethu Colliery (although this area was declared as a private nature reserve in the 1980’s and is therefore reflected as a PA on the MBSP, it has not been managed as such).

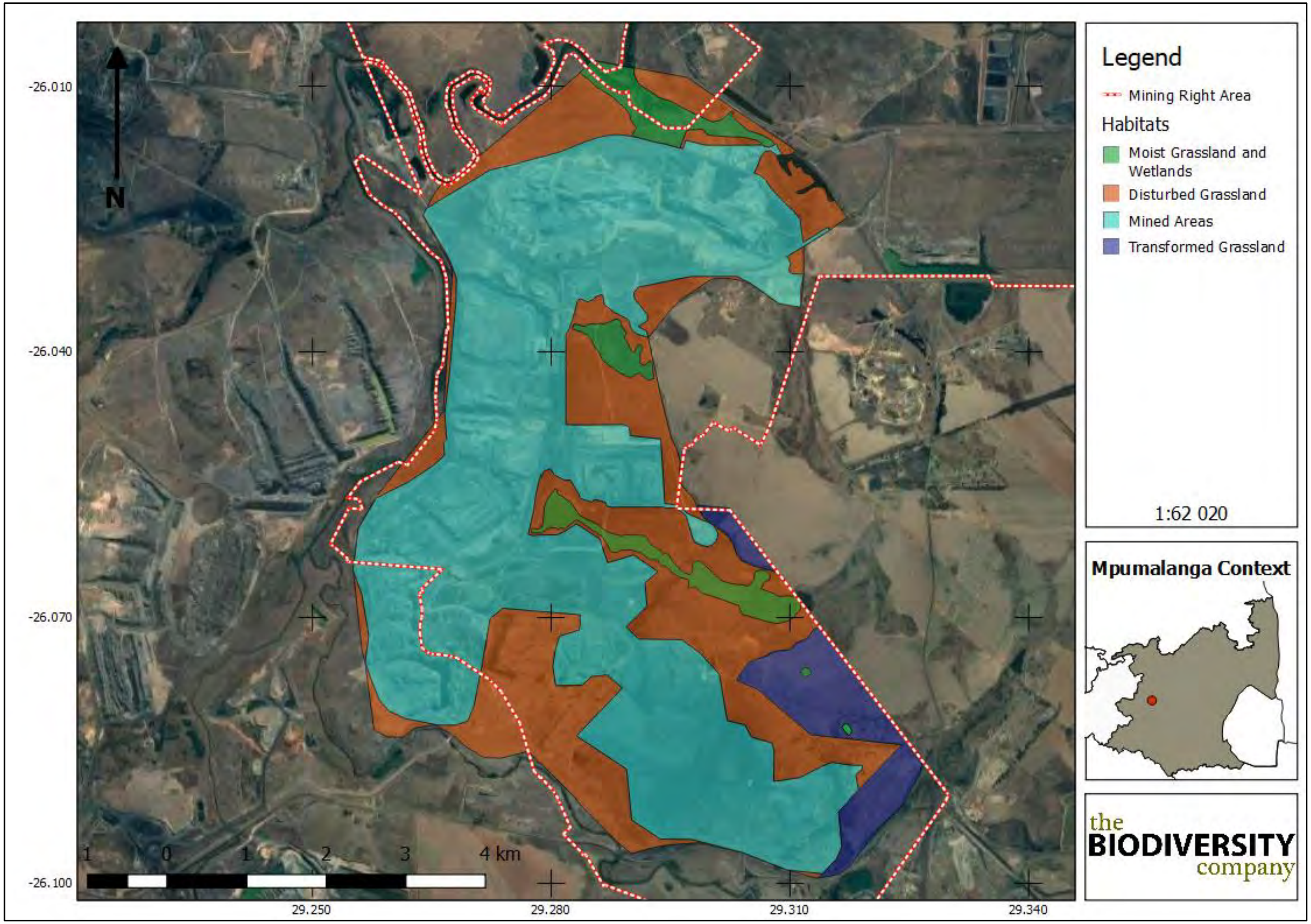


Figure 10-24: **Main habitat types identified (TBC, 2019)**

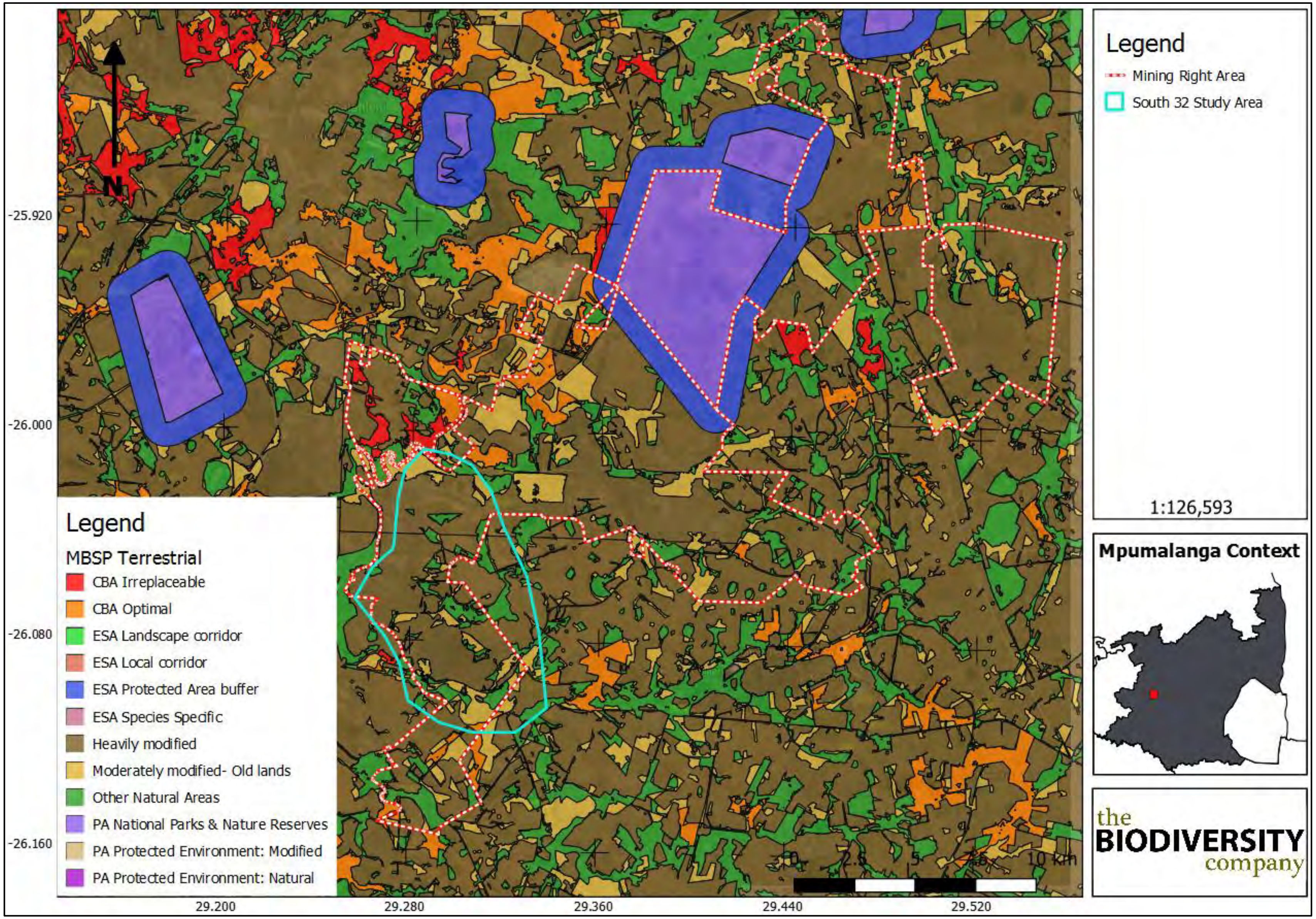


Figure 10-25: Study area superimposed on the MBSP Terrestrial Critical Biodiversity Areas (CBA) map (TBC, 2019)

10.1.1.11. Social setting

The social assessment was undertaken by Batho Earth and a copy of the report is attached in **Appendix 8.10**.

Local authority

The Mpumalanga Province is divided into three district municipalities, which are comprised of 20 local municipalities. The VDDC area falls within the eMalahleni Local Municipality (ELM) which falls within the Nkangala District Municipality (NDM).

The NDM is a Category C municipality and comprises six local municipalities: Victor Khanye, eMalahleni, Steve Tshwete, Emakhazeni, Thembisile Hani, and Dr JS Moroka. The NDM has 160 towns and villages under its jurisdiction.

The district is host to the Maputo corridor which brings increased potential for economic growth and tourism development. In addition, the district shares the western side of its borders with the economic hub of Gauteng which opens up opportunities to a larger market, which is of benefit to the district's agricultural and manufacturing sectors. There is further potential in exporting goods that provides opportunities within the district.

The NDM's economy is dominated by electricity, manufacturing and mining. These sectors are followed by community services, trade, finance, transport, agriculture and construction. The relatively large economies of Steve Tshwete LM (Middelburg) and eMalahleni LM (Witbank/eMalahleni) sustain the economy of the Nkangala District to a large extent and are based on the steel industry with high reliance on the manufacturing sector.

However, the NDM is not exempt from the difficulties facing all municipalities in South Africa. Poverty and unemployment in the rural areas are a major threat to socio-economic growth (Batho Earth, 2019).

The ELM has a mining and industrial history and is thus the most industrialised municipal area in the NDM. It consists of the towns of eMalahleni, Ga-Nala (formerly Kriel) including Thubelihle, Ogies including Phola, Rietspruit, Van Dyksdrift and Wilge. The landscape and land-use mainly consist of rural areas with scattered towns, as well as underground and opencast coal mines. The area also has the largest concentration of power stations in the country. The coal deposits and power stations in the southern section of the municipality thus have a major influence on the settlement patterns in the area. The fragmented development pattern is further intensified by the large areas that are undermined or those that have mining rights.

The area surrounding eMalahleni does not lend itself to major tourism activities, as it is primarily a mining and farming area. The only conservation area under the jurisdiction of the ELM is the eMalahleni Nature Reserve established around the eMalahleni Dam.

The Vandyksdrift and the Izingulubeni Settlements that were in close proximity to the VDDC project have been demolished, but some informal settlements still remain in the area such as the Lindokuhle settlement situated to the south of the mining activities. To the north east of the proposed infrastructure development is the Springbok settlement, which developed as a mining town. The Ideal Shopping Complex is situated at the entrance to Lindokuhle and the Vaalkrans complex is near the R544-R542 intersection. Various informal settlements and some farm buildings/homesteads were further identified within the surrounding area.

The proposed infrastructure development project mainly falls within Ward 32. A small section of the northern section of the VDDC complex falls within the southern section of

Ward 19. Ward 25's northern boundary is in close proximity to the southern boundary of the VDDC complex area (Batho Earth, 2019). Statistics from these three wards have therefore been used in the description of the social context below.

Population figures

In 2011, the eMalahleni population was 395 466 individuals. According to the 2016 Community Survey, the population of the ELM totals approximately 455 228 individuals, with 150 420 households and a 3.2% average annual population growth rate. As the economy of the eMalahleni area provides various employment opportunities, a large influx of individuals to the ELM area are experienced.

The population is expected to increase to 516 399 individuals in 2020 and 646 708 individuals in 2030 (Batho Earth, 2019).

Age structure and gender

The age structure of the ELM indicates a fairly young population, as 25.2% of the local population is under the age of 14. Those within the working age (15-64) forms 71.2% of the local population.

This young population would in future put extreme pressure on the socio-economic fabric of the area. Pro-active planning with regards to employment creation, social activities, recreational facilities, sports and educational facilities, medical facilities, the development of the youth, training and capacity building programmes, would therefore be imperative.

Within Wards 19 and 32, 48% of the population is males (Batho Earth, 2019).

Population stability

The increase in the population figure as a result of the average growth rate, but also due to the in-migration of various people from outside the municipality might be due to mining industries and businesses within the eMalahleni area. This trend impacts on the population stability and further results in the following social challenges:

- An estimated 10 000 people reside in Informal settlements and back rooms;
- The provision of water supply to informal settlements without resident contributing to these services;
- Additional pressure on the provision of water, sanitation and electricity infrastructure;
- Additional pressure on the local roads resulting in poor quality roads without sufficient capacity to handle the traffic volumes; and
- Increase in unemployment particularly amongst youth and unskilled which might impact on issues of crime, prostitution, and drug abuse (Batho Earth, 2019).

Education levels

According to the Department of Education, there are currently 34 pre-schools in the ELM. There are 58 primary schools and 19 secondary schools servicing the area, and four tertiary education facilities in the Emalahleni area. The Edupark in eMalahleni consists of the Tshwane University of Technology, Pretoria University and Unisa. The eMalahleni College is situated in the CBD in close proximity to the municipal offices. The other tertiary institutions are the Mpondozankomo Technical College in Ackerville and the Coal Training College in Klipfontein.

The ELM's performance with regards to the level of education obtained is higher compared to the other local municipalities in the NDM. The 2011 highest level of education profile indicates a large proportion of individuals within the local municipality (49.8%) have at least a secondary (Grade 8-12) level of education. However, the majority still have only grade 12 qualifications with a small percentage who have obtained some secondary education. The rural areas also still have the highest level of "No Schooling". Vocational skills training for local industries and motivating individuals to obtain a Grade 12 (or equivalent) qualification is still necessary.

The education profile for the NDM, ELM and relevant ward are summarised in **Table 10-24**.

Table 10-24: Education profiles (Batho Earth, 2019)

Municipality / ward	No schooling	Grade 12	Higher education
Nkangala District Municipality	9%	35%	8.7%
eMalahleni Local Municipality	6%	31%	14%
Ward 19	5%	33%	16%
Ward 25	10%	25%	2%
Ward 32	9%	27%	4%

Employment

In 2011, the unemployment rate was 27.3% and the youth unemployment rate 36%. The Community Survey of 2016 indicates that 23.2% of the local population is unemployed.

This unemployment rate is similar to that of the NDM. With such a large local economy, a lower unemployment rate is expected. Many people migrate to ELM in search of employment but might not have the right skills to work in the local economy and thus put more pressure on the provision of services and infrastructure. The investment climate of the municipality needs to improve and be conducive so it can accommodate the new job seekers. The municipality also needs to increase the levels of education and skills to improve the employability of young people.

The employment profile per ward in provided in Table 10-25.

Table 10-25: Employment profile per ward (Batho Earth, 2019)

Ward	Employed	Unemployed	Discouraged work-seeker	Other not economically active
Ward 19	4 261 (57%)	1 133 (15%)	252	1751
Ward 25	4 805 (46%)	2 559 (25%)	445	2483
Ward 32	4 304 (49%)	1 372 (16%)	759	2285

Income levels

In 2016, the average annual household income was R120 492, but 14% of the population still received no income.

The average annual household income is higher than the NDM average household income. The high average income and education levels should reflect a lower unemployment rate which means that there are more opportunities for employment for highly skilled workers, which again, highlights the importance of high levels of education.

Significant concentrations of people living under the Minimum Living Level (MLL) occur within eMalahleni. It is evident that 67.1% of households within the ELM earn an annual income well below the MLL, with the highest percentages of these households located in Emalahleni Rural (78.7%) and Emalahleni West (78.0%). The low-income levels are concerning as it indicates high dependency levels of households on government grants, subsidies and services. Specific areas of concentration include eMalahleni, Ogies and Ga-Nala.

The people that depends on grants have increased from 34 849 to 89 585 people between 2012 to 2017. The grant with the largest recipients is the child support grant, followed by old age grant.

Within Ward 32 the average annual household income was R29 400 which is more or less similar than the average for ELM. Within Ward 19, the average annual household income was R57 300 which is double the amount compared to those within Ward 32 (Batho Earth, 2019).

Poverty

According to the 2016 Community Survey of StatSA, the so-called poverty headcount (multi-dimensionally) of eMalahleni deteriorated from 8.0% in 2011 to 10.9% in 2016 and is the second highest in the Province. The so-called poverty intensity also increased from 43.6% to 45.4% in the same period (Batho Earth, 2019).

Household profile and services

The number of informal dwellings in the ELM increased from 23 138 in 2011 to 34 845 in 2016, which is an increase of more than 11 000 households. According to information obtained, 56% of the population within Ward 32 lives in formal structures, while 15.2% lives in informal dwellings or shacks.

Accelerated service delivery is the key. Strong collaboration between the municipality, relevant national, provincial departments and public entities in prioritizing building of houses should be considered.

The Municipality is both a Water Services Authority (WSA) and a Water Services Provider (WSP). There are three water schemes operating in the Municipality, namely the:

- Witbank Water Treatment Works;
- Ga-Nala Water Treatment Works; and
- Rietspruit Water Treatment Works

The infrastructure, however, is approximately fifty years old and has reached the end of its design life. The Municipality is planning to improve the reliability of the distribution network, including the refurbishment of its water treatment plant in eMalahleni, reducing the water losses, improving on the quality of water supplied, improving on the Blue Drop status targets and enhancing scheduled deliveries of portable water through water tankers.

The number of households with access to piped water is 136 628 households with a share of 90.8% of households having access to piped water. There is however, 13 792, or 9.2%, of households without access to piped water in 2016.

In Wards 32, 19 and 25, the majority of households received their water via a regional/local water scheme operated by a Water Service Authority or provider. However, in Ward 19 (856 households) and in Ward 32 (507 households) a number of households still depend on borehole water for household purposes.

The number of households with access to flush/chemical toilets improved in the relevant period is 108 868 households or a percentage access of 72.4% of households however, 2 186 households are without any toilet facilities (no toilets). The majority of households in Wards 19 and 32 have access to a flush toilet that is connected to a sewerage system.

Households with a connection to electricity were 106 306, which constitutes 70.7% in 2016. Within the area, 40 721 households are not connected to electricity at all, which is more than a quarter of the households. From information obtained from the 2011 Census, the majority of households within Wards 19 and 32 have access to electricity (Batho Earth, 2019).

Community health

According to Mpumalanga Department of Health, the HIV prevalence rate of eMalahleni was measured at 40.7% in 2013 (latest available figure). The ELM has a shortage in terms of adequate basic health care services. Aspects that put additional pressure on these are the growing population, the poverty levels of the residents in the area, the spread of HIV/Aids and the enlargement of formal and informal settlements.

Within the Van Dyksdrift area there is only one mobile clinic functioning. The Naledi Clinic is situated at Naledi Village which is situated along the R575 nor the north of the VDDC area. The Impungwe District Hospital situated on the outskirts of eMalahleni is the nearest hospital to the area. Ga-Nala and Thubelihle have two clinics, which are thus approximately 20 km from the proposed development (Batho Earth, 2019).

Crime

Crime is a source of concern within the area, especially within the informal settlements where unemployment levels are high. Residents in these areas usually resort to illegal activities as a source of income.

The Blinkpan Police Station, near Komati, is the nearest station to the study area. According to information from the SAPS, the major crimes noted at the Blinkpan Station includes theft, burglaries, drug related crime and contact crime.

It is thus unlikely that the criminal incidents would decrease should unemployment in the area prevails (Batho Earth, 2019).

Local economic profile

The average annual economic growth rate for eMalahleni was at 2.4% over the period 1996 to 2015. The forecasted average annual GDP growth for eMalahleni for 2015-2020 is anticipated to be more or less 2% per annum in line with national and provincial growth expectations.

However, the local economy is not diversified due to the mining industry (44% of the gross value added (GVA)) which contributes the most to the local economy. This is followed by the utilities (11% of GVA) and trade sectors (9% of GVA). Mining also remains the most prominent sector in terms of its employment contribution with 23%, followed by the trade sector which provides 18% of the employment in the ELM area. The community and finance sectors both provide 12% of the employment.

In 2013, the eMalahleni GDP was R 58.1 billion. This figure indicates a 48.26% contribution to NDM GDP of R 120 billion in the same year and a 20.92% contribution to the GDP of Mpumalanga Province.

eMalahlani is also one of the municipalities which experienced population growth rates higher than their economic growth rates, which has significant negative implications from a GDP per capita and an infrastructure, service delivery, and job creation point of view (Batho Earth, 2019).

10.1.1.12. Visual Aesthetics

A visual assessment was undertaken by J&W and a copy of the report is attached in **Appendix 8.3**.

The grassland found within the study area is very short with intermittent trees close to farmsteads and settlements. In the eastern parts of the site, maize is planted and harvested annually, resulting in open fields without cover during the winter months. The vegetation therefore provides little visual cover for structures.

Some visual screening has been planted at the Steenkoolspruit (SKS) workshops to the north of the VDDC mining area. The screening is effective for a section of the R544 road, but does not eliminate the visual impact, especially since the proposed new structures will be constructed outside of the area that is screened.

Most of the infrastructure present in the greater study area stems from mining activities (South32 Wolvekrans, Glencore Impunzi and Anglo Goedehoop Collieries). Some other industrial development is concentrated around the towns of eMalahleni and Middelburg. The main road in the area is the N12/N4 Highway, connecting Gauteng with Mpumalanga. In addition, the Duvha and Komati power stations provide further industrial impact. These activities have an industrial visual character and result in a more pronounced impact on the natural character of the landscape. Additionally, prominent Eskom powerlines cross the landscape to and from the two power stations.

Visually there are no sensitive features or no-go areas on the site itself. In the surrounding area, the following are considered to be visually sensitive:

- Topographic Features
  - None.
- Surrounding homesteads
  - The area around the site has several settlements overlooking the proposed mining area as well as along the infrastructure routes.
- Towns/urban areas
  - The towns of eMalahleni and Middelburg are located to the north of the project area.
  - The proposed infrastructure should not affect any towns/urban areas.

- Roads
  - The proposed project will be located west of the R544 from eMalahleni.

In order to determine the potential baseline for the proposed development, the viewshed within the study area was determined. A viewshed is the geographical area that is visible from a location. It includes all surrounding points that are in line-of-sight with that location and excludes points that are beyond the horizon or obstructed by terrain and other features.

The viewshed from the proposed development is indicated in **Figure 10-26** and extends some 10 – 12 km to the north and south. The elevated views from the Ogies dyke in the north is offset by the flat terrain around the Olifants River floodplain, where the development site is located. Views to the east and west are somewhat blocked due to topography, with a few isolated exceptions (J&W, 2019e).

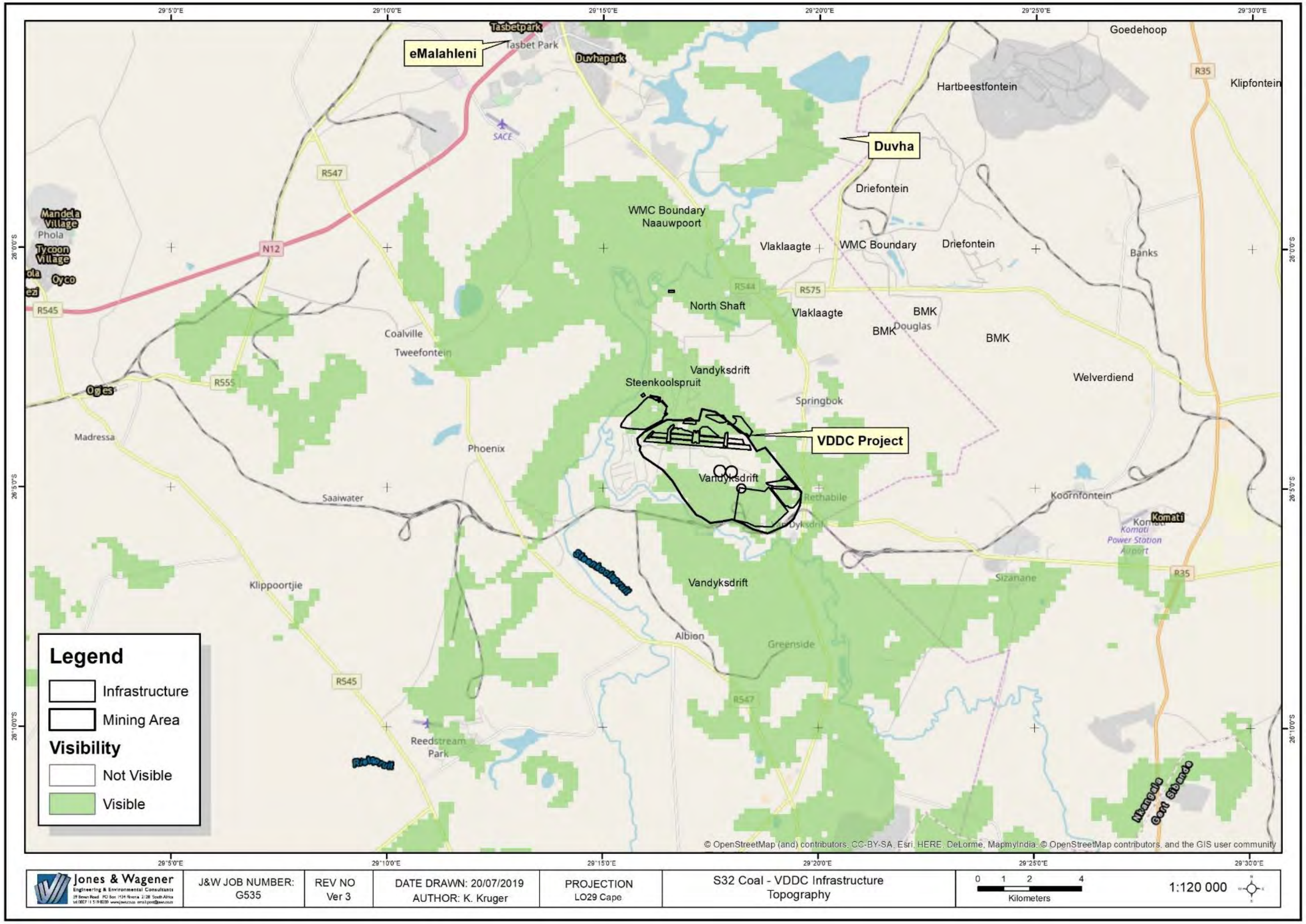


Figure 10-26: Viewshed of the proposed VDDC development (J&W, 2019e)

10.1.1.13. Noise

A noise assessment was undertaken by Airshed Planning Professionals (Airshed) and a copy of the report is attached as **Appendix 8.2**.

SANS 10103 (2008) addresses the manner in which environmental noise measurements are to be taken and assessed in South Africa and is fully aligned with the World Health Organisation guidelines for Community Noise developed in 1999. Typical rating levels that is recommended in different districts which should not be exceeded outdoors, is indicated in **Table 10-26**. Outdoor ambient noise exceeding these levels will be annoying to the community (Airshed, 2019b).

Table 10-26: Typical ratings for outdoor noise (Airshed, 2019b)

Type of district	Equivalent Continuous Rating Level ($L_{Req,T}$) for Outdoor Noise		
	Day/night $L_{R,dn}$[(c)] (dBA)	Day-time $L_{Req,d}$[(a)] (dBA)	Night-time $L_{Req,n}$[(b)] (dBA)
Rural districts	45	45	35
Suburban districts with little road traffic	50	50	40
Urban districts	55	55	45
Urban districts with one or more of the following; business premises; and main roads.	60	60	50
Central business districts	65	65	55
Industrial districts	70	70	60

Notes:

(a) $L_{Req,d}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the day-time period, i.e. from 06:00 to 22:00.

(b) $L_{Req,n}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the night-time period, i.e. from 22:00 to 06:00.

(c) $L_{R,dn}$ =The L_{Aeq} rated for impulsive sound and tonality in accordance with SANS 10103 for the period of a day and night, i.e. 24 hours, and wherein the $L_{Req,n}$ has been weighted with 10dB in order to account for the additional disturbance caused by noise during the night.

A noise survey was completed by Airshed on 3 and 4 July 2018. The sampling locations is summarised in **Table 10-27** and the positions are shown on **Figure 10-27**. The following indices were determined:

- **L_{Zeq} (T)** – The unweighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured);
- **L_{Aeq} (T)** – The A-weighted equivalent sound pressure level, where T indicates the time over which the noise is averaged (calculated or measured);
- **L_{A90}** – The A-weighted 90% statistical noise level, i.e. the noise level that is exceeded during 90% of the measurement period. It is a very useful descriptor which provides an indication of what the L_{Aeq} could have been in the absence of noisy single events and is considered representative of background noise levels; and
- **L_{AFmax}** – The maximum A-weighted noise level measured with the fast time weighting. It's the highest level of noise that occurred during a sampling period (Airshed, 2019b).

Table 10-27: Description of locations surveyed for noise impacts during July 2018 (Airshed, 2019b)

Site	Description	Observations	
		Day-time	Night-time
Site 2	Small village	Traffic audible	Traffic and mining audible
Site 3	In an open field near a road and petrol station	Traffic audible	Traffic audible
Site 4	Small village	Community activity	Community activity
Site 5	Open, uncultivated field	Birds, traffic, aeroplanes	Traffic audible
Site 6	Open land next to main road	Traffic from road audible	Traffic and mining audible

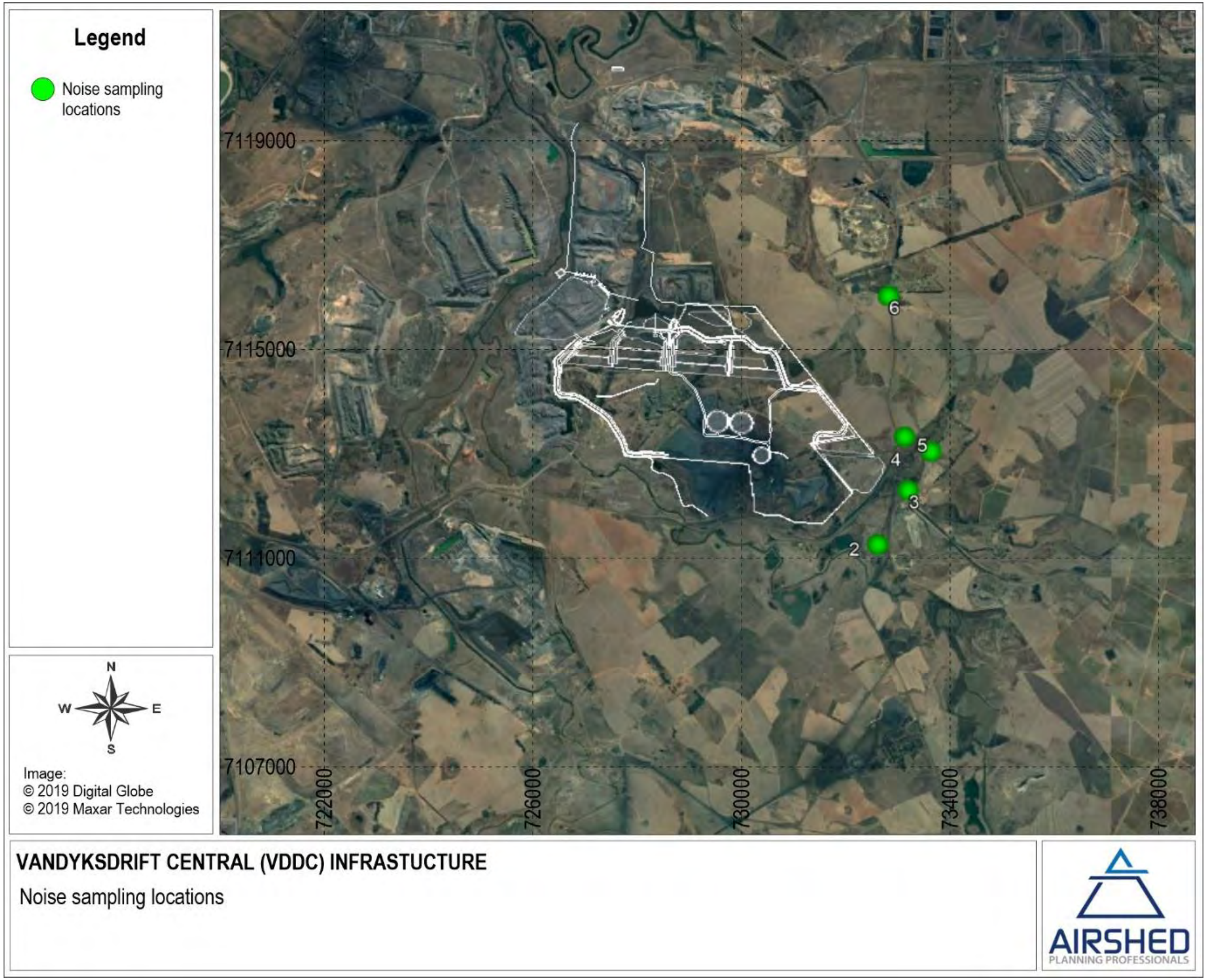


Figure 10-27: Baseline noise survey sites (Airshed, 2019b)

Table 10-28: Baseline environmental noise survey results summary (Airshed, 2019b)

Site	Date and time	Dura-tion	L_{AFmax} (dBA)	L_{Aleq} (dBA)	L_{Aeq} (dBA)	L_{A90} (dBA)	C_t (dBA)	Observations
Day-time								
Site 2 Small village	03/07/2018 13:49	30:00	93.54	79.98	70.4	38.33	0	Traffic audible.
Site 3 In an open field near a road and petrol station	03/07/2018 13:02	30:00	80.65	63.65	55.55	41.52	5	Traffic audible.
Site 4 Small village	03/07/2018 11:10	30:00	62.7	49.06	44.44	33.2	0	Community activity.
Site 5 Open, uncultivated, field	03/07/2018 12:16	30:00	57.01	42.14	39.35	31.98	0	Birds, traffic, aeroplanes.
Site 6 Open land next to main road	03/07/2018 10:10	30:00	73.42	60.76	59.23	48.08	0	Traffic from road audible.
Night-time								
Site 2 Small village	04/07/2018 0:08	15:00	68.35	48.48	43.91	32.28	0	Traffic and mining audible.
Site 3 In an open field near a road and petrol station	03/07/2018 23:43	15:00	67.56	50.68	49.71	31.64	0	Traffic audible.
Site 4 Small village	03/07/2018 22:48	15:00	62.66	44.55	36.21	30.09	0	Community activity.
Site 5 Open, uncultivated, field	03/07/2018 23:17	15:00	63.27	43.73	35.77	31.5	0	Traffic audible.
Site 6 Open land next to main road	03/07/2018 22:14	15:00	74.49	59.2	51.24	36.98	0	Traffic and mining audible.

The results from the noise survey are summarised in **Table 10-28**. During the noise survey, the following was observed:

- Day-time baseline noise levels:
  - o The highest day-time noise levels were measured at Site 2, comparative to industrial areas according to SANS 10103;
  - o L_{Aeq}'s for Site 4 and Site 5 were quiet and considered typical of rural areas

according to SANS 10103 with higher noise levels at Site 3 and Site 6, typical of urban areas; and
  - Recorded L_{Aeq}'s during the day were within the International Finance Corporation (IFC) guidelines for residential, institutional and educational receptors (55 dBA) at Site 4 and Site 5.
- Night-time baseline noise levels:
  - Measurements indicate night-time ambient noise levels at Site 4 and Site 5 are quiet;
  - Mining activities are clearly audible at Site 2 and Site 6 during the night;
  - On-site L_{Aeq}'s ranged between 30 dBA and 52 dBA which is considered typical of rural to urban areas according to SANS 10103; and
  - Recorded L_{Aeq}'s during the night were within IFC guidelines for residential, institutional and educational receptors (45 dBA) at Site 2, Site 4 and Site 5 (Airshed, 2019b).

Noise sensitive receptors

Noise sensitive receptors generally include places of residence and areas where members of the public may be affected by noise generated by processing and transport activities.

The impact of an intruding industrial/mining noise on the environment rarely extends over more than 5 km from the source. Noise sensitive receptors within 5 km of the project are shown on **Figure 10-28** and include individual homesteads and small residential areas.

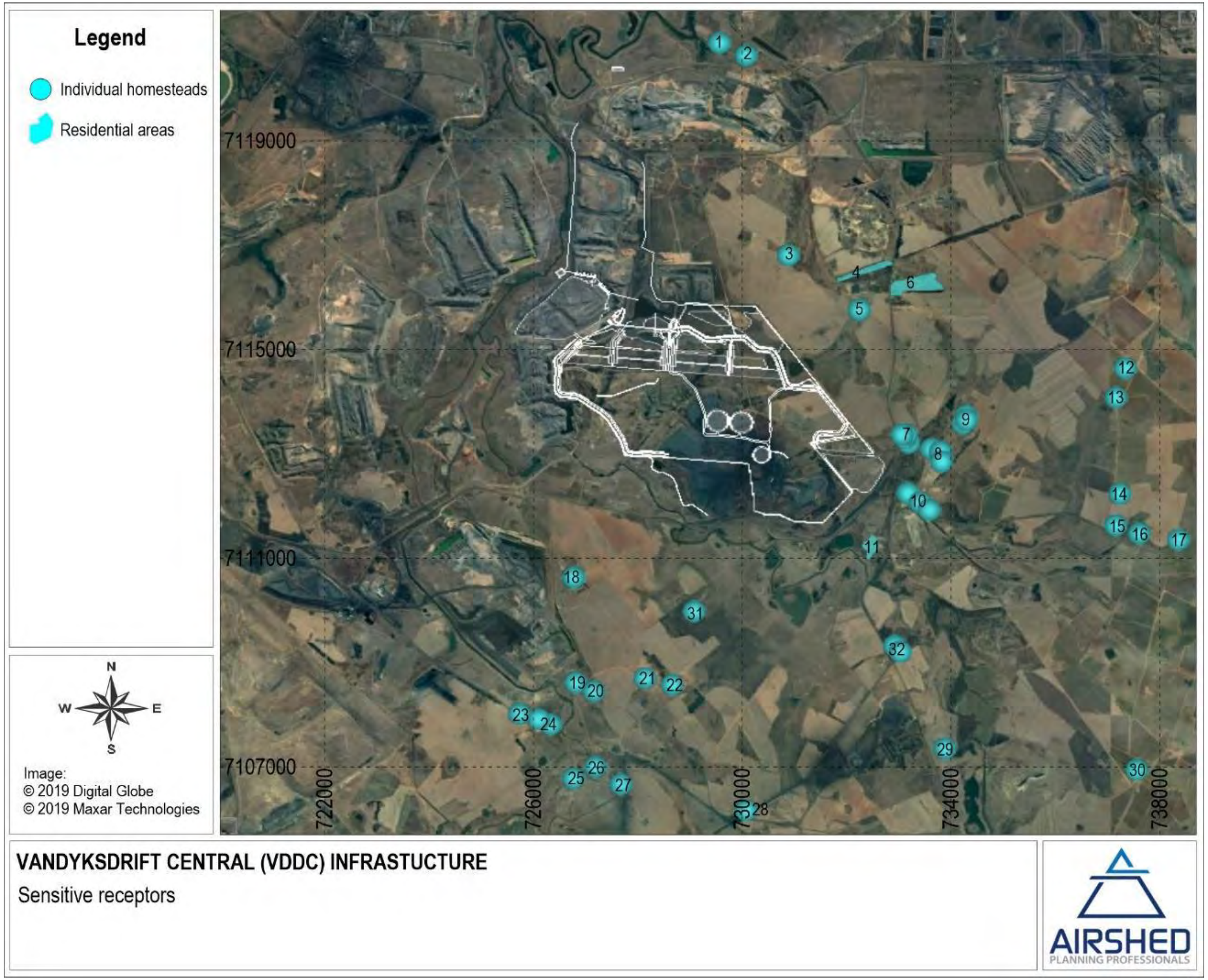


Figure 10-28: Noise sensitive receptors within 5 km of project area (Airshed, 2019b)

10.1.1.14. Air quality

An air quality assessment was undertaken by Airshed and a copy of the report is attached as **Appendix 8.4**.

The VDDC project area is located within the Highveld Priority Area (HPA), an area of typically poor air quality. The HPA was declared the second national air quality priority area (after the Vaal Triangle Airshed Priority Area) by the Minister of Environmental Affairs at the end of 2007. This required that an Air Quality Management Plan for the area be developed. The plan includes the establishment of emissions reduction strategies and intervention programmes based on the findings of a baseline characterisation of the area. The implication of this is that all contributing sources in the area will be assessed to determine the emission reduction targets to be achieved over the following few years (Airshed, 2019a).

Sources of air pollution

The current land uses contribute to the baseline pollutant concentrations via vehicle tailpipe emissions, household fuel combustion, biomass burning and various fugitive dust sources. The main sources of air pollutants include:

- Power generation;
- Primary and secondary metallurgical operations;
- Mining operations;
- Domestic fuel combustion;
- Vehicle tailpipe emissions;
- Biomass burning; and
- Other fugitive dust sources – unpaved and paved roads, agricultural tilling operations and wind erosion of open sparsely vegetated areas.

Fugitive emissions from opencast mining operations are the main contributing sources of air pollution in the project area, and originate from land clearing operations, materials handling operations, vehicle entrainment from haul roads, wind erosion from open areas, drilling and blasting.

The main emissions from power generation operations in the area (Duvha, Komati, and Kendal power stations) are carbon dioxide (CO_2), SO_2, NOx and ash (Airshed, 2019a).

Sensitive receptors

The project area is primarily surrounded by coal mining operations, agricultural activities, as well as the Duvha, Hendrina, and Komati Power Stations. Residential areas in the region include Springbok (2.5 km northeast), Komati town (~13 km east), Pullens Hope (~28.5 km east-northeast), Middelburg (~35 km north-northeast), and eMalahleni (~20 km north-northwest). Individual residences (i.e. farmhouses) are also in the immediate vicinity of the proposed operations and are considered to be sensitive receptors with respect to air quality. The sensitive receptors identified by Airshed Planning Professionals are indicated on **Figure 10-29**.

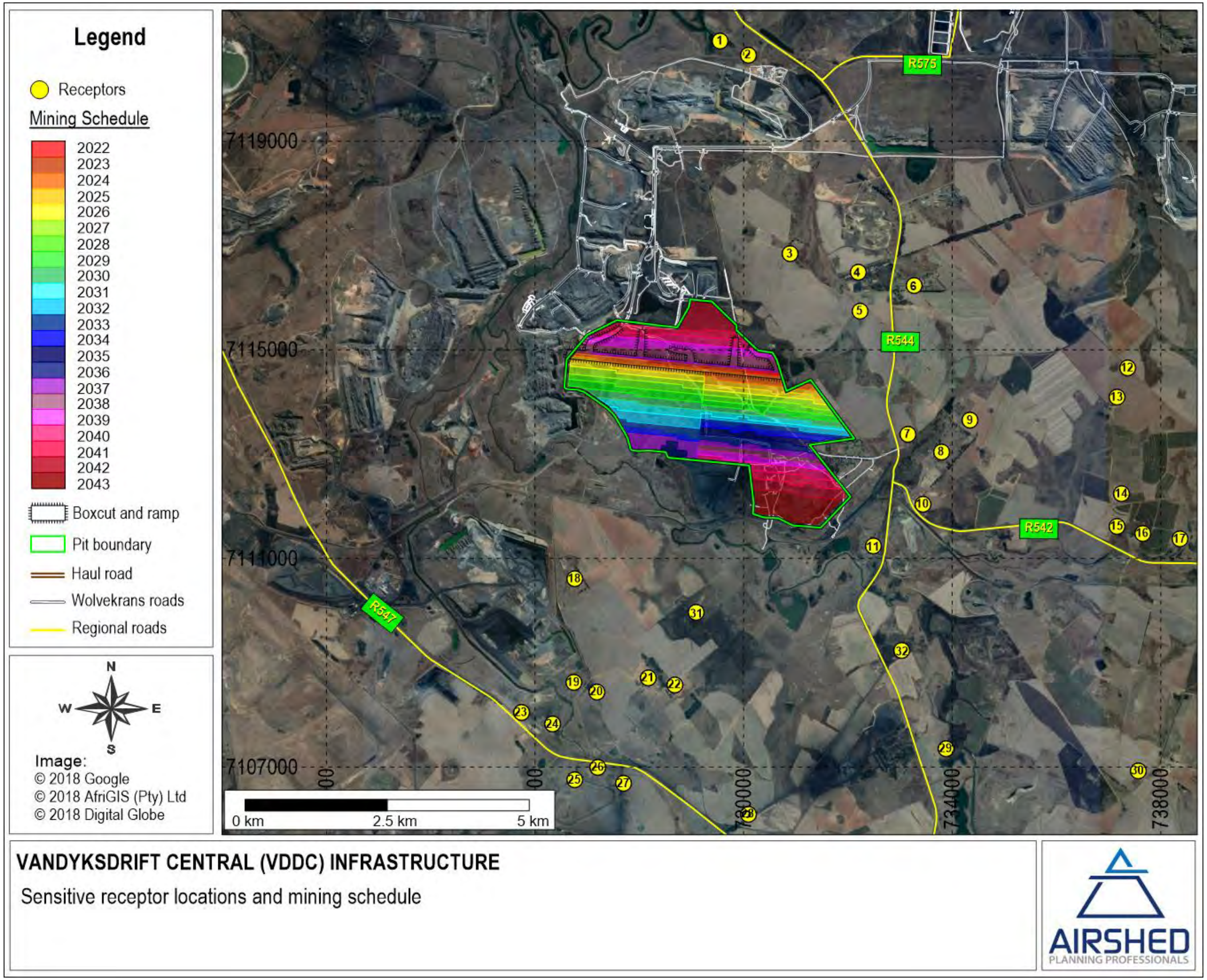


Figure 10-29: Sensitive receptors in the VDDC project area (Airshed, 2019b)

Air quality: nuisance dustfall

A network of 36 dustfall monitoring units (buckets) are managed by South32 in the greater vicinity of the VDDC project area, as shown in **Figure 10-30**. The points closest to the VDDC project area were selected to establish the nuisance dust levels in the study area. These included six (6) single bucket and two (2) locations with directional buckets. At the point labelled “DGS Next to Anglo”, both a single and directional bucket sampler is located.

The National Dust Control Regulations (NDCR) were published on 1 November 2013 in GNR 827, with the purpose to prescribe general measures for the control of dust in all areas including residential and non-residential areas. The standard for acceptable dustfall rates is set out in **Table 10-29** for residential and non-residential areas. According to these regulations, the dustfall rates at the boundary or beyond the boundary of the premises where it originates cannot exceed 600 mg/m²/day in residential and light commercial areas; or 1 200 mg/m²/day in areas other than residential and light commercial areas.

Table 10-29: Acceptable dustfall rated according to NDCR (Airshed, 2019a)

Restriction Area	Dust-fall rate (D) (mg/m²/day, 30-day average)	Permitted frequency of exceeding dust fall rate
Residential	D < 600	Two within a year, not sequential months.
Non-residential	600 < D < 1 200	Two within a year, not sequential months

Dustfall rates measured by South32 for the period February 2017 to May 2018 are illustrated in **Figure 10-31**. The sample taken at the SKS Prefab Offices recorded the next highest dustfall rate, with an average of 1 644 mg/m²-day and exceeding the NDCR limit value on 7 months of the year. The samplers located at BCP10 and Vandyksdrift Plant each exceeded the limit for one month. Their annual averages were 762 mg/m²-day and 721 mg/m²/day, respectively. The lowest dustfall rates were recorded at Vandyksdrift Village (300 mg/m²/day), followed by DHS next to Anglo (368 mg/m²/day) and Pit Haul Road (577 mg/m²/day). Whilst not quite correct to compare with the NDCR, the directional dust buckets located at DGS21 had an average of the maximum bucket dustfall rate of 540 mg/m²/day (Airshed, 2019a).

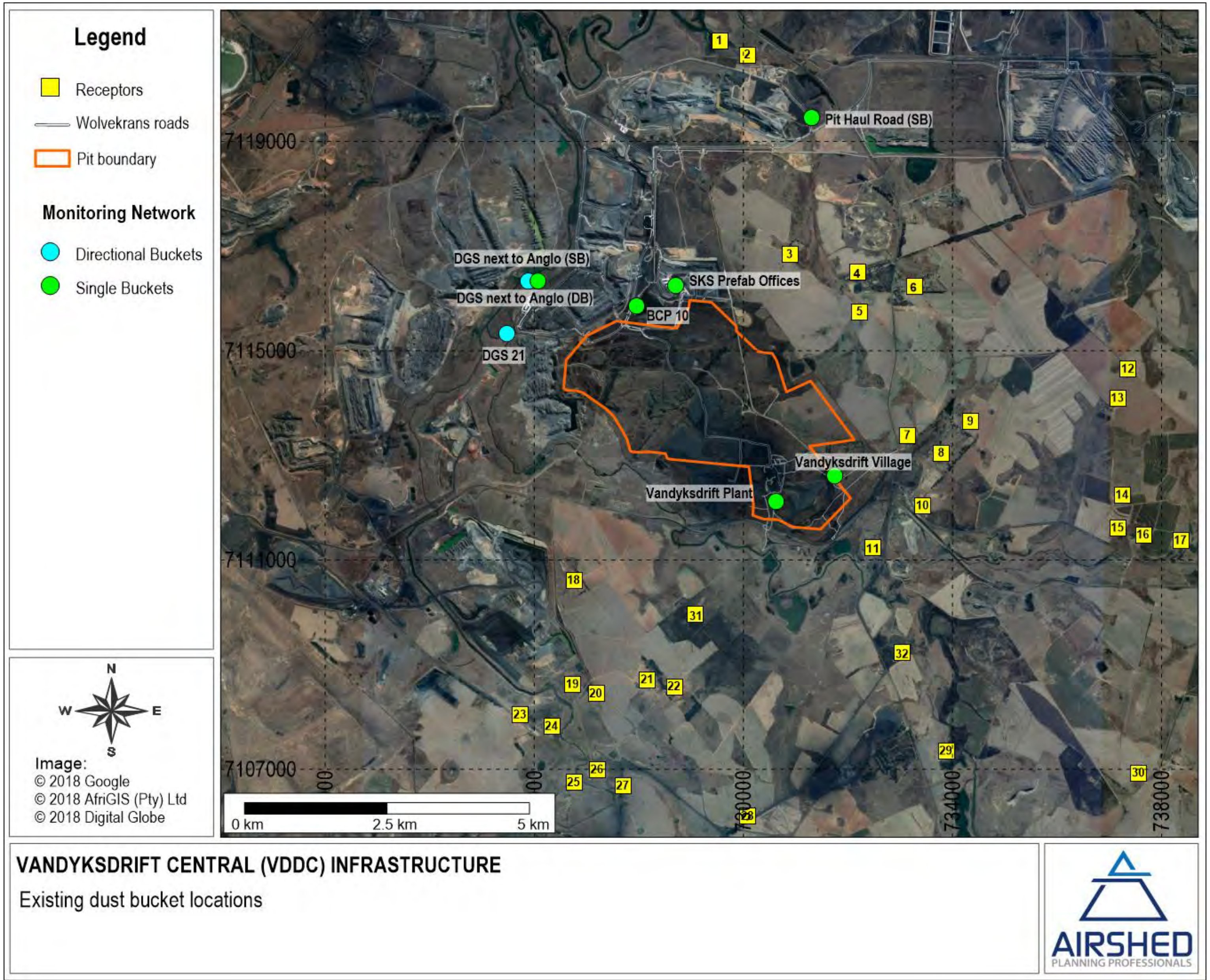
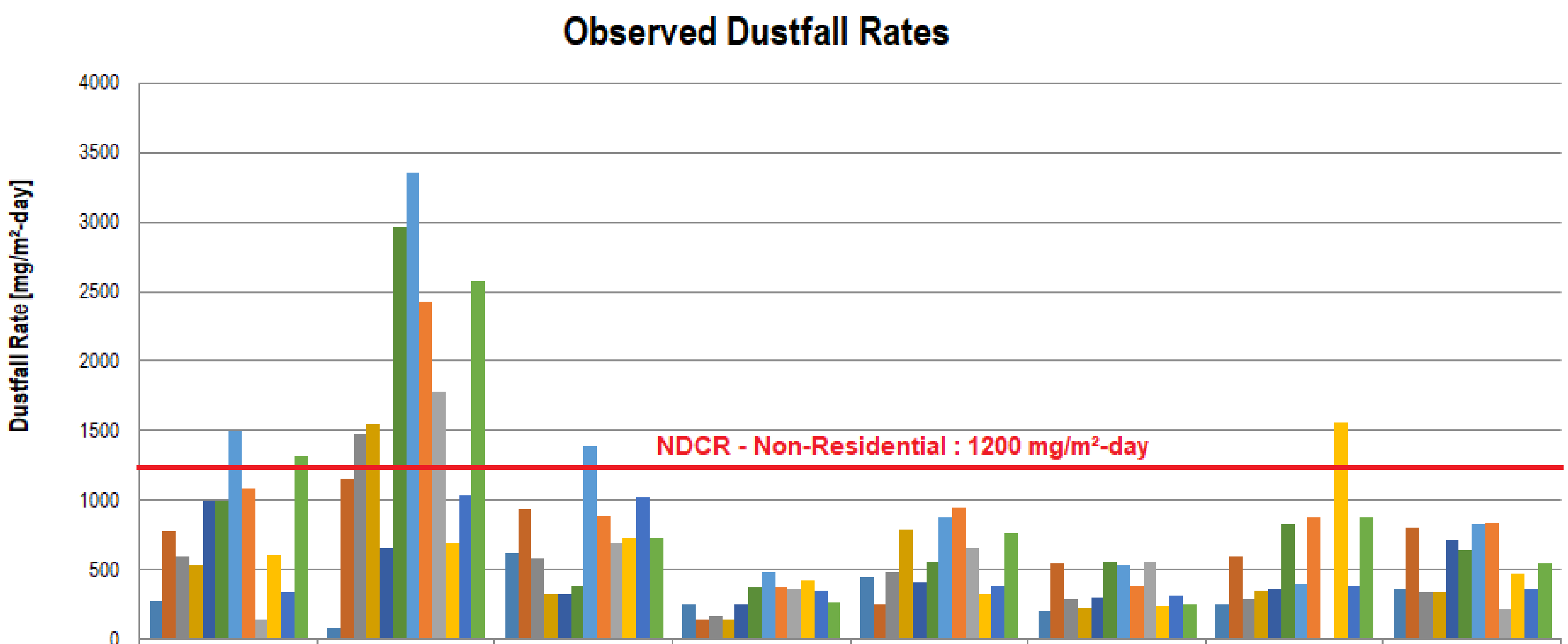


Figure 10-30: Location of dust-fall monitoring units (Airshed, 2019a)



	BCP10	SKS Prefab Offices	Vandyksdrift Plant	Vandyksdrift Village	Pit Haul Road	DGS Next to Anglo (single)	DGS Next to Anglo (directional)	DGS21 (directional)
Feb-Mar 2017	278	88	623	260	450	208	256	367
Mar-Apr 2017	776	1153	941	143	253	551	591	799
Apr-May 2017	591	1471	579	165	491	289	286	336
May-Jun 2017	529	1548	332	145	792	232	356	344
Jun-Jul 2017	994	654	332	255	414	304	365	721
July-Aug 2017	995	2962	386	371	554	553	829	644
Aug-Sep 2017	1495	3354	1395	480	881	531	396	828
Sep-Oct 2017	1082	2425	884	382	948	383	875	839
Dec 2017-Jan 2018	143	1782	699	368	660	558		221
Jan-Feb 2018	603	687	735	423	330	243	1560	476
Feb-Mar 2018	345	1034	1022	349	387	313	385	360
Mar-May 2018	1315	2568	728	266	762	257	873	550

Figure 10-31: Dustfall rates for February 2017 to May 2018 at 8 locations near the VDDC project area (Airshed, 2019a)

10.1.1.15. Blasting and Vibrations

Source and receiving environment

The source environment of possible blasting and vibration impacts is the opencast mining operations, whereas the receiving environment is the area adjacent to the VDDC project area and specifically the area adjacent to the Pit area. The area of influence is not expected to exceed a distance range of 3 500 m radius around the Pit Area.

Anticipated impacts

Blasting operations are required to break rock for excavation to access the targeted ore material. Explosives in blast holes provide the required energy to conduct the work. The blasting operation has the potential to yield secondary effects such as ground vibration, air blast, fly rock and fumes. These aspects may have a negative impact on the surrounding areas depending on the levels generated. The potential impacts considered can be described as follows:

- **Ground vibration:** Levels greater than recommended limits may be damaging to structures and different structures will have different permitted levels. Ground vibration may cause damage if levels exceed the structure's safe limit. People may also experience ground vibration as perceptible at very low levels and normally react negatively to the experience of ground vibration;
- **Air blast:** The effect of air blast is usually underestimated. High levels of air blast could damage windows. Levels lower than required to induce damage may rattle windows and large roof surfaces. These effects are generally mistaken as ground vibration effect and lead to complaints. Rattling of doors and roofs causes concern and causes people to be concerned.
- **Fly rock:** Fly rock can be mitigated but may not be eliminated. Fly rock can be managed properly with relative ease. Control on fly rock will also control the effects of air blast. Wild fly rock could cause damage to structures and installations but also be lethal to people and animals.

To outline the expected environmental effects that blasting operations could have on the surrounding environment, the receiving environment is classed into three areas, namely:

- High Sensitivity Area (0 to 500 m around the mining area): Considered the most critical areas, this area is classified as the unsafe zone and is normally cleared of all people and animals when blasting is conducted in a mining environment. Levels of ground vibration and air blast are also expected to be higher closer to the pit area;
- Medium Sensitivity Area (500 to 1 500 m around the pit area): The possibility of impact is still expected, but it is lower. The expected level of influence may be low, but there may still be reason for concern, as levels could be low enough not to cause structural damage but still upset people;
- Low Sensitivity Area (> 1 500 m around the pit area): In this area, it is relatively certain that influences will be low with low possibility of damages and limited possibility to upset people.

Figure 10-32 to **Figure 10-34** indicates the different sensitivity areas and possible receptors as identified by Blast Management and Consulting (BMC).

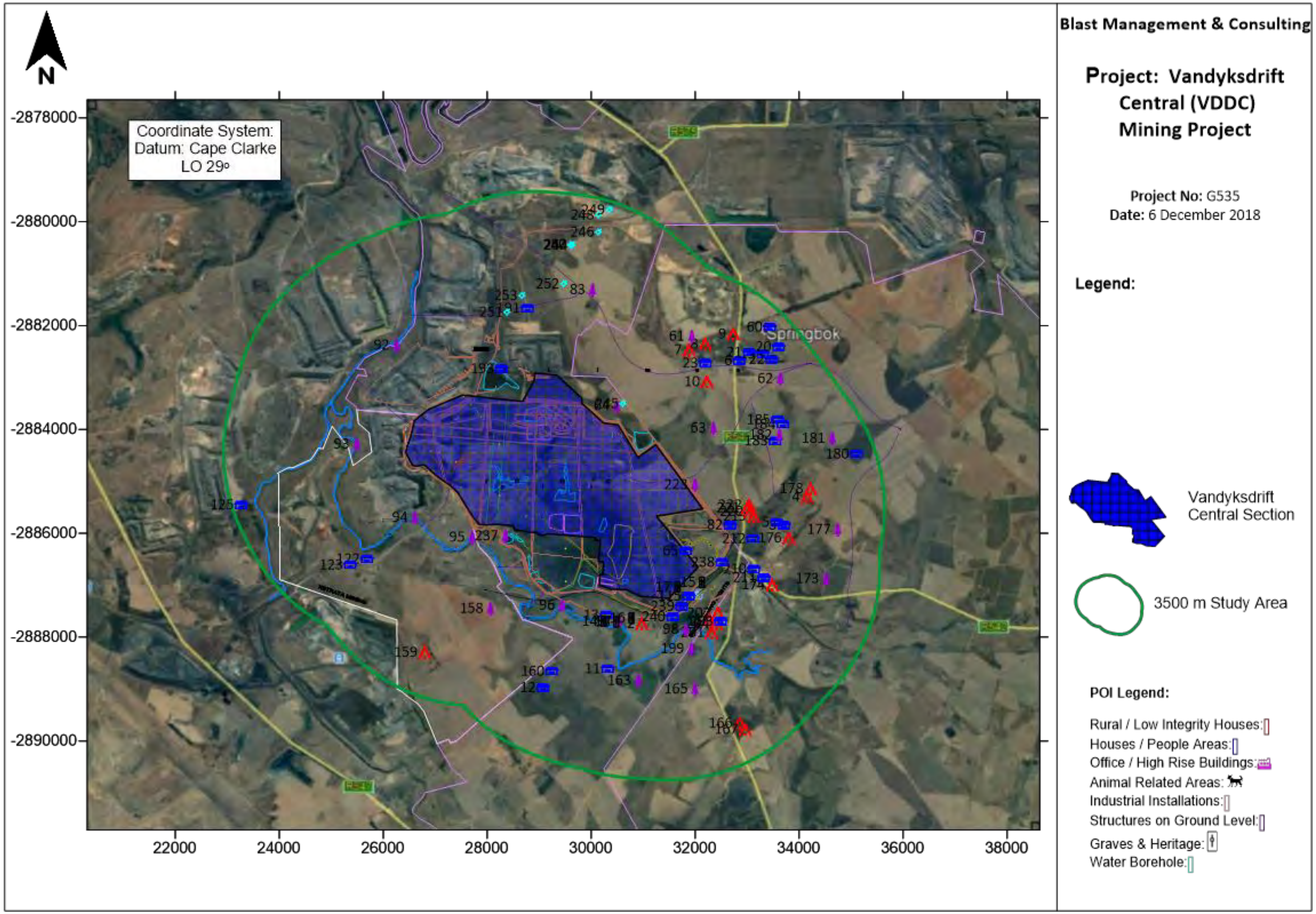


Figure 10-32: **VDDC study area indicating points of interest (POI) in terms of blasting and vibration impacts: residential, settlements, boreholes, graves and heritage and other structures (excluding industrial and powerlines) (BMC, 2019)**

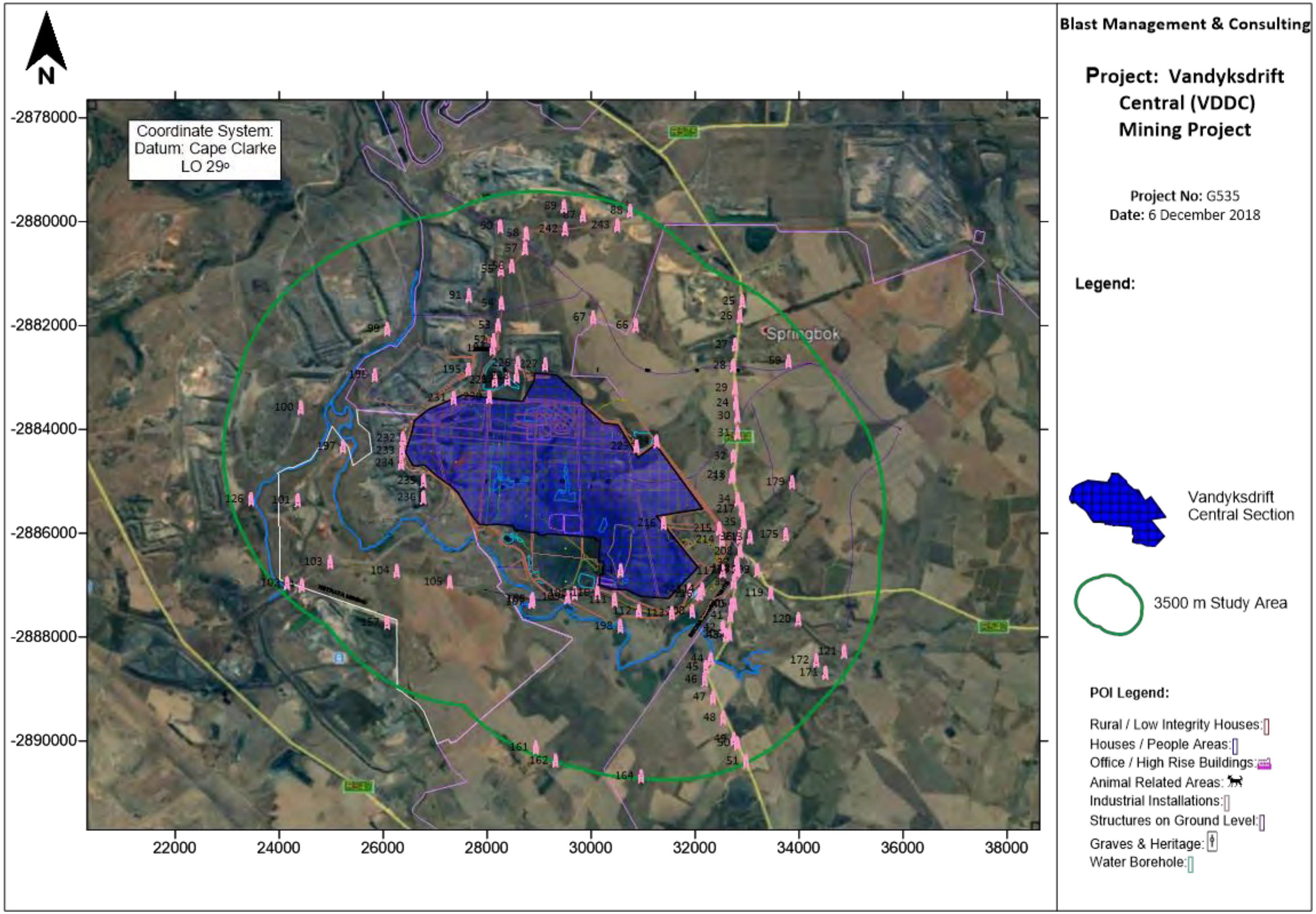


Figure 10-33: **VDDC study area indicating points of interest (POI) in terms of blasting and vibration impacts: industrial (BMC, 2019)**

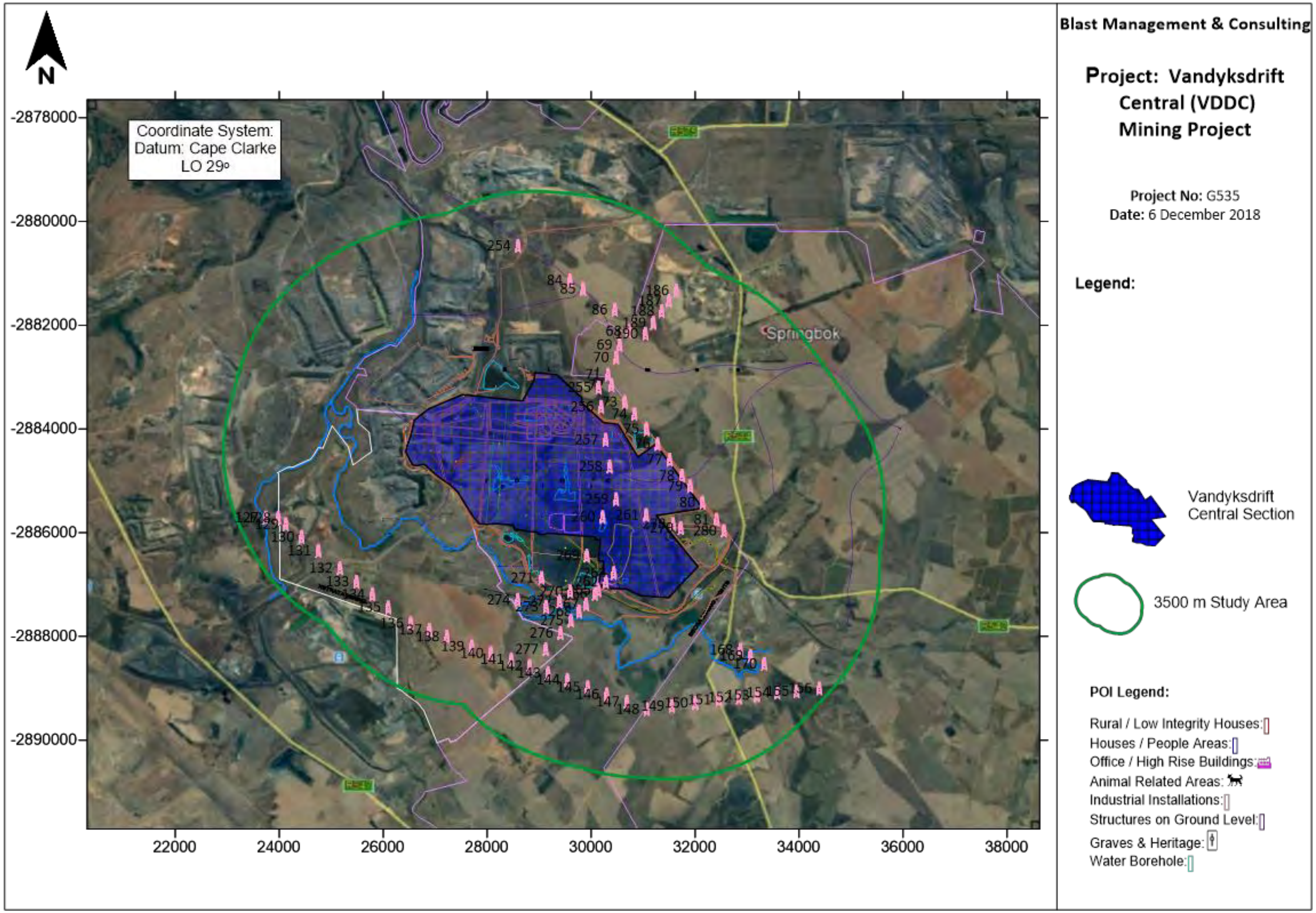


Figure 10-34: VDDC study area indicating points of interest (POI) in terms of blasting and vibration impacts: powerlines (BMC, 2019)

10.1.1.16. Heritage and Paleontological setting

A heritage assessment was undertaken by Dr Julius Pistorius and the palaeontological assessment by Prof Marion Bamford. Copies of their reports are attached in **Appendix 8.6** and **Appendix 8.5** respectively.

Heritage resources

The Phase 1 heritage impact assessment study for the VDDC project area by Dr Julius Pistorius, revealed the following types and ranges of heritage resources as outlined in Section 3 of the National Heritage Resources Act, 1999 (Act 25 of 1999) (NHRA), namely:

- Historical structures; and
- Informal graveyards.

The position of these heritage resources is indicated on **Figure 10-35**. During the field survey, photographs were taken of the relevant heritage and historical remains and are shown in **Figure 10-36**.

The significance of the heritage resources must be determined to establish the significance of the impact on any of these remains and will determine whether mitigation measures may be required for heritage resources which may be negatively affected by the VDDC project.

The historical structures comprise remains which are older than sixty years or which are approaching this age and are therefore protected by the NHRA. The historical structures are rated as of medium significance. This rating is based on the use of two rating (grading) schemes, namely:

- A scheme of criteria which outlines places and objects as part of the national estate as they have cultural-historical significance or other special value (outlined in Section 3 of the NHRA). In terms of these criteria, the historical remains identified within the VDDC project areas are graded as of low to medium significance
- A field rating scheme according to which heritage resources are graded in three tiers (levels) of significance based on the regional occurrence of heritage resources (Section 7 of the NHRA). The historical remains were rated as of medium significance by the heritage specialist and can be destroyed after the remains have been recorded and a permit allowing for the destruction of the remains have been obtained from SAHRA.

The graveyards have a high significance (Pistorius, 2019).

Figure 10-35: Position of heritage resources identified (J&W, 2019g)

A –Douglas Colliery pump station

B –South African Railway station pump station

C –Vandyksdrift Railway Station / siding

D – Graveyard 1

E – Graveyard 2

Figure 10-36: Historical structures and graves on the VDDC area (Pistorius, 2019)

Palaeontology

The whole mining area falls in palaeontologically sensitive sediments (shales, mudstones and coal) of the early Permian Vryheid Formation in the Witbank coalfield. Coals seams are between 15 – 110 m below the land surface.

The position of the proposed project in relation to the SAHRIS palaeosensitivity map is indicated in **Figure 10-37.** The project is located within a very highly sensitive area as indicated in red.

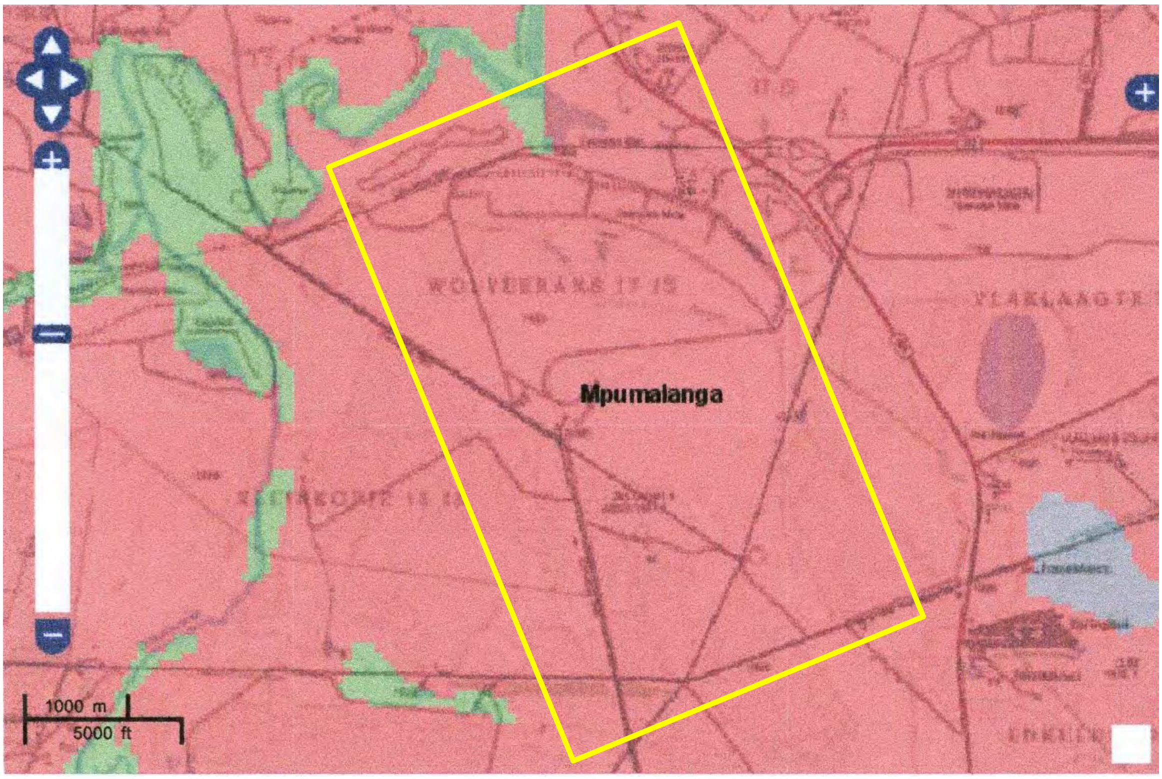


Figure 10-37: VDDC project area in relation to SAHRIS palaeosensitivity map (Bamford, 2019)

10.1.2 Description of the current land uses

The proposed infrastructure development location is on a brownfield site, indicating that the grassland area has already been altered considerably, mostly due to mining. Current land uses include mining, as well as cultivated fields to the east of the VDDC area. Refer to **Figure 10-7** for the current land uses in the area.

10.1.3 Description of specific environmental features and infrastructure on the site

A detailed description of the existing environmental features based on the baseline assessment was described in section 10.1.1.

The following infrastructure is currently present at VDDC (refer to **Figure 5-2**):

- Existing haul roads and service roads;
- Railway and powerlines;
- 132/22kV Olifants and Klein Olifants Substations;
- 132kV overhead powerline from the Kromfontein / Klein substation feeder;

- An overland conveyor system to the South Export Plant;
- Topsoil dump on the north-eastern boundary of the VDDC section;
- Various stormwater diversion berms and canals, as well as the Vleishaft Dam which is the main PCD in the area;
- There are four structures upstream of the Vleishaft PCD for the diversion of clean storm water, namely:
    - Attenuation Dam;
    - Attenuation Berm 2;
    - Attenuation Berm 1; and
    - A farm dam.
- Bob Henry dam, which is the PCD for the Fraser's Plant;
- Mine residue disposal sites, i.e. the PSS and LAC dumps. These dumps are in the process of being reclaimed. It is expected that 40% of the material will be recovered. The southern portion of the PSS dump will remain and will be used as a Final Rejects Dump for any material that cannot be reclaimed;
- Run-of-mine (ROM) coal and slurry are stockpiled on the delineated Mixed ROM and slurry temporary stockpiles, from where it is taken to the South Export Processing Plant Warehouse, change houses, workshops, wash bays, laydown areas and fuelling facilities;
- Facilities at SKS facilities are in use by Vandyksdrift North (VDDN): contractors' offices, laydown areas and FLAC (fuel, lube, air and coolant) station.

10.1.4 Environmental and current land use map

(Show all environmental, and current land use features)

Land use in the project area is mainly mining. The environmental sensitivities are shown in **Figure 10-38**.

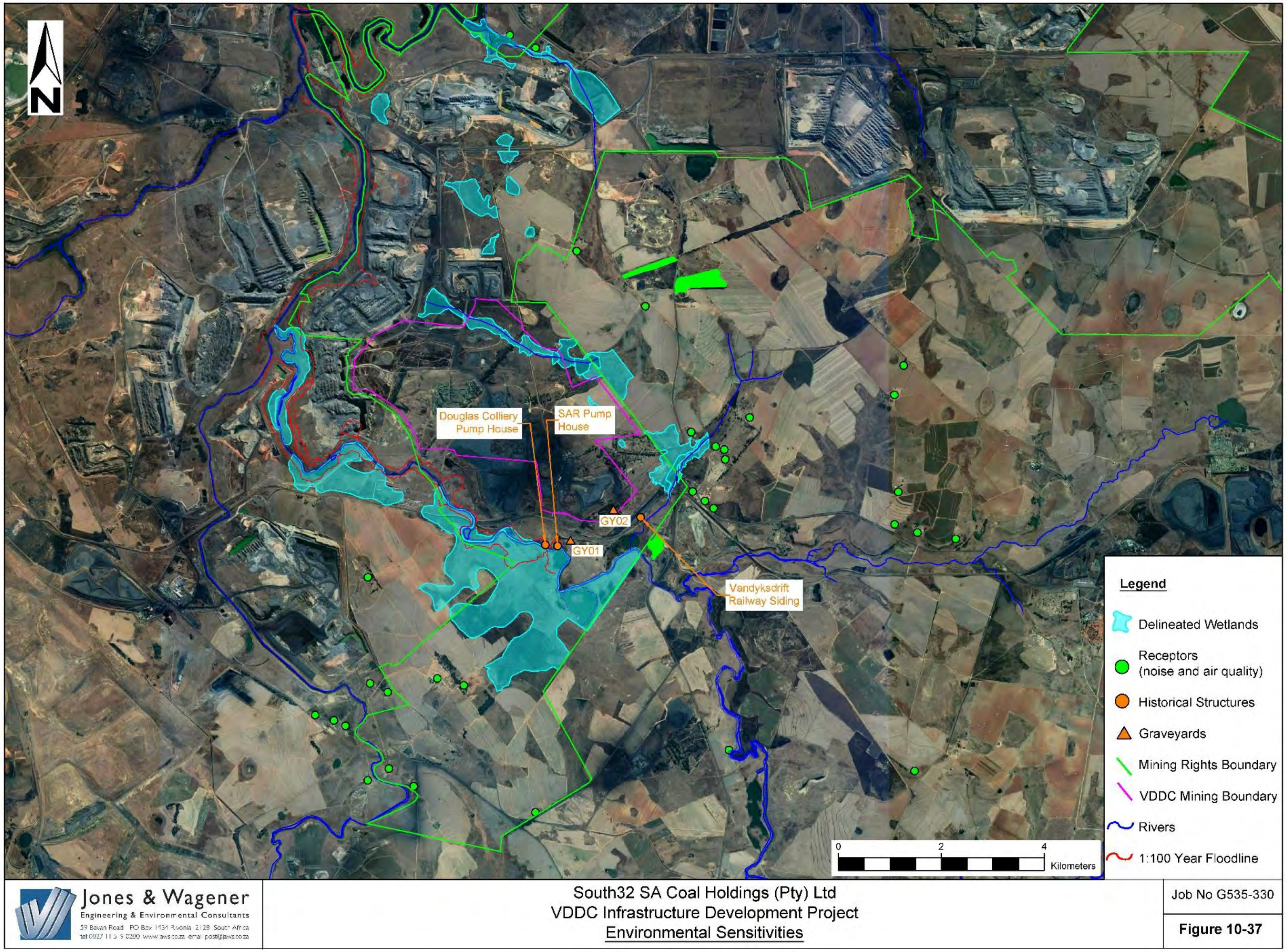


Figure 10-38: Environmental sensitivities

11. IMPACTS AND RISKS IDENTIFIED INCLUDING THE NATURE, SIGNIFICANCE, CONSEQUENCE, EXTENT, DURATION AND PROBABILITY OF THE IMPACTS, INCLUDING THE DEGREE TO WHICH THESE IMPACTS CAN BE REVERSED/AVOIDED/MANAGED AND/OR MITIGATED

(Provide a list of the potential impacts identified of the activities described in the initial site layout that will be undertaken, as informed by both the typical known impacts of such activities, and as informed by the consultations with affected parties together with the significance, probability, and duration of the impacts. Please indicate the extent to which they can be reversed, the extent to which they may cause irreplaceable loss of resources, and can be avoided, managed or mitigated).

The proposed infrastructure development is anticipated to impact on various biophysical aspects, and to a lesser extent on social aspects. The potential impacts identified are summarised in **Table 11-1**. Several specialist studies were conducted to investigate and assess the potential impacts in detail. A detailed impact assessment was conducted by each specialist where the significance, extent, duration, and probability of the impacts were determined. The methodology for assessing the impacts are described in detail in **Section 12** below.

Table 11-1: Potential environmental impacts investigated in the impact assessment phase

Environmental aspect	Potential environmental impact
Topography and land use	• The proposed infrastructure development may alter the topography and land use of the project area.
Soil and land capability	• The soils and land capability may be impacted by the proposed infrastructure development due to topsoil stripping, soil stockpiling, and increased soil compaction because of the movement of heavy machinery. • Hydrocarbon spills from the mine vehicles may occur during construction and operation, as well as from the maintenance of these vehicles.
Air quality	• Construction activities may result in increased dust generation • Blasting may contribute to dust generation • Dust may be generated due to the utilisation of haul roads • Stripping, loading, and dumping activities may generate dust • Mechanical evaporation of dirty water may result in the dispersion of salts into the receiving environment, particularly during windy conditions
Flora	• Construction of infrastructure may result in vegetation clearing. • Alien invasive species may establish due to soil disturbance
Fauna	• Construction may result in destruction of habitat • An increase in activity in the area and the resultant noise, traffic and dust generation, may disturb daily activities, nesting sites / breeding grounds, and interrupt the migration routes of fauna.
Surface water and wetlands	• The proposed infrastructure (some located near a watercourse) may negatively influence the surface water runoff regime, wetland functioning, ecological status and sensitivities.

Environmental aspect	Potential environmental impact
	• Water quality may be negatively affected due to contaminants entering surface resources.
Geohydrology	• Water quality may be negatively affected due to contaminants entering groundwater resources. • Groundwater flow and groundwater levels may be altered as a result of pit dewatering. • Potential decant from the opencast mining area, resulting in contamination of the surface water resources.
Heritage resources and palaeontological findings	• Existing heritage resources (such as graves), palaeontological findings, engravings, rock art and historic buildings near the proposed project may be damaged or destroyed.
Social	• Some portions of land used for agricultural activities may be disturbed for the development of the proposed infrastructure, impacting on agricultural production. • Construction activities may negatively impact the ambient noise levels with reference to sensitive receptors. • Development of infrastructure may result in further visual disturbance in the area. • Employment opportunities may only exist during the construction of the infrastructure. This may have a negative impact on the expectations of local jobseekers and may result in environmental degradation and/or community unrest. • Ambiguous and insufficient consultation with communities and land owners may generate false expectations and negative sentiments towards the infrastructure development project that could persist past the construction phase. • Blasting may cause result in ground vibration, air blast, fly rock and fumes, with an impact on nearby infrastructure and sensitive receptors

12. METHODOLOGY USED IN DETERMINING AND RANKING THE NATURE, SIGNIFICANCE, CONSEQUENCES, EXTENT, DURATION AND PROBABILITY OF POTENTIAL ENVIRONMENTAL IMPACTS AND RISKS

(Describe how the significance, probability, and duration of the aforesaid identified impacts that were identified through the consultation process was determined in order to decide the extent to which the initial site layout needs revision).

In order to ensure uniformity, a standard impact assessment methodology will be utilised so that a wide range of impacts can be compared. The impact assessment methodology makes provision for the assessment of impacts against the following criteria:

- Significance;
- Spatial scale;
- Temporal scale;
- Probability; and
- Degree of certainty.

A combined quantitative and qualitative methodology will be used to describe the impacts for each of the aforementioned assessment criteria. A summary of each of the qualitative descriptors along with the equivalent quantitative rating scale for each of the aforementioned criteria is given in **Table 12-1**.

Table 12-1: Quantitative rating and equivalent descriptors for the impact assessment criteria

RATING	SIGNIFICANCE	EXTENT SCALE	TEMPORAL SCALE	PROBABILITY
1	VERY LOW	Isolated corridor / proposed corridor	Incidental	Practically impossible
2	LOW	Study area	Short-term	Unlikely
3	MODERATE	Local	Medium-term	Could happen
4	HIGH	Regional / Provincial	Long-term	Very Likely
5	VERY HIGH	Global / National	Permanent	It's going to happen / has occurred

A more detailed description of each of the assessment criteria is given in the following sections.

Significance Assessment

Significance rating (importance) of the associated impacts embraces the notion of extent and magnitude but does not always clearly define these since their importance in the rating scale is very relative. For example, the magnitude (i.e. the size) of the area affected by atmospheric pollution may be extremely large (1 000 km^2) but the significance of this effect is dependent on the concentration or level of pollution. If the concentration is great, the significance of the impact would be HIGH or VERY HIGH, but if it is diluted it would be VERY LOW or LOW. Similarly, if 60 ha of a grassland type are destroyed the impact would be VERY HIGH if only 100 ha of that grassland type were known. The impact would be VERY LOW if the grassland type was common. A more detailed description of the impact significance rating scale is given in **Table 12-2** below.

Table 12-2: Description of the significance rating scale

RATING		DESCRIPTION
5	VERY HIGH	Of the highest order possible within the bounds of impacts which could occur. In the case of adverse impacts: there is no possible mitigation and/or remedial activity which could offset the impact. In the case of beneficial impacts, there is no real alternative to achieving this benefit.
4	HIGH	Impact is of substantial order within the bounds of impacts, which could occur. In the case of adverse impacts: mitigation and/or remedial activity is feasible but difficult, expensive, time-consuming or some combination of these. In the case of beneficial impacts, other means of achieving this benefit are feasible but they are more difficult, expensive, time-consuming or some combination of these.
3	MODERATE	Impact is real but not substantial in relation to other impacts, which might take effect within the bounds of those which could occur. In the case of adverse impacts: mitigation and/or remedial activity are both feasible and fairly easily possible. In the case of beneficial impacts: other means of achieving this benefit are about equal in time, cost, effort, etc.
2	LOW	Impact is of a low order and therefore likely to have little real effect. In the case of adverse impacts: mitigation and/or remedial activity is either easily achieved or little will be required, or both. In the case of beneficial impacts, alternative means for achieving this benefit are likely to be easier, cheaper, more effective, less time consuming, or some combination of these.
1	VERY LOW	Impact is negligible within the bounds of impacts which could occur. In the case of adverse impacts, almost no mitigation and/or remedial activity is needed, and any minor steps which might be needed are easy, cheap, and simple. In the case of beneficial impacts, alternative means are almost all likely to be better, in one or a number of ways, than this means of achieving the benefit. Three additional categories must also be used where relevant. They are in addition to the category represented on the scale, and if used, will replace the scale.
0	NO IMPACT	There is no impact at all - not even a very low impact on a party or system.

Spatial Scale

The spatial scale refers to the extent of the impact i.e. will the impact be felt at the local, regional, or global scale. The spatial assessment scale is described in more detail in **Table 12-3**.

Table 12-3: Description of the spatial scale

RATING		DESCRIPTION
5	Global/National	The maximum extent of any impact.
4	Regional/Provincial	The spatial scale is moderate within the bounds of impacts possible and will be felt at a regional scale (District Municipality to Provincial Level). The impact will affect an area up to 50km from the proposed site / corridor.
3	Local	The impact will affect an area up to 5km from the proposed route corridor / site.
2	Study Area	The impact will affect a route corridor not exceeding the boundary of the corridor / site.
1	Isolated Sites / proposed site	The impact will affect an area no bigger than the corridor / site.

Temporal Scale

In order to accurately describe the impact, it is necessary to understand the duration and persistence of an impact in the environment. The temporal scale is rated according to criteria set out in **Table 12-4**.

Table 12-4: Description of the temporal rating scale

RATING		DESCRIPTION
1	Incidental	The impact will be limited to isolated incidences that are expected to occur very sporadically.
2	Short-term	The environmental impact identified will operate for the duration of the construction phase or a period of less than 5 years, whichever is the greater.
3	Medium term	The environmental impact identified will operate for the duration of life of the project.
4	Long term	The environmental impact identified will operate beyond the life of operation.
5	Permanent	The environmental impact will be permanent.

Degree of Probability

The probability or likelihood of an impact occurring will be described, as shown in **Table 12-5** below.

Table 12-5: Description of the degree of probability of an impact occurring

RATING	DESCRIPTION
1	Practically impossible
2	Unlikely
3	Could happen
4	Very Likely
5	It's going to happen / has occurred

Quantitative Description of Impacts

To allow for impacts to be described in a quantitative manner in addition to the qualitative description given above, a rating scale of between 1 and 5 was used for each of the assessment criteria. Thus, the total value of the impact is described as the function of significance, spatial and temporal scale as described below.

$$\textbf{\textit{Impact Risk}} = \frac{(\text{SIGNIFICANCE} \mathbf{+} \textit{Spatial} \mathbf{+} \text{Temporal})}{3} \times \frac{\text{Probability}}{5}$$

An example of how this rating scale is applied is shown in **Table 12-6**.

Table 12-6: Example of Rating Scale

IMPACT	SIGNIFICANCE	SPATIAL SCALE	TEMPORAL SCALE	PROBABILITY	RATING
	LOW	Local	Medium Term	Could Happen	
Impact to air	2	3	3	3	1.6

Note: The significance, spatial and temporal scales are added to give a total of 8, that is divided by 3 to give a criteria rating of 2.67. The probability (3) is divided by 5 to give a probability rating of 0.6. The criteria rating of 2.67 is then multiplied by the probability rating (0.6) to give the final rating of 1.6. The impact risk is then classified according to 5 classes as described in **Table 12-7**.

Table 12-7: Impact Risk Classes

RATING	IMPACT CLASS	DESCRIPTION
NEGATIVE IMPACTS		
0.1 – 1.0	1	Very Low
1.1 – 2.0	2	Low
2.1 – 3.0	3	Moderate
3.1 – 4.0	4	High
4.1 – 5.0	5	Very High
POSITIVE IMPACTS		
Rating as for negative impacts		Positive impact

Therefore, with reference to the example used for air quality above, an impact rating of 1.6 will fall in the Impact Class 2, which will be considered to be a low impact.

13. THE POSITIVE AND NEGATIVE IMPACTS THAT THE PROPOSED ACTIVITY (IN TERMS OF THE INITIAL SITE LAYOUT) AND ALTERNATIVES WILL HAVE ON THE ENVIRONMENT AND THE COMMUNITY THAT MAY BE AFFECTED

(Provide a discussion in terms of advantages and disadvantages of the initial site layout compared to alternative layout options to accommodate concerns raised by affected parties)

Alternatives were considered for the dirty water management measures, as well as the layout of the topsoil stockpile:

- *Dirty water management measures:* The initial site lay-out included a proposed PCD to the southwest of the existing PSS dump, in close proximity to the Olifants River, and a section of the dam was located within the 1:100 year floodline. An alternative considered for the location of the proposed new PCD was to extend the existing Bob Henry dam to accommodate the additional mine-affected water that would be associated with the opencast mining. The preferred option as per the final lay-out is to manage the dirty water make from the operations through mechanical evaporators and a modular WTP, if required;
- *Topsoil dump alternatives:* The initial site lay-out considered an alternative location, to the south of the existing LAC discard dump. The preferred location for the stockpiling of topsoil is an extension of the existing topsoil dump to the east of the proposed mining and infrastructure development.

The positive and negative impacts of the alternatives are as discussed in **Table 13-1.**

Table 13-1: Positive and negative impacts associated with alternatives considered

Positive impacts	Negative impacts
Dirty water management	
Develop mechanical evaporators and water treatment plant, if required (preferred alternative)	
• Mine impacted water is managed within dirty water management system at proposed evaporation sites. • Mine impacted water is treated to acceptable quality with reduced impact potential. • Treated water discharged back into the river system.	• Concentrated brine from the WTP is evaporated through mechanical evaporators on the SKS void, which could result in air quality, soil, surface water and groundwater impacts.
Construct a new pollution control dam southwest of PSS dump	
• A new PCD would be in line with the relevant regulations with an updated design that would impact the environment to a lesser extent (compared to upgrading the Bob Henry dam). • Reduced cost of construction as compared to upgrading the Bob Henry dam.	• A section of the proposed PCD is located within the 1:100 year floodline of the Olifants River. • Destruction of terrestrial ecology within proposed PCD footprint.
Upgrade of existing Bob Henry dam	
• Reduced impact on terrestrial ecology surrounding the dam (compared to constructing a new PCD).	• The costs associated with upgrading the Bob Henry dam is expected to be significant.
Topsoil stockpile	
Topsoil stockpile area adjacent to existing topsoil stockpile (preferred alternative)	
• Topsoil is stockpiled for use in rehabilitation. • All topsoil stockpiled will be located within the same area. • Lesser transport cost associated with hauling of topsoil to the stockpile, compared to a stockpile located in the far south. • Not located within the vicinity of a watercourse.	• Located next to the proposed clean water diversion system and could affect the integrity of the system if the dump is not maintained (i.e. if erosion takes place and result in sedimentation of clean water system),

Positive impacts	Negative impacts
Topsoil stockpile alternative to the south of the LAC dump	
• Topsoil is stockpiled for use in rehabilitation.	• In close vicinity of the Olifants River. Potential impacts as a result of vehicle movement, potential dust and erosion from the stockpile on the water quality of a watercourse. • Increased transport distance for placement of topsoil during construction, will result in higher emissions.

14. THE POSSIBLE MITIGATION MEASURES THAT COULD BE APPLIED AND THE LEVEL OF RISK

(With regard to the issues and concerns raised by affected parties provide a list of the issues raised and an assessment/ discussion of the mitigations or site layout alternatives available to accommodate or address their concerns, together with an assessment of the impacts or risks associated with the mitigation or alternatives considered)

A detailed report of the comments received and the responses thereto, is provided in **Section 9.2** and an indication is provided of how the comments have been incorporated into the EIR/EMPr.

The comments related to project alternatives specifically are summarised below in **Table 14-1.**

Table 14-1: List of issues raised regarding project alternatives

Comment	I&AP	Mitigation measure(s) or alternative to address/accommodate concerns
The MTPA has no objection to the proposed amended mining right but is concerned about the following conservation important species that has survived on the degraded areas. The Critically Endangered ground orchid – the Albertina Sisulu *Brachycorythis conica subs transvaalensis* was recently recorded on site and *Frithia humilus*. The MTPA requires that a thorough plant study in the growing season of this area is done. The plant study will inform authorities of which habitat needs to be conserved. Mitigation methods of possible subsidence and trampling are required.	MTPA	These species were not recorded by the specialist during the dual season survey, however it was stated that these species could be present in the moist grassland and wetland areas. It is recommended that areas to be developed be specifically demarcated so that during the construction phase, only the demarcated areas be impacted upon and to prevent the movement of workers and machines into any sensitive surrounding environments. See mitigation measures in Table 18-6 and Table 18-7.
Eskom noted that it is likely that their Dx Infrastructure is affected by the proposed project.	Eskom	The infrastructure referred to by Eskom will be affected and a self-build agreement has been signed between Eskom and South32 regarding the deviation of the section of the powerline.
The buffer zone of the cemeteries in the HIA must be amended to allow for 100m. The PCD footprint must be amended to allow for the safe retention of the cemetery labelled GY01.	SAHRA	SAHRA raised concern regarding the proximity of the proposed PCD to GY01 and required that a buffer of 100 m be maintained around GY01 (refer to Table 9-1). The PCD

Comment	I&AP	Mitigation measure(s) or alternative to address/accommodate concerns
A buffer zone of 100m around the perimeter of the cemetery must be maintained at all times, the cemetery must be fenced with an access gate. Social consultation must be undertaken to find the relatives of the graves in the cemetery, and to obtain permission for the fencing of the graves. These conditions must be included in the EMPr. SAHRA will comment further once the PIA is submitted to the case along with the EIA report and its appendices.		as proposed in the initial CSR has been removed from the site layout following consideration of alternatives for the management of dirty water. The recommendation regarding the required buffer around GY01 has been retained – see Table 18-6 and Table 18-7.

The possible mitigation measures for the anticipated impacts are summarised in **Table 14-2** and discussed in more detail in section 18.15.

Table 14-2: Summary of possible mitigation measures

Environmental aspect	Potential environmental impact	Possible mitigation measures
Topography and land use	• The proposed infrastructure development and opencast mining will alter the topography and land use of the project area.	• Only disturb the area required for the proposed development
Soil and land capability	• The soils and land capability will be impacted by the proposed infrastructure development and opencast mining due to topsoil stripping, soil stockpiling, and increased soil compaction as a result of the movement of heavy machinery. • Hydrocarbon spills from the mine vehicles may occur during construction and operation phases, as well as from the maintenance of these vehicles. • Soil quality may be negatively affected as a result of salinisation from the mechanical evaporator system due to spray drift.	• Implement erosion control measures. • Spill clean-up kits always available. • Maintenance of vehicles to be done in demarcated areas. • Mechanical evaporators only to be used in previously disturbed mining areas. • Control spray drift by only using mechanical evaporators on windless days.
Air quality	• Construction activities will result in increased dust generation. • Blasting at the opencast mining area will contribute to dust generation. • Dust will be generated due to the utilisation of haul roads. • Stripping, loading, and dumping activities will generate dust. • Opencast mining will generate dust.	• Develop and implement adequate dust control strategies. • Implement concurrent rehabilitation once steady state is reached.

Environmental aspect	Potential environmental impact	Possible mitigation measures
Flora	• Construction of infrastructure and opencast mining will result in vegetation clearing and destruction of habitats. • Alien invasive species may establish due to soil disturbance.	• Limit the surface disturbance and vegetation clearing to the development footprint. • Develop and implement an alien invasive species control programme. • Develop a Rescue and Relocation Plan for SCC floral species.
Fauna	• Construction of infrastructure and opencast mining will result in destruction of habitat. • An increase in activity in the area and the resultant noise, traffic and dust generation, may disturb daily activities, nesting sites / breeding grounds, and interrupt the migration routes of fauna.	• Limit the surface disturbance and vegetation clearing to the development footprint. • Develop a Rescue and Relocation Plan for faunal species.
Surface water	• The proposed infrastructure and opencast mining extension will negatively influence the surface water run-off regime since clean water will be diverted away from the mining area and dirty runoff collected from the dirty water management areas (mining and infrastructure area) will be collected and contained. The surplus dirty water make from the mine will however be treated to acceptable standard and discharged back into the Olifants River system. • Water quality may be negatively affected due to contaminants entering surface resources as a result of inappropriate management of dirty water. • Water quality may be negatively affected as a result of spillage of hydrocarbons due to vehicular movement and maintenance. • Water quality may be negatively affected as a result of salinisation from the mechanical evaporator system.	• Separate clean and dirty storm water. • Divert clean runoff around the designated dirty areas by means of cut-off canals, sized to accommodate at the 1:50 year peak flow event. • Collect and contain dirty runoff and seepage. • All facilities with the potential to generate dirty storm water runoff, effluent or washdown water to be located within the designated dirty water management area. • If required, mine impacted water should be treated to Resource Quality Objectives for the receiving catchment before discharge. • Spill clean-up kits always available to address any leakages or spillages. • Maintenance of vehicles to be done in demarcated areas. • ROM coal stockpiles to be located within the dirty water management area. • Mechanical evaporators only to be used in dirty water management areas with

Environmental aspect	Potential environmental impact	Possible mitigation measures
		appropriate dirty water management measures. • Temporarily halt mechanical evaporation during high wind conditions.
Wetlands	• Wetland functioning, ecological status and sensitivities may be negatively affected as a result of changes to the runoff regime. • Wetland areas may be lost as a result of infrastructure development to support opencast mining (note that the opencast mining of wetlands has been approved in 2007).	• Demarcate delineated wetlands and any buffers recommended by the specialist as no-go areas where activities close to, or within the watercourse is not authorised. • Comply to conditions of authorisations for activities within watercourses. • Divert clean water around mining areas and manage clean and dirty water separately. • Contain dirty water and manage appropriately.
Geohydrology	• Water quality may be negatively affected due to contaminants entering groundwater resources. • Groundwater flow and groundwater levels will be altered as a result of pit dewatering.	• Provide appropriate barrier systems for the Mixed ROM coal and slurry stockpile areas and overburden dumps using a risk-based approach. • ROM coal stockpiles to be located within the dirty water management area. • Contain mine-impacted water abstracted from the pit, re-use as far as possible, or manage appropriately. • Maintain the pit dewatering pumping system throughout the operational phase. • Monitoring groundwater levels as per geohydrological specialist's recommendations.
Heritage resources and palaeontological findings	• One graveyard (GY02) is located within the opencast mining area not previously authorised and will be destroyed. • Palaeontological findings, and historic structures near the proposed project may be damaged.	• Relocate GY02 before mining commences in that area. • Implement a 100 m buffer around GY01 (as per comment received from SAHRA).

Environmental aspect	Potential environmental impact	Possible mitigation measures
		• Implement a Chance Find Procedure for heritage and paleontological resources.
Social	• Some portions of land used for agricultural activities will be disturbed for the development of the proposed infrastructure, impacting on agricultural production. • Construction activities will negatively impact the ambient noise levels with reference to sensitive receptors. • Development of infrastructure will result in further visual disturbance in the area. • Employment opportunities will only exist during the construction of the infrastructure. This will have a negative impact on the expectations of local jobseekers and may result in environmental degradation and/or community unrest. • Ambiguous and insufficient consultation with communities and land owners could generate false expectations and negative sentiments towards the infrastructure development project that could persist past the construction phase. • Blasting will cause result in ground vibration, air blast, fly rock and fumes, with an impact on nearby infrastructure and sensitive receptors.	• Develop a communication plan regarding employment opportunities. • Implement noise abatement measures. • Keep disturbance to the smallest area required. • Implement concurrent rehabilitation once steady state is achieved. • Implement monitoring (air quality, noise and blasting) to determine level of impact on sensitive receptors.

15. MOTIVATION WHERE NO ALTERNATIVE SITES WERE CONSIDERED

Not applicable. Alternatives were considered.

16. STATEMENT MOTIVATING THE ALTERNATIVE DEVELOPMENT LOCATION WITHIN THE OVERALL SITE

(Provide a statement motivating the final site layout that is proposed)

The proposed infrastructure development is limited in terms of its necessity to be in close proximity to the approved opencast mining. The preferred location of the infrastructure is determined on its potential impact on environmental, social and economic aspects, as well as its operational and financial implications.

The final lay-out plan is provided in **Figure 5-4** and a large scale map provided in **Appendix 5**. Alternatives were considered for the management of dirty water makes, as well as the position of the topsoil stockpile as discussed in section 8.1 The final lay-out plan incorporates the preferred options.

Consultation with I&APs to date, have not resulted in any changes to the site lay-out.

17. FULL DESCRIPTION OF THE PROCESS UNDERTAKEN TO IDENTIFY, ASSESS AND RANK THE IMPACTS AND RISKS THE ACTIVITY WILL IMPOSE ON THE PREFERRED SITE (IN RESPECT OF THE FINAL SITE LAYOUT PLAN) THROUGH THE LIFE OF THE ACTIVITY.

(Including (i) a description of all environmental issues and risks that were identified during the environmental impact assessment process and (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.)

A list of potential impacts associated with the proposed mining and infrastructure development was identified during the Scoping Phase and is summarised in **Table 11-1**.

A detailed description of the impact assessment and rating methodology is provided in **Table 12-1** to **Table 12-7** in **Section 12**. The following information sources were used in the assessment process:

- Observations made on site;
- Outcome of specialist studies;
- Review of the pre-feasibility studies;
- Review of existing approved EMPRs, water use licences and environmental authorisations;
- Input obtained from stakeholders during the public participation process;
- Liaison with the South32 project team;
- Review of engineering designs and reports compiled by the design engineers for the project (Worley); and
- Discussions with specialists, where required, regarding assessment and ranking of impacts.

18. ASSESSMENT OF EACH IDENTIFIED POTENTIALLY SIGNIFICANT IMPACT AND RISK

(This section of the report must consider all the known typical impacts of each of the activities (including those that could or should have been identified by knowledgeable persons) and not only those that were raised by registered interested and affected parties).

The main impacts associated with the proposed VDDC mining and infrastructure development is described below and the impact rating according to the methodology described in **Section 12,** as well as proposed mitigation, is provided in **Table 18-6** (Construction Phase), **Table 18-7** (Operational Phase) and **Table 18-8** (Decommissioning, Closure and Post-closure Phase). The detailed impact rating is attached as **Appendix 9**.

18.1 Wetlands

18.1.1 Construction phase

The main aspect to consider when assessing the impact of the proposed development on wetlands is that opencast mining of the Vleishaft tributary (referred to as HGM 2 in the wetland assessment – refer to section 10.1.1.6 and **Figure 10-16**) was authorised 2007. The VDDC pit is located within the opencast mining area indicated in the 2007 EMPR, except for the changes in the south as discussed in section 5.2.2.2. The additional opencast mining areas in the south due to the change in the pit lay-out does not result in the further destruction of wetlands. The additional opencast area in the south is, however, located within 500 m of delineated wetlands and was therefore included as a S21(c)&(i) water use in the IWULA. There are, therefore, no changes to the extent of direct impact on wetlands as a result of opencast mining.

The proposed infrastructure development within, or close to HMG 2, is also located within the opencast mining area indicated in the 2007 EMPR and the mining of this system was authorised. HGM 5, a depression of less than 1.5 ha will be lost due to the development of the Eastern overburden dump.

A total wetland area of 198.9 ha was delineated for the VDDC infrastructure and mining project, with 120 ha expected to be lost/impacted as a result on the proposed infrastructure and mining development. This represents a 60% loss of wetland area. As stated above, the total extent of HGM 2 has already been authorised to be opencast mined. Any impact associated with the proposed infrastructure development will therefore be of temporary nature (approximately 20 years) until the infrastructure is decommissioned and the area opencast mined.

A wetland offset strategy was compiled in support of the 2007 EMPR amendment for the mining of the wetland and addresses the impact associated with the total development in HGM 2.

No direct impacts are expected for the unchanneled valley bottom wetland, which is associated with HGM 4, and any indirect impacts may be mitigated due to the presence of the railway line and existing PCD's. These structures are likely to intercept any contaminated surface run-off, preventing contamination of the unchanneled system.

The ecological integrity and functioning of the channelled valley bottom wetland associated with the Olifants River (HGM 1) is unlikely to be affected by the project (TBC, 2019).

The overall impact on wetlands during the construction phase after mitigation measures have been implemented is anticipated to be LOW to MODERATE.

18.1.2 Operational phase

The loss of wetland areas during the construction phase and the resultant loss of water, increased sedimentation of these systems and the impaired water quality will result in the degradation of the remaining wetland reaches.

The planned opencast mining poses an indirect risk to the local wetlands as a result of the cone of depression that will result from the dewatering of the opencast pit.

The overall impact on wetlands during the operational phase after mitigation measures have been implemented is anticipated to be LOW to HIGH.

18.1.3 Decommissioning, closure and post-closure phase

The removal of infrastructure and rehabilitation activities will be a large-scale operation, but it will not necessarily result in the restoration of wetland areas. Based on the final rehabilitation plan, the rehabilitation of the area will not result in the creation of the lost wetland areas and associated ecosystem services.

The potential decant of mine impacted water may impact on wetland systems in close proximity to the decant point.

The overall impact on wetlands during the decommissioning phase after mitigation measures have been implemented is anticipated to be LOW.

18.1.4 Cumulative impact

There is an existing high impact on wetlands considering the extent of mining and development in the area, and the wetland areas and associated services already lost, or authorised to be developed.

Taking into consideration the extent of wetland area already authorised to be developed, the cumulative loss of wetland ecosystem services, or degradation of these services, is expected to remain HIGH.

18.2 Terrestrial biodiversity (Fauna and Flora)

Where the proposed activities footprint and natural areas overlap, the proposed activities will result in direct loss of habitats, direct mortalities and displacement of fauna and flora. The removal of natural vegetation to accommodate these activities will reduce the habitat available for fauna species, populations and ecological compositions within the project area.

The project area considered in this study was noted to be inhabited by several plant, mammal, reptile and bird species. Although it is assumed that the majority of fauna species will relocate to different areas as a result of disturbance, many fauna species have very specific habitat requirements, and the destruction of their habitats could result in their displacement to less optimal habitats. This will result in a decline in species numbers which may ultimately affect the conservation status of specific species on global, national and provincial scales.

As mentioned previously, a number of high sensitivity areas were identified within the project area. These include significant wetlands and/or are areas considered to have a high biodiversity value or are areas where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part of the project area (habitats associated with the Vleishaft Tributary) and intersects with many of the proposed infrastructure development areas. Approval was, however granted in 2007 for this area to be mined.

18.2.1 Construction phase

During the construction phase, clearing of vegetation and topsoil removal will result in:

- Destruction and fragmentation of the vegetation community, including portions of an Endangered vegetation type (i.e. the Eastern Highveld Grassland), a Vulnerable ecosystem type, wetlands (which is also classified as ESAs in terms of the MBSP), as well as corridors;

- Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.

The overall impact on terrestrial biodiversity during the construction phase after mitigation measures have been implemented is anticipated to be MODERATE.

18.2.2 Operational phase

During the operational phase, opencast mining and the operation of infrastructure will result in the continued removal and fragmentation of an Endangered vegetation type (including portions of wetlands and areas classified as ESAs), as well as potential encroachment by alien invasive plant species. Potential leaks and discharges of pollutants from the mining activities into the surrounding environment could influence the floral habitat negatively.

The mining activities will also result in the continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation (litter, road mortalities and/or poaching).

The overall impact on terrestrial biodiversity during the operational phase after mitigation measures have been implemented is anticipated to be MODERATE.

18.2.3 Decommissioning, closure and post-closure phase

During the decommissioning phase, activities will have similar impacts as during the construction and operational phase with potential displacement of faunal and floral communities. The risk of the establishment of floral alien invasive species should be carefully managed once the area has been rehabilitated.

The proposed end land use is grazing and the vegetation to be established will therefore be commensurate with this land use.

The overall impact on terrestrial biodiversity during the decommissioning phase after mitigation measures have been implemented is anticipated to be LOW.

18.2.4 Cumulative impact

Based on the findings of the biodiversity assessment, the majority of the overall area was prescribed a low sensitivity due to the extent of current and previous mining activities and associated disturbances. Despite this, a number of high sensitivity areas were identified within the project area, which are wetlands and/or are areas considered to have a high biodiversity value or where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part of the project area. This area has already been authorised to be mined and the cumulative impact is therefore rated as HIGH.

18.3 Aquatic ecosystems

The following two aspects have been considered:

- The conditions within the physical make-up of the considered river reaches, which includes the riverine substrates, banks, riparian vegetation and water column. These physical components of a watercourse determine the quality of the aquatic habitats and therefore, modification of these physical components would result in an impact on habitat quality;

- The chemical properties of water within the river reaches. Considering aquatic biota have requirements for habitat, as well as sensitivity to changes in water chemistry. Any change to surface water quality as discussed in section 18.8 will therefore impact on the aquatic ecosystem.

18.3.1 Construction phase

No direct contact between the instream and riparian areas, and the proposed infrastructure are anticipated. Some of the infrastructure will, however, be developed within 500 m of these areas. Diffuse runoff and seepage from the activities may have an impact on the aquatic ecosystems and result in a change to the PES of the system and the habitat quality.

The overall impact during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.3.2 Operational phase

The proposed discharge of treated water into a wetland feeding into the Olifants River will result in an increase in the overall water volumes in the Olifants River. This may serve to inundate additional riverine habitat. This impact is dependent on the existing water levels in the Olifants River. It is noted that following the inundation of additional habitats associated with discharge of treated water volumes, an equilibrium would be established within the short term and therefore this habitat impact is not expected to last for the entirety of the discharge period. It is assumed that the treated water will be of good quality (the RQO for this catchment of the Olifants River) and the discharge of the treated water would therefore likely serve to reduce the salinity in the system, which would be a positive impact to the watercourse.

The overall impact on aquatic ecosystems during the operational phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.3.3 Decommissioning, closure and post-closure phase

The removal of infrastructure and rehabilitation activities will be a large-scale operation, which could impact on surface water quality with the resultant impact on the aquatic ecosystem.

The potential decant of mine impacted water may impact on the aquatic ecosystem as a result of the deterioration in water quality.

The overall impact on aquatic ecosystems during the decommissioning phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.3.4 Cumulative impact

The aquatic ecosystem has been impacted as a result of existing land uses and has been shown to be seriously modified (PES of class E). The proposed VDDC mining and infrastructure development is expected to result in an improvement of water quality directly downstream of the discharge from the WTP, which will result in a new equilibrium reached in the aquatic ecosystem. The cumulative impact is, however, expected to remain HIGH.

18.4 Soil, land use and land capability

The proposed VDDC mining and infrastructure development project is located within an active mining area and the soils have been widely impacted. As indicated in **Table 10-1**, at least 56% of the soils within the study area have been impacted by mining and associated structures.

18.4.1 Construction phase

Activities during the construction phase will include the clearing of areas and the disturbance of the topsoil through excavations, as well as the construction of a soil stockpile. The topography and natural drainage lines will be disturbed. The overall impact will be loss of topsoil as well as loss of land capability as a result of soil removal, erosion and possible contamination of the soil by fuel and oils from machinery. Soil compaction caused by heavy vehicles and machinery surrounding the pit areas could also be a problem.

Construction activities will change the land use to mining causing unsuitable conditions for any further commercial farming.

The bulk of the proposed infrastructure will be located on areas for which the soils and land capability is already impacted (542 ha out of 716 ha, or 75.6%). Only 12.2 ha of agriculturally producing soils will be impacted. The potential impacts to wetland soils will be 19 ha in extent, with a further 62 ha of impact on grazing land.

The overall impact on soil, land use and land capability during the construction phase after mitigation measures have been implemented is anticipated to be MODERATE.

18.4.2 Operational phase

During the operational phase, the following impacts are expected on the soils and land capability:

- Opencast mining destroys the soil profile since the material is removed and stockpiled. This is relevant to the opencast mining not previously authorised;
- Stockpiled soils will deteriorate over time, organic material will be lost and the seedbank in the soil will become sterile. Compaction and potential anaerobic conditions inside the stockpile can further impact on stockpiled soils;
- The soils under stockpiles and overburden dumps will be compacted, and potentially contaminated from the overlying waste material;
- The mechanical evaporators proposed as part of the project will results in salinisation of the soils, with increased salt and sulphate concentrations due to salty mine water evaporating on the surface. Previous studies at WVK indicated an approximate area of impact for 12 evaporators to be estimated 12 ha. For the VDDC project, the evaporators will however be placed at the backfilled SKS pit. If the pit backfill is rehabilitated, the salinisation will be an impact on the rehabilitated soils. If the backfill is not rehabilitated, the salinisation will add to the salt load of the water make in the pit;
- Soil erosion through wind and storm water runoff, and soil pollution by means of hydrocarbon contamination and potentially coal dust. Stormwater runoff from roads must therefore be controlled and managed by means of proper storm water management facilities in order to prevent soil erosion;

- Diesel and oil spills are common at mine sites due to the large volumes of diesel and oil consumed by mine vehicles. Pollution may however be localised. Small pockets of localised pollution may be cleared up easily using commercially available hydrocarbon emergency clean-up kits;
- Continuous vehicle and machinery movement will also likely lead to a further increase in soil compaction, which may contribute to soil erosion if it is not managed.

The overall impact on soil, land use and land capability during the operational phase after mitigation measures have been implemented is anticipated to be HIGH.

18.4.3 Decommissioning, closure and post-closure phase

Soil quality deteriorates during stockpiling and replacement of these soil materials into soil profiles during rehabilitation cannot imitate pre-mining soil quality properties. Soil depth, however, can be imitated but the combined soil quality deterioration and resultant compaction by the machines used in rehabilitation during decommissioning, leads to a net loss of land capability. A change in land capability then forces a change in land use. Typically, in this area, arable land capability changes to grazing land capability.

The rehabilitation of soil, land capability and land use by replaced soils over disturbed areas will bring back a form of land capability that can support an alternative end land use.

The overall impact on soil, land use and land capability during the decommissioning phase after mitigation measures have been implemented is anticipated to be LOW POSITIVE.

18.4.4 Cumulative impact

The baseline impact on soils is regarded as HIGH due to the extent of existing disturbance of soils, land use and land capability.

The aim of the rehabilitation and closure phase is to reduce the effects of the impacts of the proposed project. In this case it will be the removal of the stockpiles, the discard and the use of the topsoil dumps for rehabilitation of the larger mining area. The VERY LOW positive impact of the rehabilitation will replace the soil in layers, but it will not be sufficient to bring back agricultural production or soil sustainability. Therefore, the impact remains a HIGH Impact.

18.5 Heritage resources

The expected impact during the construction and operational phases on the heritage resources is similar.

Based on the layout plan for the project, the following is noted:

- The historical structures consisting of pump stations and a railway siding will not be affected by the proposed project. *The impact on these structures is rated as VERY LOW;*
- GY02 will be affected when the opencast pit is expanded beyond the current approved area *and the impact is therefore rated as VERY HIGH*. This graveyard will therefore have to be exhumed and relocated in terms of the relevant legislation before opencast mining in that area may proceed.

Chance Find Procedures are applicable during all the project phases and apply to all contractors, subcontractors, subsidiaries or service providers. If any of these institutions' employees find any heritage resources during any developmental activity, all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site.

18.6 Palaeontology

18.6.1 Construction phase

Based on the nature of the infrastructure development, the surface soils will be excavated to a depth of several metres for the construction of the storm water management structures, the Mixed ROM coal and slurry stockpile area; topsoil stockpile following clearance of vegetation; pipelines for the conveyance of water, and new haul roads. Since there is no chance of finding fossils in the topsoil and down to about 15 m or more, there would be no impact on the fossil heritage.

18.6.2 Operational phase

The project is located in a well-established coal mining area with economically productive coal seams. While coal *per se* does not preserve any recognisable fossil plant material because it has been altered and compressed by high temperatures and pressures, impressions of the coal flora can be found in the shales and mudstones between the coal lenses. Vertebrates are seldom found to occur with fossil plants as the preservation conditions are different and vertebrate fossils are extremely rare at this time.

Opencast mining of the areas not approved previously, will result in the excavation of the shales and mudstones between the coal lenses where paleontological findings could be made. *The impact is rated as MODERATE.*

It is therefore recommended that a Fossil Chance Find Protocol be implemented during the operational phase. If recognisable fossils are found by the responsible person monitoring the excavated sediments, then a palaeontologist should be called to assess them. As far as the palaeontology is concerned the proposed development can go ahead. Any further palaeontological assessment would only be required after mining has commenced and if fossils are found by the geologist or environmental personnel.

18.6.3 Decommissioning, closure and post-closure phase

No deep excavations are anticipated during the decommissioning phase and there is no risk to the paleontological resources.

18.6.4 Cumulative impact

Although no fossils have been recorded from this region, there is a small chance that they could occur and therefore a Fossil Chance Find Protocol has been recommended.

18.7 Groundwater

18.7.1 Construction phase

Impact on groundwater during the construction phase is expected to be minimal. It is therefore expected that the current status quo will be maintained. However, it should be noted that the current groundwater quality on site shows an existing impact as a result of historic mining activities. Potential impact is on groundwater quality may occur as a result of localised spillages of hydrocarbons and other material with pollution potential.

No impact is expected on groundwater levels as a result of construction activities.

The overall impact on groundwater quality and levels during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW

18.7.2 Operational phase

18.7.2.1. Groundwater levels

During the operational phase, it is expected that the main impact on the groundwater environment will be dewatering of the surrounding aquifer. Water entering the pit will have to be pumped out to enable mining activities to continue. This will cause a lowering in the groundwater table in- and adjacent to the mine.

The dewatering of the aquifer has been calculated for the proposed opencast using the calibrated numerical model referred to above. It should be noted that dewatering of the historic underground workings was also calculated based on the information for the VDDC dewatering project compiled by Jaco-K Consulting in 2016. This report stated that an average dewatering rate of 24 Mℓ/d would be extracted from the workings. Therefore, drawdown was calculated after 2 years of this dewatering when opencast mining would commence. Further to this, the mining sequence was also taken in consideration when calculating the drawdown. The calculated drawdown of groundwater levels is depicted as contours of drawdown in Figure 18-1.

The dewatering of the VDDC opencast mining area is expected to result in a maximum drawdown of 20 – 60 m, with a cone of depression of 200 – 250 m from the edge of the pit. The tributary of the Olifants River to the south-east of the mining area is likely to be impacted as a result of the drawdown caused by the mining activities and related dewatering. Surface water users that make use of this tributary may therefore be affected due to reduced baseflow.

The overall impact on groundwater levels during the operational phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.7.2.2. Groundwater quality

During the operational phase, the flow in the aquifer will be directed towards the mine as discussed above. Very little groundwater pollution affecting private users and surface water is thus expected. Additionally, current contaminated groundwater could also flow into the mine, diverting the current contaminant plume from the defunct underground mine.

A groundwater flow and transport model was developed to assess the potential groundwater pollution associated with the facilities to be developed. It should be noted that the potential pollution sources were modelled as if the facilities remain in position for the entire LOM, whereas these facilities will in fact be moved or removed as mining progresses, e.g. boxcut spoils dumps will only remain on surface until steady state mining is achieved and will then be used in the backfilling of the pit as part of concurrent rehabilitation. In addition, it was assumed that the stockpile areas will not be provided with any barrier system, whereas the Eastern overburden dump and the Mixed ROM coal and slurry stockpile areas will be provided with a barrier system. The modelled impact therefore represents worst case scenario (J&W, 2019a). The calculated spread of contamination is shown on **Figure 18-2**.

Contamination from the various potential surface sources (i.e. Eastern overburden dump, Mixed ROM coal and slurry stockpile areas, Vleishaft PCD and Final Rejects Dump is expected to result in concentration increases of 200 – 1 000 mg/ℓ with regards to SO_4.

The overall impact on groundwater quality during the operational phase after mitigation measures have been implemented is anticipated to be VERY LOW.

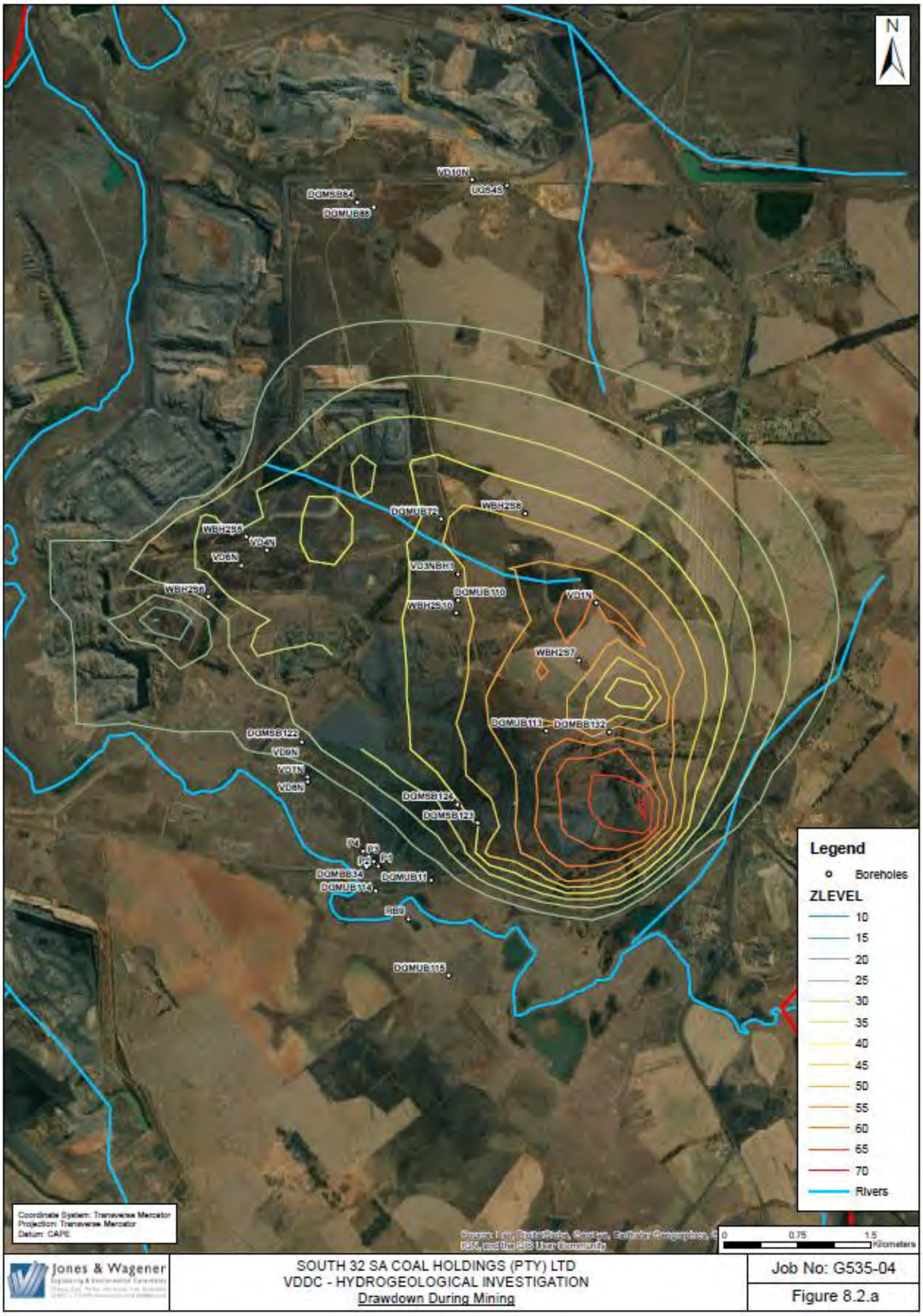


Figure 18-1: Modelled drawdown during mining (J&W, 2019a)

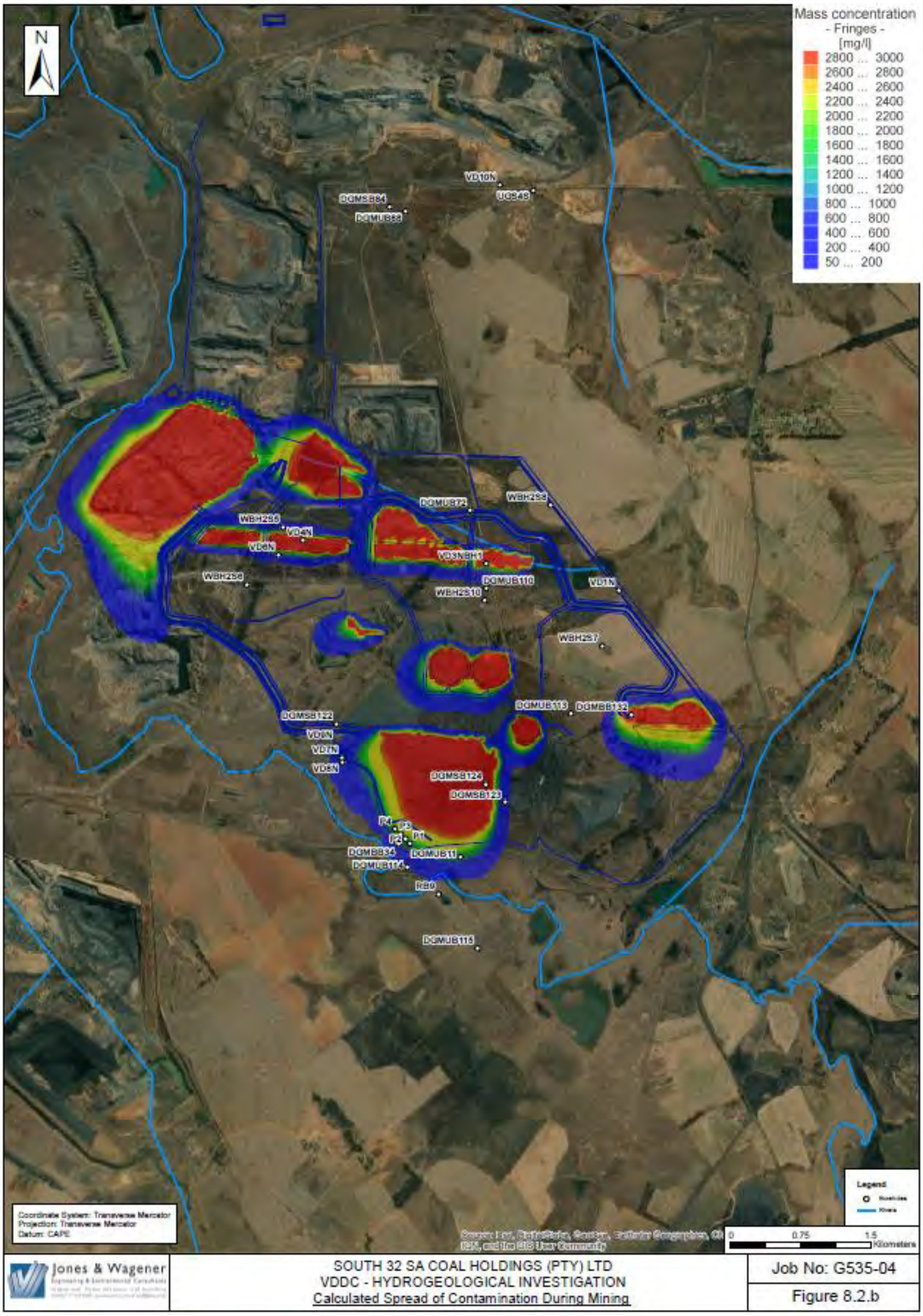


Figure 18-2: Calculated spread of contamination during mining (J&W, 2019a)

18.7.3 Decommissioning, closure and post-closure phase

18.7.3.1. Groundwater levels

During the decommissioning phase (i.e. after mining has ceased) it is assumed that dewatering of the opencast will cease, and it will be allowed to flood. The groundwater regime will return to a state of equilibrium once mining has stopped and the removal of water from the mining void has been discontinued.

The rise in groundwater level is predicted to be relatively quick and the water levels are expected to recover in about 2-5 years. The quick recovery is ascribed to the elevated hydraulic conductivity of the surrounding bedrock due to historic mining activities as well as connections to surrounding defunct underground and opencast mines. The following possible impacts were identified at this stage:

- Following closure of the mine, the groundwater level will rise to an equilibrium that will differ from the pre-mining level due to the disturbance of the bedrock;
- Groundwater quality within the mined areas is expected to deteriorate due to chemical interactions between the geological material and the groundwater. The resulting groundwater pollution plume is expected to commence with downstream movement;
- Continued groundwater contamination is likely to be released from the waste storage facilities, if not removed (J&W, 2019a).

18.7.3.2. Groundwater quality

Once the normal groundwater flow conditions have been re-instated, polluted water could potentially migrate away from the mining area. As some discards and exposed reactive mineral surfaces will remain in the mine, this outflow could be contaminated as a result of mine drainage. As sulphate is normally a significant solute in drainage from mines, sulphate concentration from the mine has been modelled as a conservative (non-reacting) indicator pollution associated with mining. A starting concentration of 3 000 mg/ℓ has been assumed as a worst-case scenario based on the J&W report of 2016. However, geological material is a transient contaminant source and decreases in the concentration of released contaminants are expected over time. A 1% decrease in contaminant concentrations in the mine were incorporated into the transport modelling. This relates to sulphide mineral oxidation and dilution effects depleting the source of sulphate (J&W, 2019a).

The migration of contaminated water from mining and the extent of the pollution plume 10, 25, 50 and 100 years after the operations have ceased, were modelled and are indicated in **Figure 18-3** to **Figure 18-6**. An increase in sulphate concentration of 200 – 1 000 mg/ℓ is expected within the aquifer.

The overall impact on groundwater quality during the decommissioning phase after mitigation measures have been implemented is anticipated to be VERY LOW

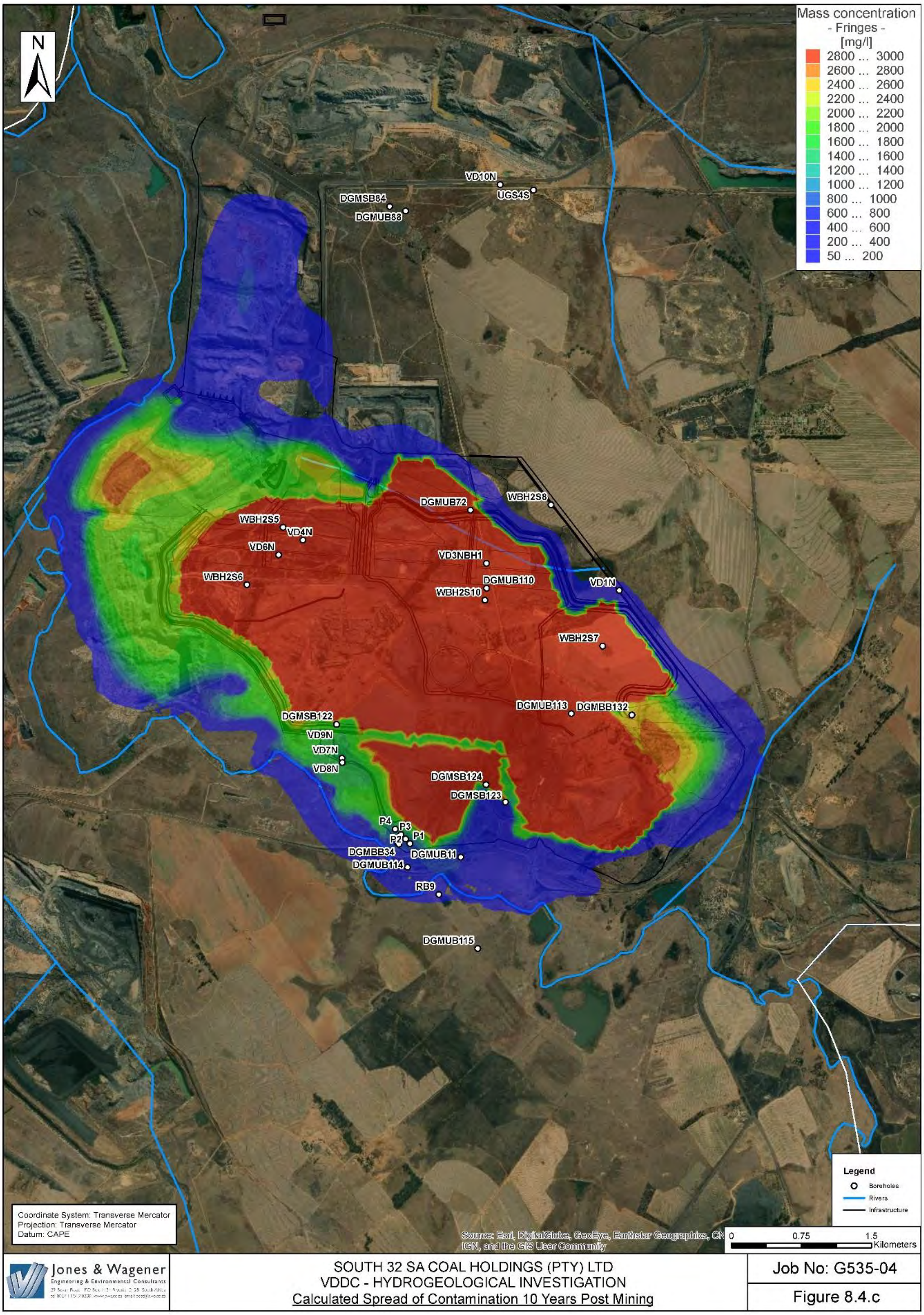


Figure 18-3: **Modelled contamination plume 10 years post mining (J&W, 2019a)**

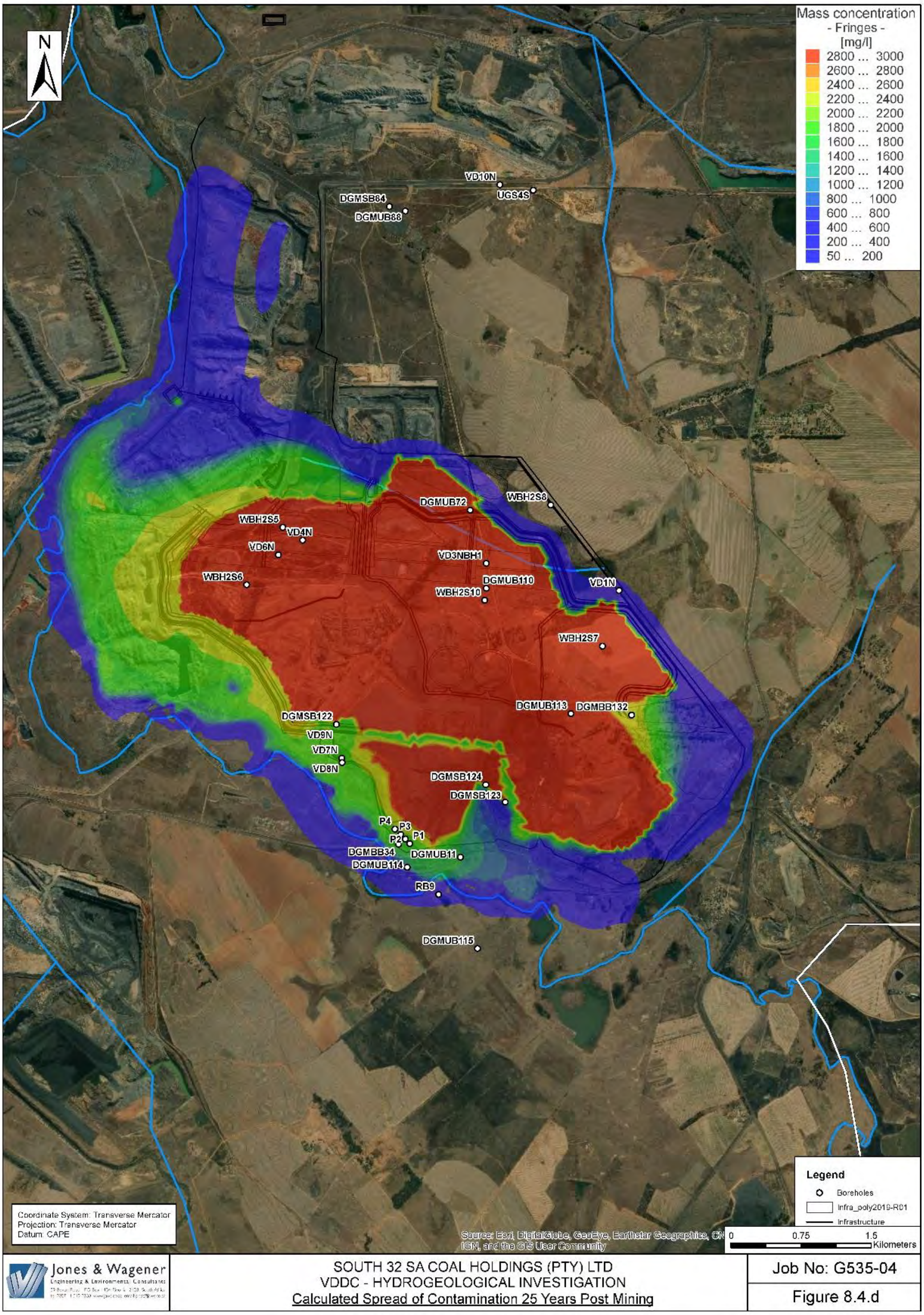


Figure 18-4: **Modelled contamination plume 25 years post mining (J&W, 2019a)**

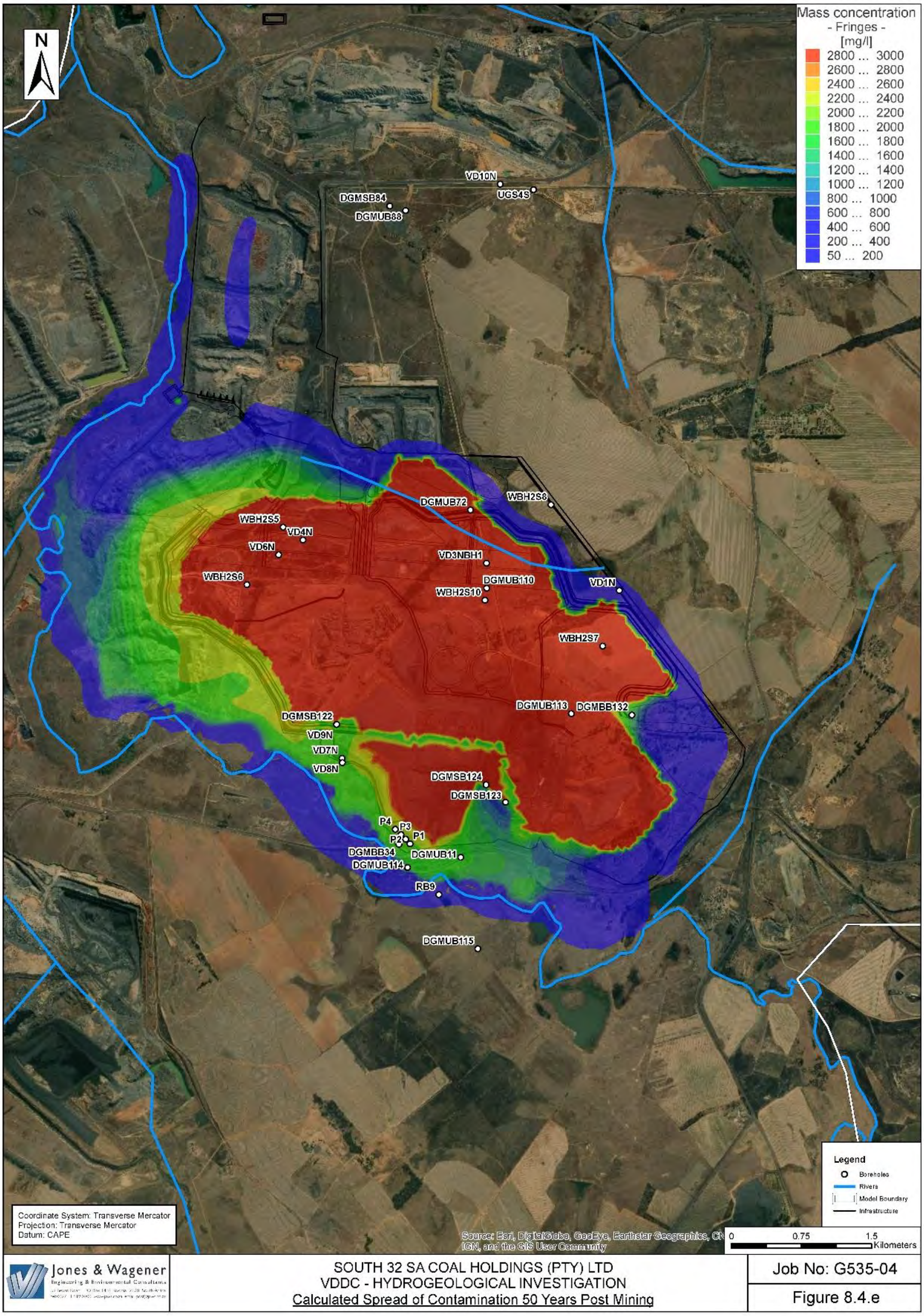


Figure 18-5: Modelled contamination plume 50 years post mining (J&W, 2019a)

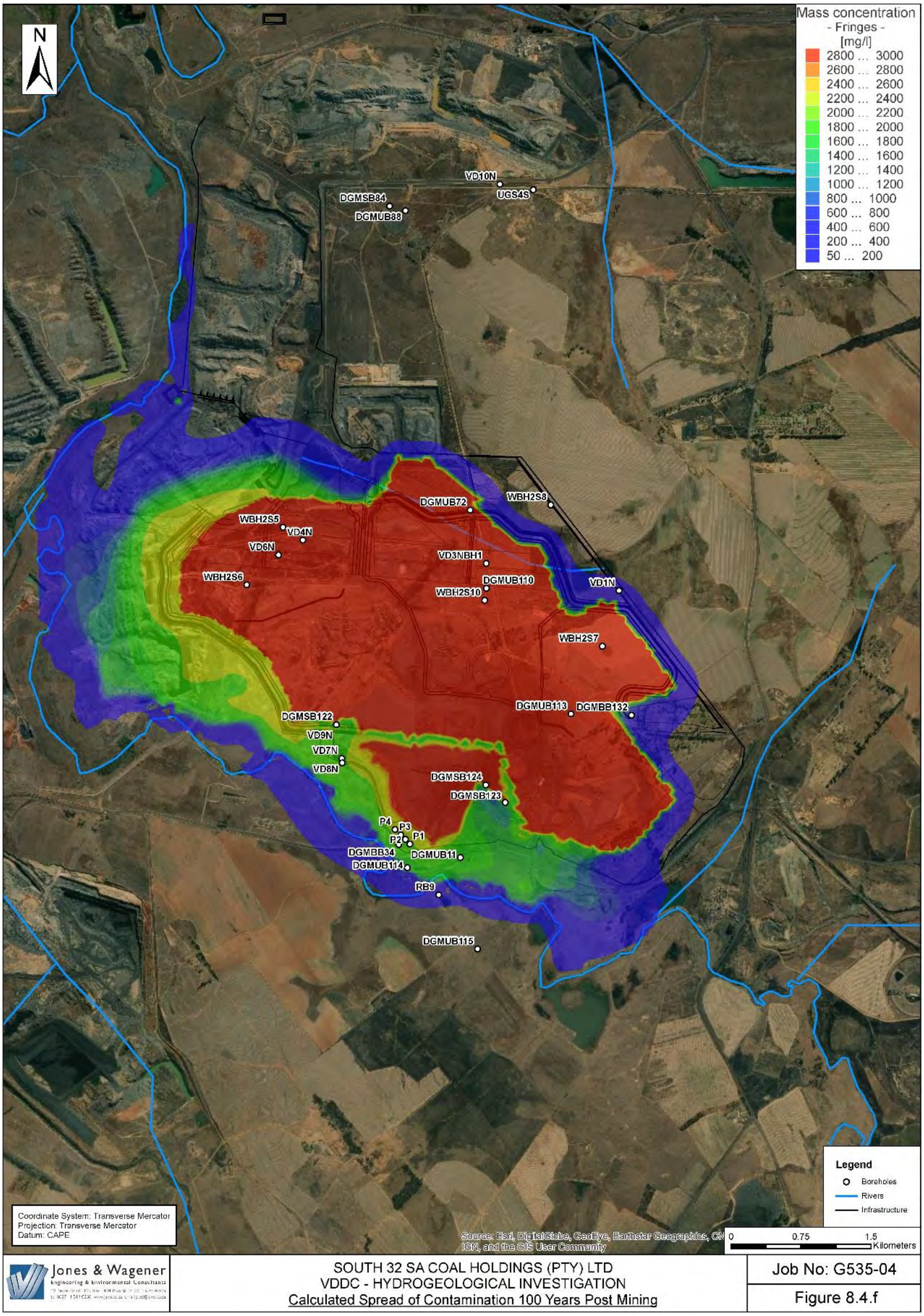


Figure 18-6: Modelled contamination plume 100 years post mining (J&W, 2019a)

18.7.3.3. *Mine water decant*

Following the cessation of opencast mining and the associated dewatering, it is assumed to lead to groundwater rebound. This estimated rebound time in years for the opencast after cessation of pumping is approximately five (5) years.

After rebound has reached equilibrium, decant has the potential to occur due to excessive rainfall and surface water run-off water entering the backfilled pit, as well as the hydraulic parameters of the backfill material. The percentage of the rainfall/runoff that is recharged into the rehabilitated opencast and potential discharge depends on:

- The slope of the rehabilitated pit and its direct surroundings;
- The thickness and composition of the topsoil. i.e. clay content and compaction;
- The vegetation of the rehabilitation and its direct surroundings;
- The amount of rainfall and intensity of the rainfall events; and
- The size of the ramps and the final voids.

The predicted discharge (decant) areas are shown in **Figure 18-7.** Please note that predicted discharge areas may vary from exact discharge areas due to sub-surface heterogeneity, however the general areas of predicted discharge should be consistent. The calculated subsurface mine water movement resulting in decant will move through the south-eastern edge of the backfilled pit of VDDC. The calculated sub-surface decant elevation is approximately 1 530 mamsl with a discharge volume of approximately 0.5 ℓ/s. The water level in the backfilled pit should be maintained approximately 5 m below the sub-surface discharge elevation as a safe management level. Please note that this decant rate and elevation is based on a model that incorporates an intact geological barrier between the VDDC opencast and the SKS and Glencore backfilled pits to the west. Should this not be the case, the decant location, rate and elevation is expected to be different (J&W, 2019a).

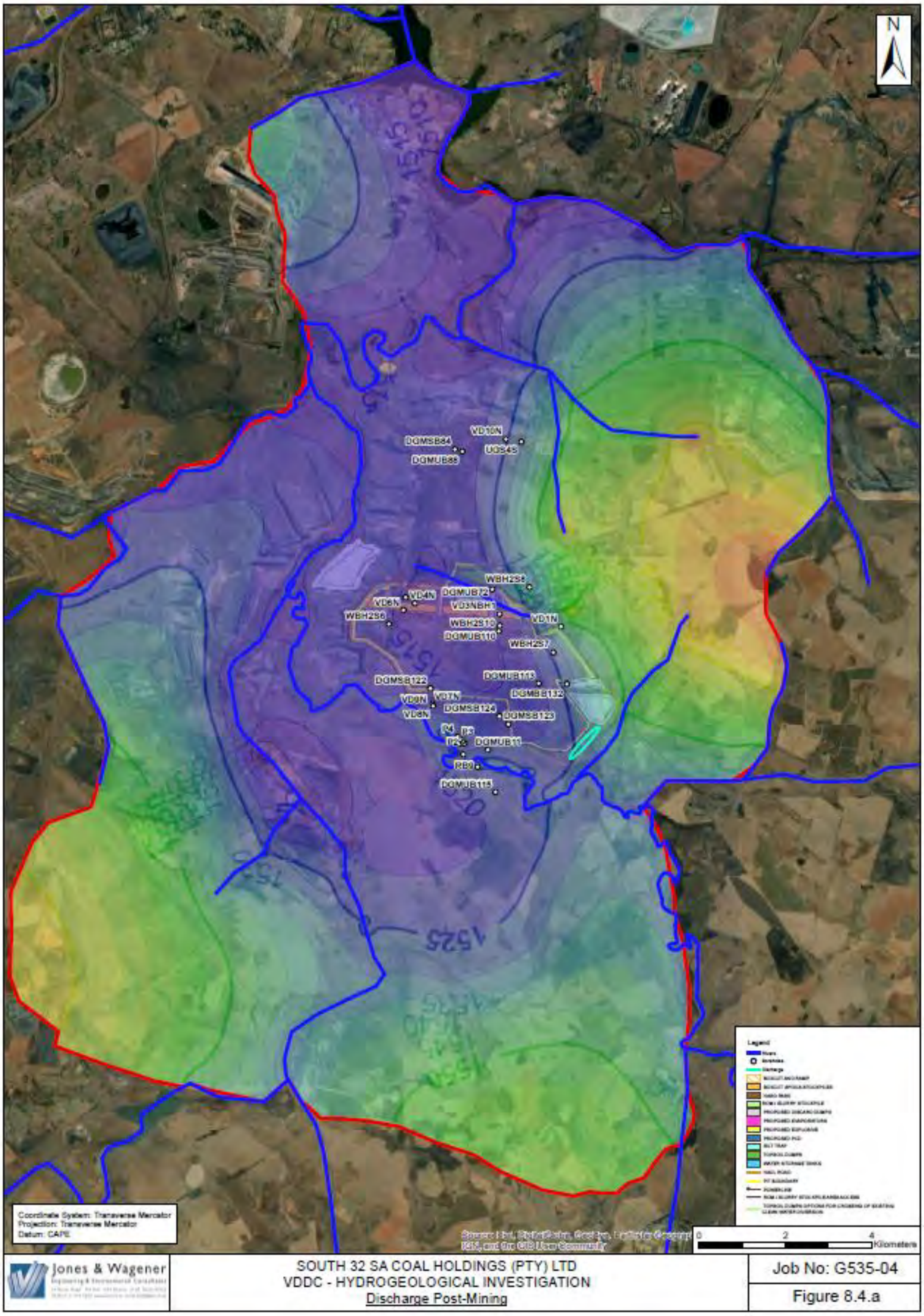


Figure 18-7: Discharge post mining (J&W, 2019a)

18.7.4 Cumulative impact

The groundwater flow and transport model considered all potential pollution sources, including the Final Rejects Dump which will remain in the long-term. There is an existing impact on the groundwater quality and levels as a result of mining activities. With the VDDC mining and infrastructure project, the cumulative impact is expected to be medium.

18.8 Surface water

18.8.1 Construction phase

18.8.1.1. Surface water quality

During the construction phase, the general construction activities such as clearing of topsoil, civil works, movement of material and equipment, as well as the servicing of construction vehicles and equipment could impact on surface water quality. Construction of mine infrastructure, including water management infrastructure (clean and dirty water canals, silt traps, pump stations and pipelines) will contribute to this.

Impacts included

- Erosion of soils during rainfall events, with elevated suspended solids in the runoff water;
- Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses;
- Hydrocarbon spillages from fuel storage, servicing areas or construction equipment itself, with resultant elevated hydrocarbon concentrations in runoff water and watercourses.

The overall impact on surface water quality during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW.

18.8.1.2. Catchment yield

During construction, surface runoff will not be released to the catchment, as the proposed activities are largely located within the existing dirty water management area of the mine.

The overall impact on surface water quantity during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW.

18.8.2 Operational phase

18.8.2.1. Surface water quality

Impacts on surface water resources include impact on surface water quality, which may arise from:

- Clean runoff entering the mine-affected areas and coming into contact with carbonaceous material, with resultant deterioration in water quality;
- Dirty runoff and mine water make discharging to the environment, with resultant deterioration in water quality within the Olifants River;
- Contaminated seepage from the overburden dumps, with potentially elevated sulphate and TDS;

- Leakage of mine impacted water from pipelines, storm water drains (if not maintained) and silt trap;
- Erosion at the clean water discharge points, resulting in the formation of erosion gullies, with elevated suspended solids in the runoff water, potentially impacting on the water quality in the Olifants River and south-eastern tributary in terms of suspended solids and deposition of silt;
- Dust suppression with mine impacted water contaminating the surface resulting in contaminated runoff during rainfall events, with resultant deterioration in water quality;
- Coal spillage, or spillage of water transported with the coal with haul trucks from the pit onto the haul roads, with resultant contamination of storm water;
- Spillage of chemical additives or waste products at the modular WTP, resulting in the deterioration of water quality in the watercourses;
- Discharge of water that does not meet the discharge standards, or untreated water during upset conditions at the WTP resulting in water quality deterioration;
- The release of surplus treated water into the catchment will influence the water quality of the receiving resource. The baseline water quality shows that the Olifants River is already heavily impacted, and the quality of water is expected to improve due to dilution effects.

The potential impact associated with the management of storm water can be mitigated through the implementation of appropriate stormwater management measures such as the separation of clean and dirty runoff and the containment of dirty water.

The overall impact on surface water quality during the operational phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW. The overall impact of the discharge of treated water on surface water quality is anticipated to be a MODERATE POSITIVE impact.

18.8.2.2. Catchment yield

The proposed mining and infrastructure development will also have an impact on the catchment yield and flow rates of the systems.

The loss in catchment yield associated with the proposed VDDC project will be primarily due to the pit area and associated infrastructure, since these areas will be isolated from the catchment due to the containment of dirty runoff. It is planned to undertake concurrent rehabilitation, which will minimise the dirty water make, as well as the reduction in catchment yield.

Treated water from the WTP will be released into the catchment, resulting in an increase in catchment yield, which is regarded as a positive impact. It is noted that the change in water quantity may have an impact on aquatic ecology, which is discussed in section 18.3.

The Witbank Dam has been selected as the receiving water body for the VDDC project as it is located downstream of the proposed development within the Olifants River catchment area. Beyond the Witbank Dam, the potential impact of the mine becomes extremely small due to the water volumes in the catchment and dilution effects.

An assessment was done of the impact of the proposed development on catchment yield for the Witbank Dam and is indicated in **Table 18-1**. It should be noted that this calculation was done assuming worst case, i.e. that no concurrent rehabilitation will take place.

Table 18-1: Calculated loss of catchment yield (J&W, 2019b)

Location	Catchment area (km^2)	MAR Pre-Construction ($x10^6$ m^3)	MAR during operations ($x10^6$ m^3)	Percentage reduction (%)
VDDC opencast pit	11.4	0.36	0	100
New proposed infrastructure	1.6	0.05	0	100
Extension/replacement of existing infrastructure	1.4	0.04	0	100
VDDC Infrastructure and mining project in total	14.5	0.45	0	100
Olifants River downstream of the mine property	3309	188.1	187.65	0.24
Witbank Dam	579	190	189.5	0.24

The impact in surface water yield to the Olifants River downstream of the project area and the Witbank Dam is low, with an expected reduction of 0.24% (J&W, 2019b).

The potential flooding of mine or mine infrastructure developed within floodlines was also assessed, which may have an impact on mining operations. It was determined that this is unlikely as no mining will take place within the 1:100 year floodline areas without the relevant necessary authorisations.

The overall impact on surface water quantity during the operational phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW. The overall impact of the discharge of treated water on surface water quantity is anticipated to be a MODERATE POSITIVE impact.

18.8.3 Decommissioning, closure and post-closure phase

18.8.3.1. Surface water quality

Impacts resulting from general decommissioning and rehabilitation activities will be similar to those during the construction phase, with earthworks related to rehabilitation and the movement of construction equipment on the site.

The water management berms and canals isolate active areas from the catchment by diverting upslope clean runoff around the active areas and containing runoff generated on the active areas. These can only be removed once the area has been rehabilitated but may result in increased erosion if not properly planned and maintained prior to their removal.

Impacts may arise from:

- Erosion of soils during rainfall events, with elevated suspended solids in the runoff water.
- Resultant elevated suspended solids in the watercourses, as well as sedimentation in the watercourses.
- Hydrocarbon spillages from fuel storage, servicing areas or construction.

Once the pit has been backfilled and rehabilitated, dewatering will cease and groundwater levels will begin to recover in the workings.

Decant from this mine is expected to take place at the Olifants River tributary to the south-east of the site via subsurface discharge at approximately 1 530 mamsl and approximately 0.5 ℓ/s. The predicted time to decant for VDDC pit is within 5 years after mining. The expected sulphate levels are approximately 2 000 – 3 000 mg/ℓ.

The overall impact on surface water quantity during the decommissioning phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW.

18.8.3.2. Catchment yield

Once the opencast pit has been rehabilitated and re-vegetated, runoff from the rehabilitated area will be regarded as clean and this will have a positive impact on the catchment yield.

The overall impact on surface water quantity during the decommissioning phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW.

18.8.4 Cumulative impact

Wolvekrans and Ifalethu Collieries (the MR379 mining right area), represents a large portion of surface disturbance in the catchment that could potentially impact on surface water. Although the VDDC area is small in relation to the larger mining right area, it does add to the surface disturbance of Wolvekrans Colliery as a whole.

There are a number of other land use activities within the Olifants River catchment, both upstream and downstream of the VDDC section that potentially impact on the water quality and quantity in the catchment. This includes:

- Coal mining operations including Kleinkopje in the west, Black Wattle Colliery to the north, as well as Mavela Colliery and Muhanga Mine on the banks of the Spookspruit, downstream of the Middelburg Water Reclamation Plant located at Ifalethu Colliery. These are however small in relation to Wolvekrans and Ifalethu Collieries, as well as the iMpunzi Complex located to the southwest of the VDDC mining area;
- Agricultural activities;
- Power stations; and
- Industrial areas.

The cumulative impact of the VDDC section on the surface water resources, with the mitigation measures described in the impact assessment, is considered to be MODERATE to HIGH in relation to the current and anticipated future activities in the area, as the catchment is already impacted by mining activities. The cumulative impact of all the coal mines in the area has resulted in deterioration of water quality and quantity in the region. Every new mine contributes to the further reduction and / or deterioration of the water resources in the Olifants River catchment. It is therefore essential that good water management practices be implemented at VDDC to limit further contributions to the existing impacts in the catchment.

18.9 Noise

The noise impacts during construction and decommissioning phase will be similar to operational phase (Airshed, 2019b).

Simulated noise levels in isopleth form is shown in isopleth form in **Figure 18-8** to **Figure 18-10**.

The simulated equivalent continuous day-time rating level ($L_{Req,d}$) due to project operations of 55 dBA (guideline level) extends approximately 120 m from the pit and approximately 80 m from the haul road. The simulated equivalent continuous night-time rating level ($L_{Req,n}$) of 45 dBA (guideline level) due to project operations extends approximately 900 m from the pit and approximately 400 m from the haul road. The simulated continuous day- and night-time rating levels do not exceed the noise guideline levels at any of the identified sensitive receptors.

For a person with average hearing acuity an increase of less than 3 dBA in the general ambient noise level is not detectable. According to SANS 10103 (2008); ‘little’ to ‘medium’ reaction with ‘sporadic’ to ‘widespread’ complaints can be expected from the community for increased noise levels up to 10 dBA. ‘Very strong’ reaction with ‘vigorous community action’ is expected from the community for increased noise levels of more than 15 dBA. With the approach adopted for the noise assessment by Airshed, the predicted increase in noise levels are expected to result in ‘little’ reaction with ‘sporadic’ complaints from noise sensitive receptors R2, R3 and R8 during the night and ‘medium’ reaction with ‘sporadic’ to ‘widespread’ complaints from receptor R7 during the night (Airshed, 2019b).

The overall impact on noise during the project duration after mitigation measures have been implemented is anticipated to be LOW.

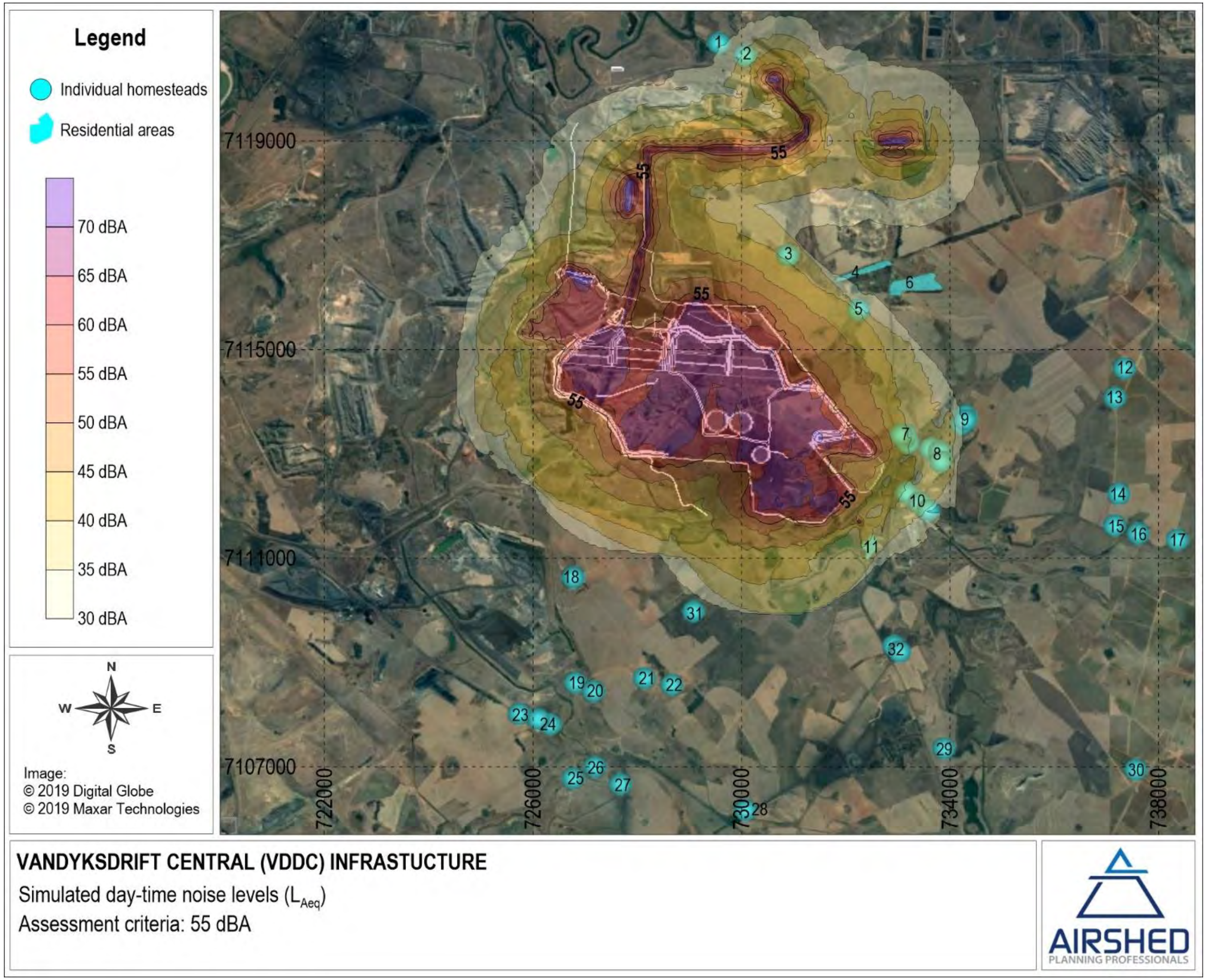


Figure 18-8: Simulated equivalent continuous day-time rating level ($L_{Req,d}$) for project activities (Airshed, 2019b)

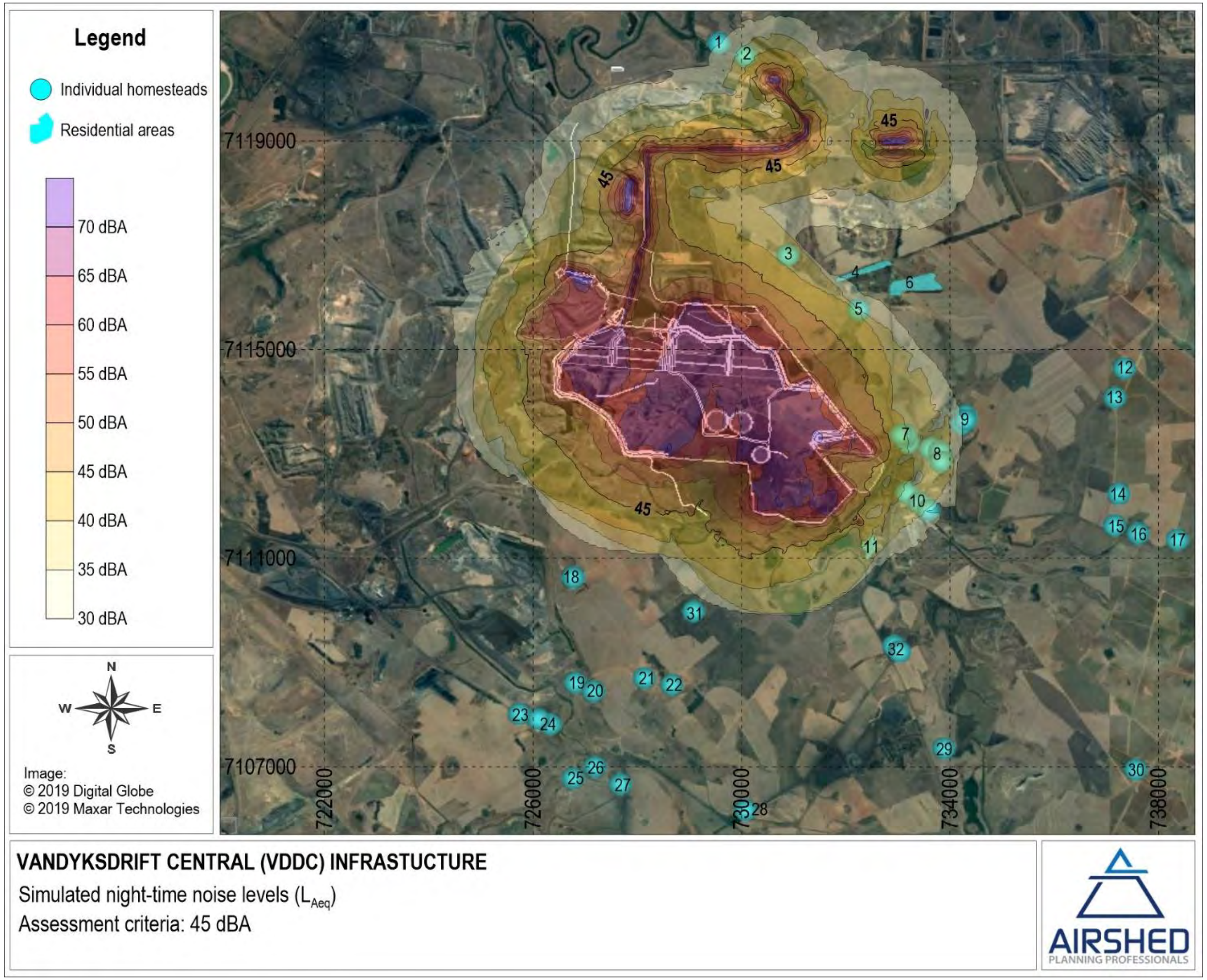


Figure 18-9: Simulated equivalent continuous night-time rating level ($L_{Req,n}$) for project activities (Airshed, 2019b)

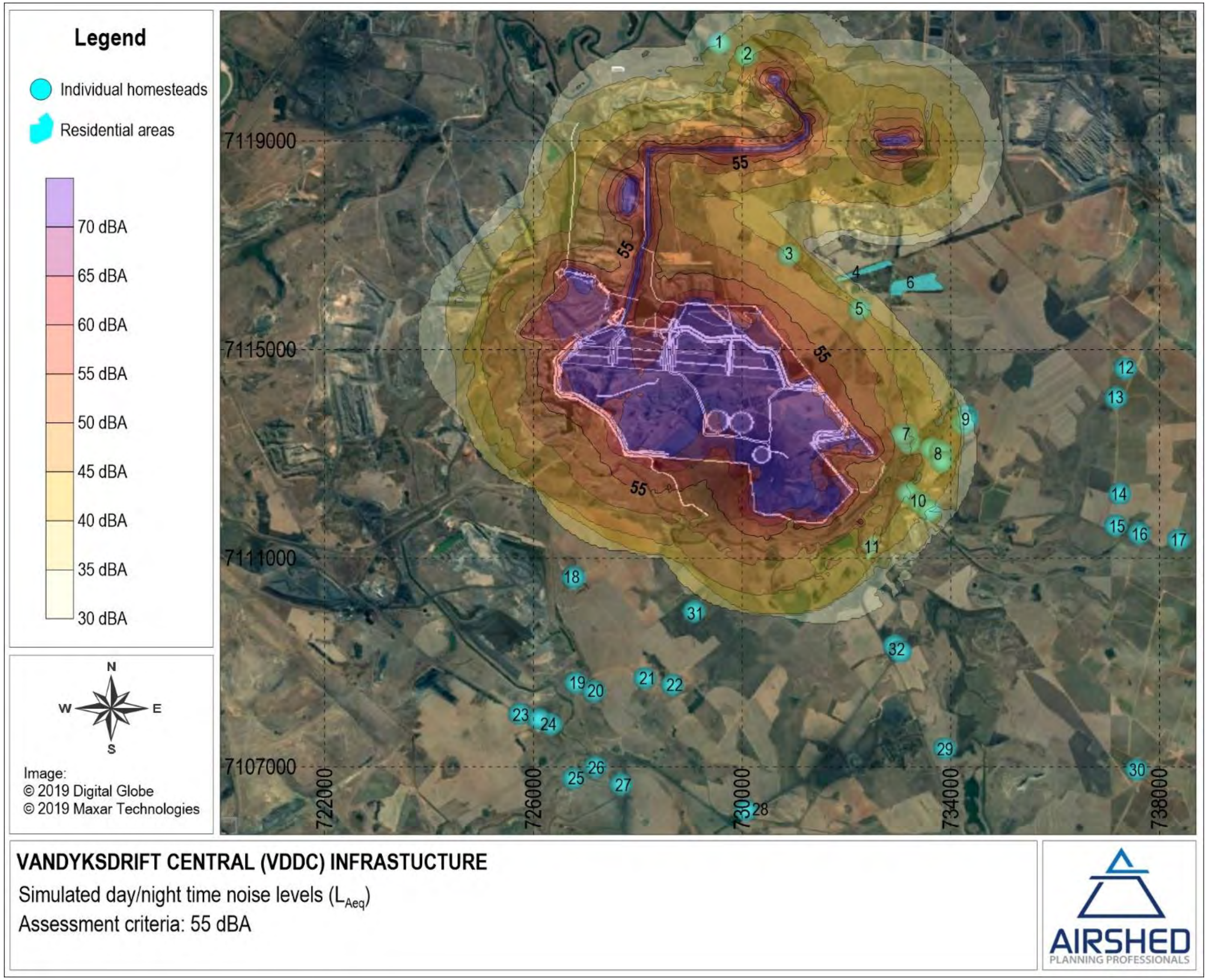


Figure 18-10: Simulated equivalent continuous day/night-time rating level ($L_{Req,dn}$) for project activities (Airshed, 2019b)

18.10 Visual

18.10.1 Construction phase

Construction activities will include the clearing of areas through excavations, as well as the construction of the various stockpiles. The topography and natural drainage lines will therefore be disturbed. The impact will be from the visual disturbance as a result of dust, as well as from vehicular movements. As the stockpiles have not yet reached their full height, the impact is limited to the cleared footprints.

Construction activities will change the land use to mining causing unsuitable conditions for any further commercial farming. Approximately 78 ha out of the 489 ha of footprint to be disturbed by this project is currently natural or farmland. The remaining 411 ha has already been disturbed by either opencast mining, underground mining or associated activities.

The anticipated impact on visual disturbance during the construction phase is expected to be LOW.

18.10.2 Operational phase

During the operational phase, the stockpiles will increase in height over time, becoming more and more visible. At the time of the visual assessment, the estimated heights for these stockpiles were not available and therefore the visual modelling assumed 40 m for stockpiles and 10 m for workshops, explosive magazines and other structures.

The visual impact was modelled for the static observer scenario and the dynamic observer scenario (i.e. driving on the nearby roads) is shown on **Figure 18-11** and **Figure 18-12** respectively. The model assumed that all structures have reached their final heights and therefore is a representation of the most conservative scenario and that all impacts will be maximised at the same time.

From the static observer model, it can be seen that the visual impact will reach some 8 – 9 km from the structures. The highest visibility will be from the explosive magazine that will be especially visible on the ridge to the north of the site, just south of Duvha power station. Another area of high impact will be to the south-east, near the Vandyksdrift railway loop, where the Eastern overburden dump and Final Reject Dump will be very visible.

The dynamic impacts from the roads in the area will be intermittent, and as shown in **Figure 18-12**, is expected to be low in magnitude but can be long in duration (depending on distance travelled). The infrastructure will be visible from the R547, R544, R575, and the R542 roads.

The overall visual impact during the operational phase is rated as HIGH.

18.10.3 Decommissioning, closure and post-closure phase

During the decommissioning and closure phase, the soil stockpiles will be utilised for rehabilitation of the mining area as well as the overburden stockpiles. Once sloped and vegetated, the rehabilitated mine should blend into the surrounding landscape.

The impact during this phase is rated as a VERY LOW POSITIVE impact.

18.10.4 Cumulative impact

The visual model shown in **Figure 18-11** and **Figure 18-12**, takes the existing visual landscape, adds the contours from the proposed development and models the visual impact of the combined landscape. Therefore, the impact demonstrated can be regarded as the cumulative impact of the VDDC site.

However, when considering the larger landscape within which the mine is located, then the numerous other mining operations (Kleinkopje, iMpunzi, Steenkoolspruit, etc) also have to be considered. The cumulative impact is therefore rated as a VERY HIGH due to the extent of visual disturbance as a result of existing and proposed land uses.

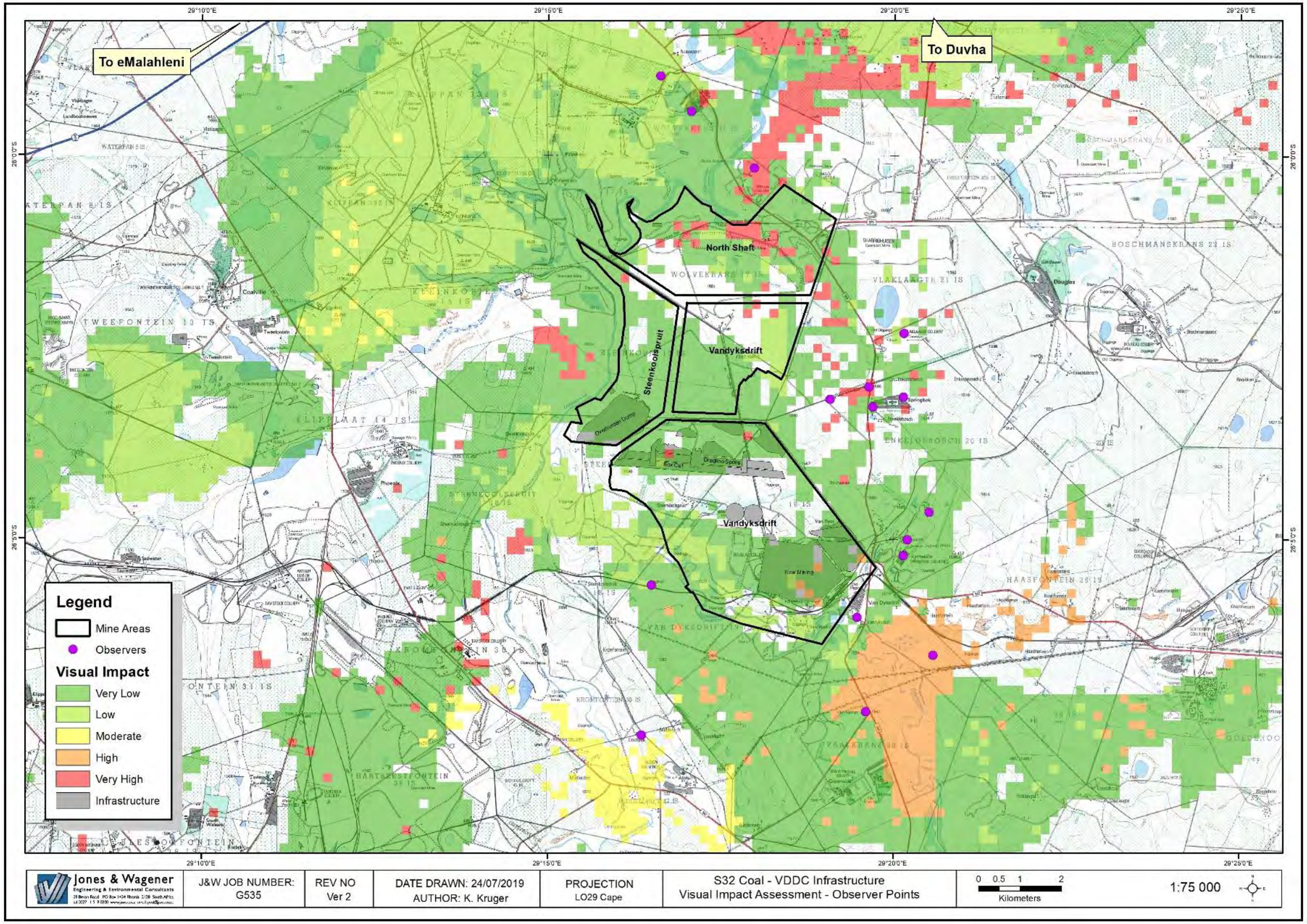


Figure 18-11: Modelled visual impacts to key static observer points (J&W, 2019e)

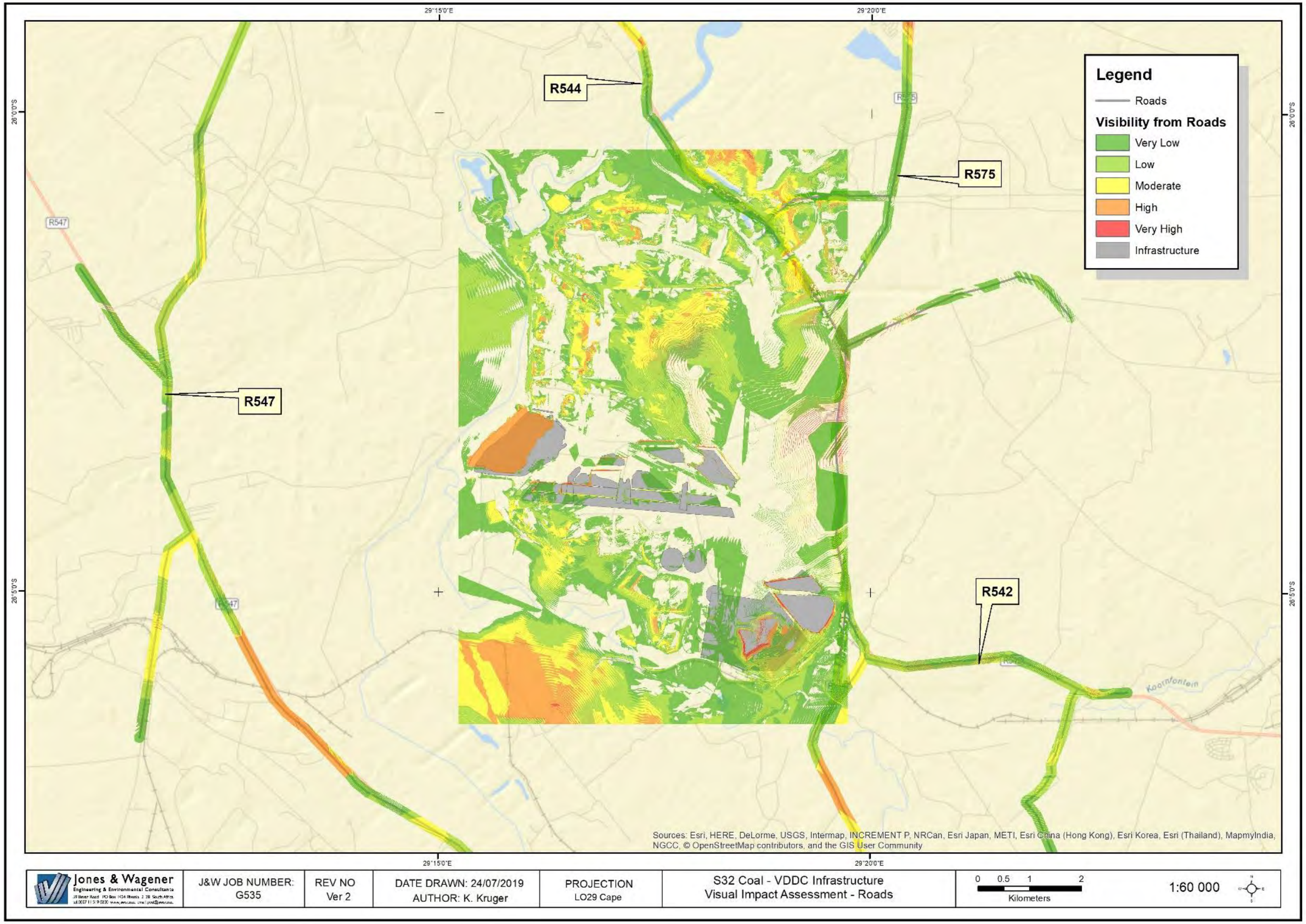


Figure 18-12: Modelled visual impact to dynamic observer points, i.e. driving on nearby roads (J&W, 2019e)

18.11 Air quality

The main pollutant of concern associated with the proposed operations is particulate matter. Particulates are divided into different particle size categories with Total Suspended Particulates (TSP) associated with nuisance impacts (dustfall) and the finer fractions of PM_{10} and $PM_{2.5}$ linked with potential health impacts. PM_{10} is primarily associated with mechanically generated dust whereas $PM_{2.5}$ is associated with combustion sources. Gaseous pollutants (such as SO_2, NO_X, CO, etc.) derive from vehicle exhausts and other combustion sources. These are, however, insignificant in relation to the particulate emissions and will not be considered in detail in this assessment (Airshed, 2019a).

18.11.1 Construction phase

Unmitigated construction activities provide the potential for impacts on local communities. On-site dustfall may also represent a nuisance to employees. The temporary nature of the construction activities, and the likelihood that these activities will be localised and for small areas at a time, will reduce the potential for significant off-site impacts. A list of all the potential dust generation activities expected during the construction phase is provided in **Table 18-2**. Each of the operations listed in the Table has their own duration and potential for dust generation. It is therefore often necessary to estimate area wide construction emissions, without regard to the actual plans of any individual construction process. Emissions were therefore calculated for general infrastructure construction activities, which was assumed to include clearing of groundcover, levelling of areas, construction of on-site roads, and general infrastructure edifices, wind erosion from open areas, vehicle entrained dust and materials handling (Airshed, 2019a).

Table 18-2: Typical sources of fugitive particulate emission associated with construction (Airshed, 2019a)

Impact	Source	Activity
Gases	Vehicle tailpipe	Transport and general construction activities
TSP, PM_{10} and $PM_{2.5}$	Opencast mining area	Clearing of groundcover
		Levelling of area
		Infrastructure edifice (on site roads, storage areas, offices, workshops)
		Wind erosion from open areas
		Materials handling
	Transport infrastructure	Clearing of vegetation and topsoil
		Levelling of proposed transportation route areas

The estimated particulate emissions associated with general construction activities over an assumed 30 month construction period is summarised in **Table 18-3.** *The expected impact is rated as LOW to VERY LOW.*

Table 18-3: Estimated particulate emissions associated with general construction activities for the construction phase (Airshed, 2019a)

	Calculated emissions		
	$PM_{2.5}$	PM_{10}	TSP
TOTAL (tonnes per 30-month period)	252	505	1294
TOTAL (tonnes per month)	8.41	16.83	43.14

18.11.2 Operational phase

To determine the significance of air pollution impacts from the proposed project, three scenarios were assessed by Airshed:

- Scenario 1: Year 2027 operations;
- Scenario 2: Year 2034 operations; and
- Scenario 3: Year 2041 operations.

These scenarios represent opencast mining impacts throughout the mine's lifetime, and were chosen based on similar mining rates, location (evenly distributed across the mine) and to represent the shape of the mine. The calculated emission rates are summarised in **Table 18-4**.

Table 18-4: Summary of calculated emission rates (Airshed, 2019a)

			Unmitigated			Mitigated		
			$PM_{2.5}$ (g/s)	PM_{10} (g/s)	TSP (g/s)	$PM_{2.5}$ (g/s)	PM_{10} (g/s)	TSP (g/s)
Opencast operations	Scenario 1: 2027	Opencast area – extraction of ore and waste	2.29	15.44	60.81	0.99	6.17	29.20
		Opencast area – rollover	0.13	0.68	2.45	0.09	0.33	1.24
	Scenario 2: 2034	Opencast area – extraction of ore and waste	2.14	13.95	55.56	0.95	5.80	27.89
		Opencast area – rollover	0.12	0.63	2.30	0.09	0.32	1.20
	Scenario 3: 2041	Opencast area – extraction of ore and waste	1.93	11.87	48.28	0.90	5.27	26.06
		Opencast area – rollover	0.10	0.35	1.29	0.09	0.25	0.96
Routine operations	Scenario 1: 2027		198	1 495	4 491	89	521	1 586
	Scenario 2: 2034		248	1 919	6 038	108	642	2 018
	Scenario 3: 2041		236	1 868	5 994	99	617	1 971

The dispersion modelling included the assessment of impacts as a result of emissions from a scenario where particulate emissions will be mitigated (controlled). Mitigation activities will apply to unpaved roads, materials handling, grading and drilling through the use of water sprays. The control efficiencies for watering were assumed to be 75% for unpaved roads, 50% for materials handling and grading, and 70% for drilling.

The National Ambient Air Quality Standards (NAAQS) as published in terms of NEM:AQA is shown in **Table 18-5**. The NAAQS, as well as the NDCR (refer to section 10.1.1.14 and **Table 10-29**) was used to assess the potential impact associated with the proposed development.

Table 18-5: National Ambient Air Quality Standards (Airshed, 2019a)

Pollutant	Averaging period	Concentration ($\mu g/m^3$)	Permitted Frequency of Exceedance	Compliance Date
Sulphur Dioxide (SO_2)	10 minutes	500	526	Immediate
	1 hour	350	88	Immediate
	24 hour	125	4	Immediate
	1 year	50	0	Immediate
Benzene	1 year	5	0	1 January 2015
Carbon Monoxide (CO)	1 hour	30000	88	Immediate
	8 hour[(a)]	10000	11	Immediate
Lead (Pb)	1 year	0.5	0	Immediate
Nitrogen Dioxide (NO_2)	1 hour	200	88	Immediate
	1 year	40	0	Immediate
Ozone (O_3)	8 hour[(b)]	120	11	Immediate
$PM_{2.5}$	24 hour	40	4	1 January 2016 till 31 December 2029
	24 hour	25	4	1 January 2030
	1 year	20	0	1 January 2016 till 31 December 2029
	1 year	15	0	1 January 2030
PM_{10}	24 hour	75	4	1 January 2015
	1 year	40	0	1 January 2015

PM_{10} emissions from the unpaved on-site haul roads were the largest source for both unmitigated and mitigated Scenario 1, 2 and 3 activities. Simulated areas of exceedance show non-compliance with the daily PM_{10} NAAQS within 6 km of the mining operations, as well as non-compliance with the annual PM_{10} NAAQS within 5 km of the mining operations (**Figure 18-13**)[9]. Simulated PM_{10} concentrations were in non-compliance with the daily NAAQS (i.e. more than 4 days exceeding the daily limit concentration of 75 µg/m^3) at 2 of the 32 receptors for Year 2027, 6 of 32 receptors for Year 2034 and 7 of 32 receptors for Year 2041. Simulated annual average PM_{10} concentrations were within the NAAQS at all receptors and for all scenarios.

Simulated $PM_{2.5}$ concentrations under design mitigation complied with the current daily NAAQS applicable 1 January 2016 to 31 December 2029 (i.e. fewer than 4 days exceeding the daily limit concentration of 40 µg/m^3) (**Figure 18-14**), as well as the future daily NAAQS applicable from 1 January 2030 (**Figure 18-15**). Simulated annual average concentrations were below the NAAQS at all receptors and for all scenarios (Airshed, 2019a).

These figures indicate the extent of impact associated with the full extent of the opencast area, as well as the impact associated with the operation of the infrastructure. It can therefore be regarded as the cumulative impact.

The simulated concentrations only associated with the opencast area not previously authorised were also modelled and is described in detail in the air quality specialist report attached in **Appendix 8.4**.

Isopleth plots showing the areas of exceedance of the dustfall residential limit for the design mitigated scenario are shown in **Figure 18-16**. The areas of exceedance are limited to the project boundary and within 250 m of off-site roads. The simulated maximum daily dustfall rates for to Scenarios 1, 2 and 3 are well within the NDCR for residential areas at all the receptors (Airshed, 2019a).

[9] Note on isopleth contours, where standards are exceeded:
The areas of exceedance are not only limited to concentration (i.e. 40 or 75 µg/m^3) but are linked to a timeframe and the average expected concentration over that period.
For example, in terms of the NAAQS, the allowable PM_{10} concentrations are:

- 75 µg/m^3 per day (24hr) – you are allowed 4 daily exceedances of this per year
- 40 µg/m^3 per annum – no exceedance allowed.

The isopleths therefore indicate the areas where:

- The daily average concentrations exceed the allowable concentration (75 µg/m^3) more than 4 times per year
- The annual average concentrations exceed the allowable concentration (40 µg/m^3).

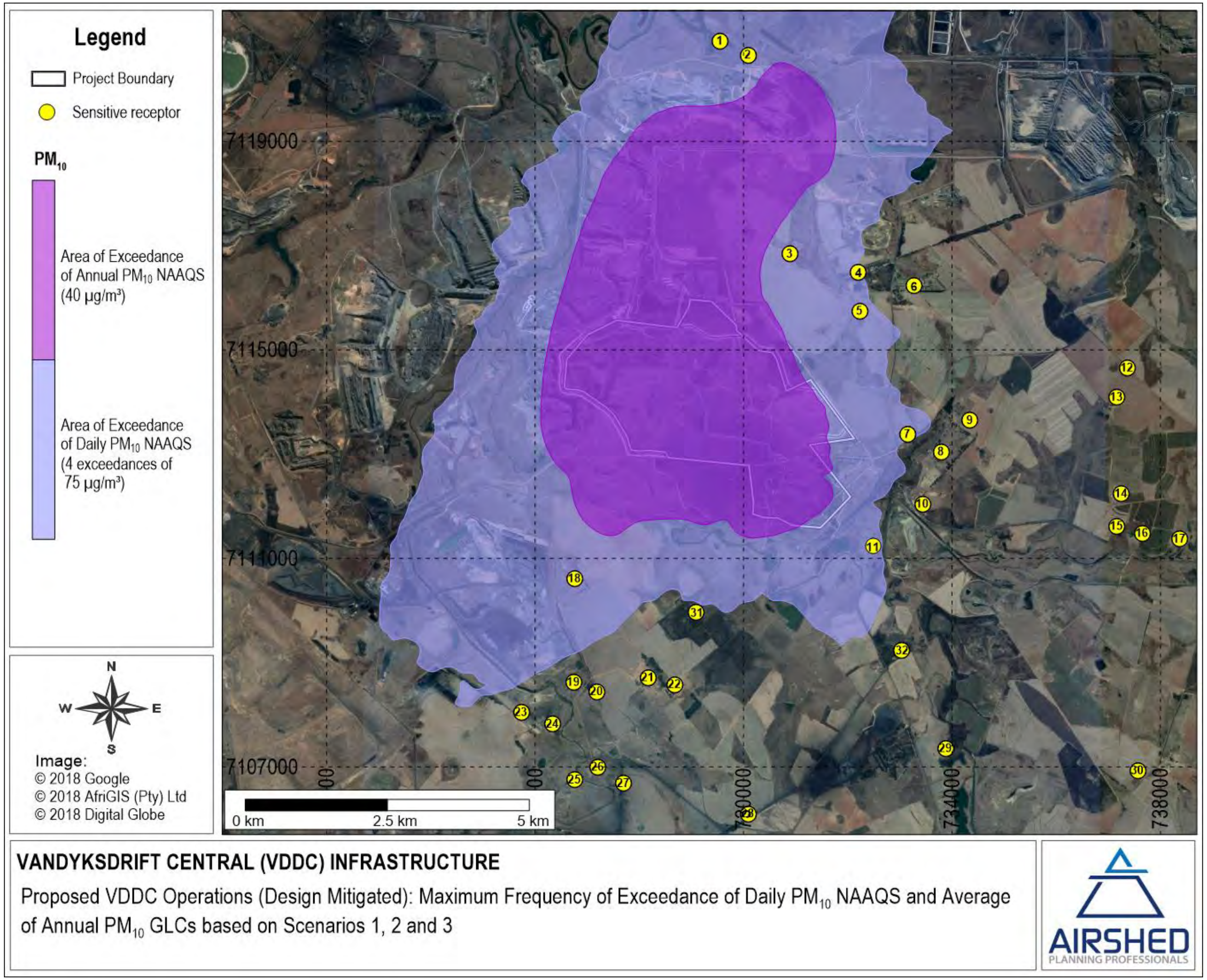


Figure 18-13: **Simulated PM_{10} impacts as a result of the mining and infrastructure operations (design mitigated scenario), indicating areas of non-compliance with the daily and annual NAAQS (Airshed, 2019a)**

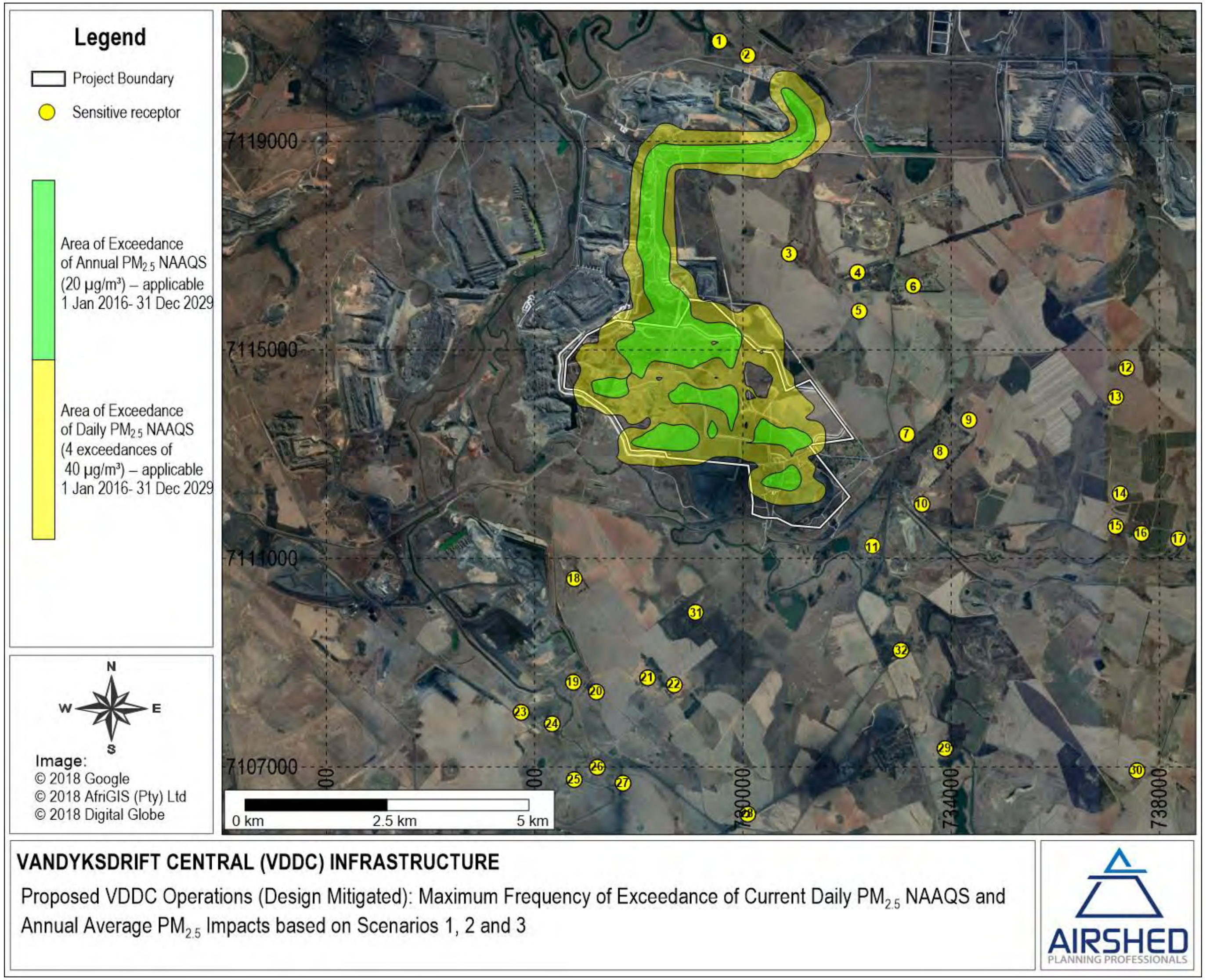


Figure 18-14: **Simulated $PM_{2.5}$ impacts as a result of the mining and infrastructure operations (design mitigated scenario), indicating areas of non-compliance with the daily and annual NAAQS (applicable between 1 January 2016 and 31 December 2029) (Airshed, 2019a)**

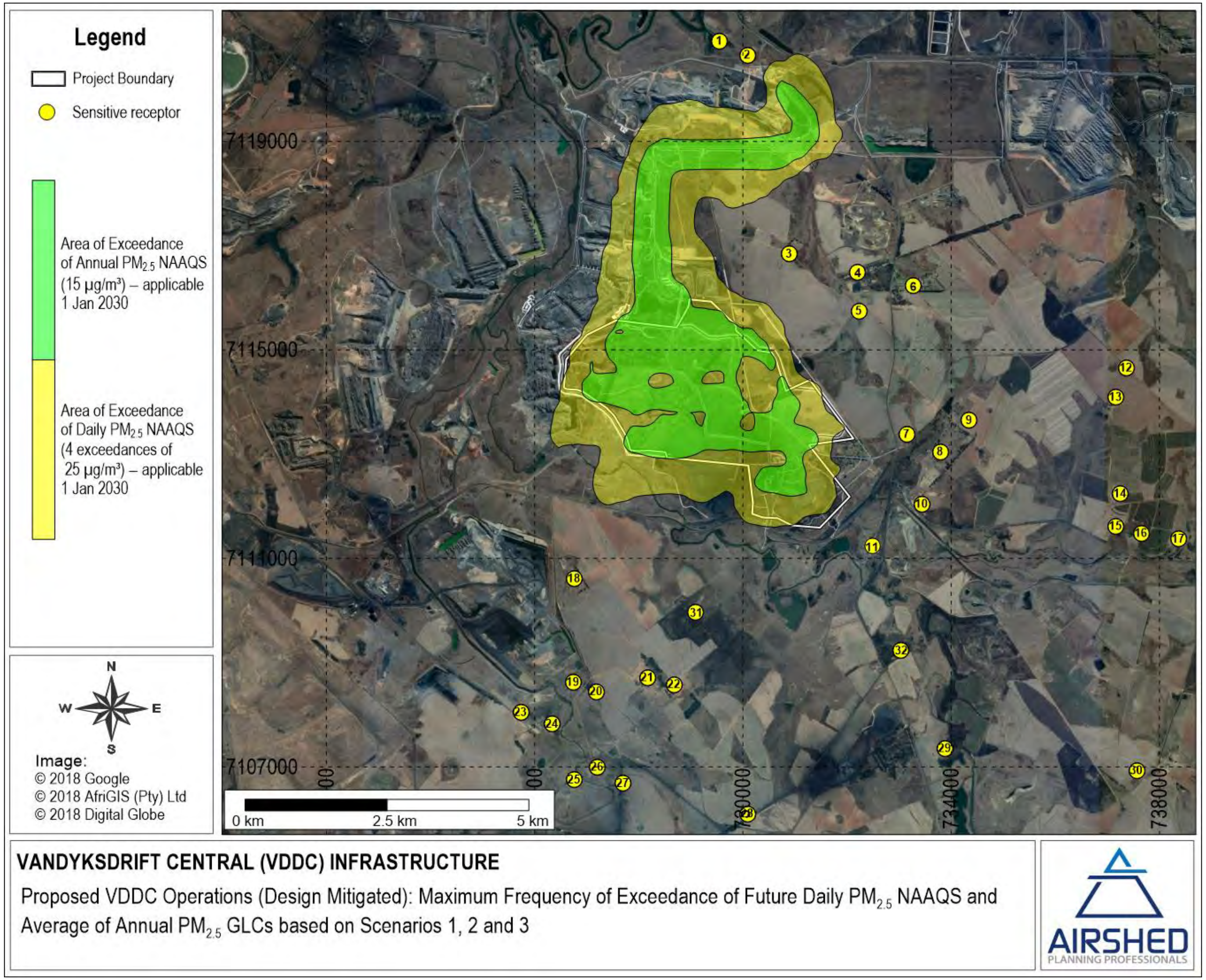
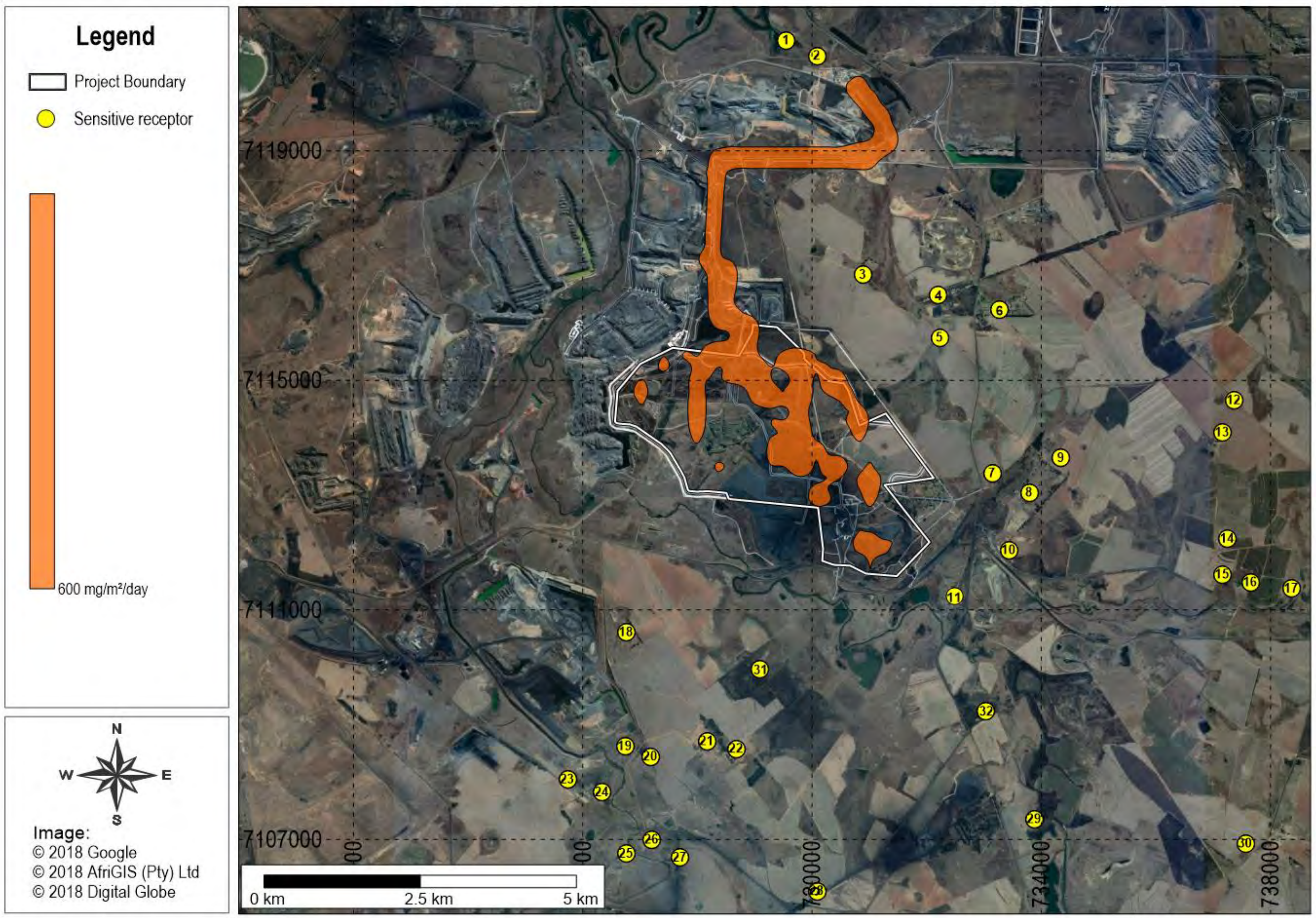


Figure 18-15: **Simulated $PM_{2.5}$ impacts as a result of the mining and infrastructure operations (design mitigated scenario), indicating areas of non-compliance with the daily and annual NAAQS (applicable from 1 January 2030) (Airshed, 2019a)**



VANDYKSDRIFT CENTRAL (VDDC) INFRASTRUCTURE

Proposed VDDC Operations (Design Mitigated): Maximum 30-day Average Dustfall Rate based on Scenarios 1, 2 and 3

Assessment criteria: 600 mg/m^2/day

Figure 18-16: Simulated dustfall rates as a result of the mining and infrastructure operations (design mitigated scenario) (Airshed, 2019a)

The impacts as a result of mining and infrastructure activities will likely elevate ambient PM_{10} concentrations, exceeding the annual NAAQS, outside of the mining right boundary, where communities outside of 5 km will be affected. The scale of impact of the operational VDDC section on ambient $PM_{2.5}$ concentrations is likely to be lesser than PM_{10} concentrations. *The impacts of the proposed mining and infrastructure project is rated as MODERATE for non-compliance with PM_{10} standards and the area where non-compliance was simulated, and LOW for potential non-compliance with $PM_{2.5}$ standards and the impact area where dustfall rates will exceed 600 mg/m^2/day*.

In addition, a qualitative assessment was also done of the potential impact of the airborne mine water mist generated by the operation of the mechanical evaporators to be located on the SKS pit. Results were based on a mathematical model done in a previous assessment. The model simulates the behaviour of the water droplet jet stream, the dispersion of the water droplets as it mixes with air, the evaporation of water droplets and the deposition of the salt contained in the droplets. The model clearly indicated that most of the fallout of water droplets and dissolved solids occur in the nearby vicinity of the evaporators, within 50 m to 70 m of the evaporator. Nearly all of the fallout (99%) occurs within 125 m to 150 m from the evaporators. Although low deposition rates were predicted beyond these distances, the accumulation of the salts over time was shown to become non-trivial. Both measurement and model results show that unless removed by rain or other means, monthly deposition of total solids of about 100 g/m² (3 g/m²-day) is possible at downwind distances of about 300 m from the evaporators. These calculations assumed an average of 5% total dissolved solids in the contaminated water. The results of the previous study were used to illustrate the potential fallout on the immediate areas of the proposed locations, as shown in **Figure 18-17**.

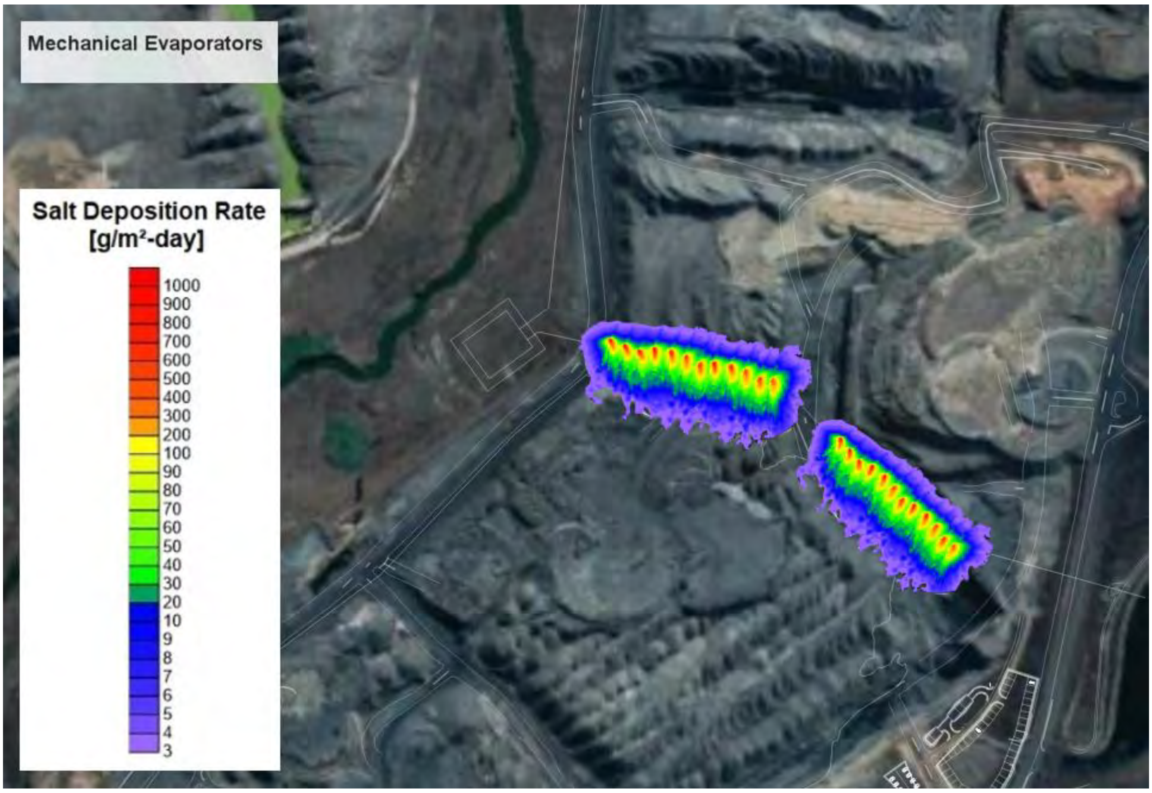


Figure 18-17: Potential fallout from mechanical evaporator at SKS pit (Airshed, 2019a)

18.11.3 Decommissioning, closure and post-closure phase

It is assumed that all the operations will have ceased by the closure phase of the project. Aspects and activities associated with the closure phase which could result in the generation of TSP, PM_{10} and $PM_{2.5}$ include the backfilling of the void, removal of infrastructure and vehicle entrainment on unpaved road surfaces. Tailpipe emissions from vehicles utilised during the decommissioning phase will result in gaseous emissions.

Simulations of the closure phase were not included in the current study due to its temporary nature.

The overall impact on air quality during the decommissioning phase after mitigation measures have been implemented is anticipated to be VERY LOW to LOW.

18.11.4 Cumulative impact

The cumulative impact, considering the status of the existing air quality and the potential impact of the VDDC project, is rated as HIGH for non-compliance with the daily PM_{10} standards and MODERATE for non-compliance with $PM_{2.5}$ standards and dustfall rates exceeding 600 mg/m^2/day.

18.12 Climate change

18.12.1 Greenhouse gas emission statement

Greenhouse gases (GHG) are defined as those gaseous constituents of the atmosphere, both natural and anthropogenic, that absorb and emit radiation at specific wavelengths within the spectrum of thermal infrared radiation emitted by the Earth’s surface, the atmosphere itself, and by clouds. This property causes the greenhouse effect. Water vapour (H_2O), carbon dioxide (CO_2), nitrous oxide (N_2O), methane (CH_4) and ozone (O_3) are the primary greenhouse gases in the Earth’s atmosphere. Moreover, there are a number of entirely human-made greenhouse gases in the atmosphere, such as the halocarbons and other chlorine and bromine containing substances.

Beside CO_2, N_2O and CH_4, the Kyoto Protocol deals with the greenhouse gases sulphur hexafluoride (SF_6), hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs). Human activities since the beginning of the Industrial Revolution (taken as the year 1750) have produced a 40% increase in the atmospheric concentration of carbon dioxide, from 280 ppm in 1750 to 406 ppm in early 2017. This increase has occurred despite the uptake of a large portion of the emissions by various natural "sinks" involved in the carbon cycle. Anthropogenic carbon dioxide (CO_2) emissions (i.e., emissions produced by human activities) come from combustion of fossil fuels, principally coal, oil, and natural gas, along with deforestation, soil erosion and animal agriculture.

A GHG inventory was compiled for the proposed project, taking into consideration the project’s diesel fuel and electricity requirements. The total CO_2-e emissions for construction period is approximately 175 398 tpa of which 39% is due to vehicle exhaust emissions (Scope 1) and 61% is due to electricity consumption (Scope 2). The total CO_2- e emissions for mining and infrastructure operations is approximately 435 438 tpa, of which 168 062 tpa is due to vehicle exhaust emissions (Scope 1).

The annual South African emission rate of GHG, which is approximately 544.31 million metric tonnes CO_2-e. The calculated CO_2-e emissions due to the construction period and future VDDC operations (entire opencast area) respectively contribute 0.03% and 0.08% to the total of South Africa’s GHG emissions, and 0.17% and 0.41% respectively to the total “manufacturing industry and construction” sector.

GHGs were declared priority pollutants in March 2014 and pollution prevention plans must be developed if the operation contributes more than 100 000 tons CO_2eq emissions. The Project's Scope 1 GHG contribution is above 100 000 tons. Based on this, a Pollution Prevention Plan is required for the proposed VDDC operations, but not for construction.

The GHG emissions from the project are considered low and not likely to result in a noteworthy contribution to climate change on its own (Airshed, 2019a).

18.12.2 Potential effect of climate change on the project and the community

The most significant of the discussed climate change impacts on the project would be as a result of:

- Temperature increase (under the "no intervention scenario", temperatures are projected to rise over the project region, by 2.5°C to 3°C in the near-future and even higher in the far-future),
- Possible reduction in rainfall (the region is projected to become systematically drier, with considerably more dry years than wet years. The drastically higher temperatures may have a negative impact on water availability from local dams due to enhanced evaporation).

With the increase in temperature there is the likelihood of an increase in discomfort and possibility of heat related illness (such as heat exhaustion, heat cramps, and heat stroke). Both of these have the potential to negatively affect staff performance and productivity. There is also the increased risk of overheating of equipment/machinery with effects on production, and a possible increase in demand for energy to satisfy an increased cooling need (in buildings). The potential exists for higher evaporation rates and thus the need for increased watering of the roads. Higher temperatures also increase the risk of veld fires and spontaneous combustion of coal stockpiles.

A decrease in rainfall may result in severe water shortages, which may interrupt mining activities and increase working costs, thereby potentially making the project unprofitable. Lower rainfall will also have a negative impact on food security, possibly resulting in food shortages which may negatively affect staff performance

Of the discussed climate change impacts, significant effect on the surrounding communities will be as a cumulative result of land uses contributing to GHG emissions and not the VDDC project only. The project's contribution to climate change is not noteworthy.

Climate change management includes both mitigation and adaptation. The main aim of mitigation is to stabilise or reduce GHG concentrations as a result of anthropogenic activities. This is achievable by lessening sources (emissions) and/or enhancing sinks through human intervention. Additional support infrastructure can reduce the climate change impact on the staff and project, for example ensuring adequate water supply for staff and reducing on-site water usage as much as possible. GHG emissions can also be kept to a minimum by ensuring there is minimal fuel use. This can be achieved by ensuring the vehicles and equipment is maintained through an effective inspection and maintenance program. A measure of reducing the project's impact is to limit the removal of vegetation and to ensure that as much as possible revegetation occurs, e.g. that concurrent rehabilitation is implemented, and possibly even the addition of vegetation surrounding the project area (Airshed, 2019a).

18.13 Social environment

18.13.1 Construction and operational phase

18.13.1.1. Employment opportunities, local procurement and inflow of workforce

The development focuses on the construction, management and maintenance of the proposed infrastructure and activities associated with the opencast mining that was not previously authorised, and the associated employment opportunities.

Therefore, it is anticipated that the development would result in limited additional employment opportunities with a temporary increase in the concentration of workers at the VDDC, e.g. during the construction of new infrastructure. Limited new opportunities such as some short-term contract work could be generated for certain periods of time. Locals could be part of the teams involved in these contracts. Some activities associated with the development (e.g. topsoil and overburden dumps) would mainly entail mechanical operations and the associated activities would be seen as extensions of the existing mining activities.

Thus, even though the Wolvekrans Colliery is operational and provides employment to various individuals and the fact that a large sector of the employed homeowners within the area are employed at the various mines in the area, the ELM IDP indicated that job creation within the Van Dyksdrift area remains a critical need.

During the operation of the mining activities maintenance activities such as emergency repairs, routine maintenance and general maintenance of the mining infrastructure will be required. This will be undertaken by a relatively small group of individuals as it is anticipated that the operations will be mainly mechanically operated and maintained. These maintenance activities will therefore not result in employment opportunities.

With the number of employees currently concentrated within the study area, the possible slight increase in workers during the construction and operational phase on site is anticipated to have a limited impact on the social environment.

The positive aspects with regard to employment creation thus remain with possible procurement of local small businesses and Small, Medium, Micro Enterprises (SMME's) with regards to the design, procurement, installation, construction and commissioning of the infrastructure, as well as opencast mining (Batho Earth, 2019).

The overall impact on employment opportunities, local procurement and inflow of workforce during the construction and operational phase after mitigation measures have been implemented is anticipated to be LOW.

18.13.1.2. Inflow of jobseekers

The Wolvekrans Colliery is operational and provides employment to various individuals. Even though a large sector of the homeowners within the municipal area is employed at the various mines in the area, the ELM IDP and Community Survey of 2016 indicated that 23.2% of the local population is still unemployed. The ELM further experiences large scale in-migration in search of employment. Some of these job seekers do not have the right skills to work in the local economy and thus put more pressure on the provision of services and infrastructure.

Even though the development is anticipated to create limited employment opportunities, it is possible that jobseekers could gather at the entrance to the colliery, due to the social profile of the local residents and residents of the larger municipal area. The distance of the settlements of Lindokuhle, Springbok and Kwajuma to the mining activities and the infrastructure development, as well as the socio-economic profile of the residents makes this impact even more likely.

The magnitude of the inflow of jobseekers, however, is difficult to predict. Even though there is a low probability of it resulting in severe negative impacts, pro-active mitigation measures should be implemented to address the issue and to avoid possible long-term negative impacts in this regard (Batho Earth, 2019).

The overall impact on inflow of jobseekers during the construction phase after mitigation measures have been implemented is anticipated to be LOW, and VERY LOW during the operational phase.

18.13.1.3. Impact on daily living and movement patterns

The proposed new roads are located within the mining right area and will not impact on daily movement.

The R544 is the main access route to the study area from eMalahleni and to the existing entrances to the mine. This road is already under pressure due to the existing traffic volumes. Construction related vehicles could have a further negative impact on the local roads, especially the R544 and smaller dirt roads (if used). Negative impacts relate to possible damage to the road surface and an increase in the traffic volumes which could pose an additional traffic safety risks to the road users and pedestrians.

The increased traffic volumes and construction of internal roads within the VDDC mining area could have negative impacts on the social environment due to increased noise and dust and possible health related impacts due to the gaseous emissions of the increased vehicular traffic. The intended use of existing haul roads and service roads could, however, limit this possible negative impact (Batho Earth, 2019).

The overall impact on daily living and movement patterns during the construction and operational phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.13.1.4. Proximity of residential areas

Van Dyksdrift has historically served a residential function, but the formal Van Dyksdrift settlement was demolished, and only some informal settlements remained. There are two small retail facilities at Van Dyksdrift.

The proposed new mining and infrastructure developments would take place within the mining right area. It should further be noted that the mines have become an infrastructural feature in the area over time. Even though the Lindokuhle informal settlement is situated in close proximity to the southern portion of the VDDC opencast mining area and some of the new infrastructure proposed, the proposed development, together with the other existing mining activities in the area, is not expected to severely change the residents' type of lifestyle with resultant impacts on the local sense of place. It should be further noted that the mining development will be phased over an extended period. Intrusive visual impacts due to the infrastructure are therefore considered of a low significance considering the existing status quo.

Other intrusion impacts anticipated to influence the daily living conditions of the Lindokuhle residents refer to noise and dust pollution. The present activities have existing impacts on these residents, and the infrastructure development is not anticipated to worsen this existing impact. The extension of the opencast mining activities that would be phased over an extended period, however, could result in additional noise and dust. Any possible negative impacts in this regard must be strictly mitigated.

Ongoing monitoring of possible negative impacts on the residents of the Lindokuhle settlement should be undertaken to determine whether any specific mitigation measures would be required in future (Batho Earth, 2019).

The overall impact on proximity of residential areas during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW, and LOW during the operational phase.

18.13.1.5. Impact on agricultural activities

The proposed development is within the mining right area.

The main agricultural activities practiced in the larger area involve maize production with some cattle farming. Possible indirect negative impacts on such agricultural activities can occur. Should water sources be contaminated as a result of the activities associated with the infrastructure development, it could have severe negative impacts for affected farming activities, especially for landowners who are dependent on groundwater for agricultural and household purposes.

Dust from the topsoil dumps is also a source of concern. Any such pollution should thus be mitigated to ensure that the negative impacts do not manifest on crop production activities to the east and south of the project area. Mitigation must be implemented to ensure that no financial losses as a result of the infrastructure development on the farming practices occur (Batho Earth, 2019).

The overall impact on agricultural activities during the construction and operational phase after mitigation measures have been implemented is anticipated to be LOW.

18.13.1.6. Impact on sense of place

The social impact associated with the impact on the sense of place relates to the change in the landscape character and visual impact of the proposed mining and infrastructure such as the overburden and topsoil dumps, ROM stockpiles and haul roads.

Mining infrastructure is usually perceived to have a visual invasiveness on the sense of place. The existing facilities as part of the current mining activities include a ROM tip, overland conveyor system, the SKS complex offices, warehouse, change houses, workshops, wash bays, laydown areas, an existing topsoil dump, surface discard dumps, water management berms and canals, as well as fuelling facilities. A significant existing visual impact is thus present in the area.

The proposed infrastructure and open cast mining areas that were not previously authorised, would probably be visible to the residents of the Lindokuhle Settlement. Limited natural vegetation exists and would not be able to serve as screening in this regard.

Due to the presence of the existing mining activities with various different infrastructural developments nearby (roads, mining, conveyor belts, transmission lines, railway line and so forth), it is not expected that the proposed new infrastructure and opencast mining would be perceived as an individual or new impact but would be balanced with the existing visual impact of the current mining operations. Even though no additional negative impacts on the sense of place in this regard is foreseen, the impact would still be rated negative due to the intrusive visual impact of additional infrastructure and opencast mining, mainly on the Lindokuhle Settlement (Batho Earth, 2019).

The overall impact on sense of place during the construction and operational phase after mitigation measures have been implemented is anticipated to be LOW.

18.13.1.7. Safety and security risks

Safety and security issues relate to the possible inflow of workers to the area as a result of the project, the movement of mining vehicles and operation of equipment, and possible risks posed by the infrastructure itself.

As limited additional employees are foreseen and as the activities would take place within the mining right area, limited added safety and security risks are foreseen. The area where the mining and infrastructure development will take place is managed according to the mine's security guidelines.

The area is characterised by the movement of mining related vehicles from different areas. Even though limited, the movement of heavy vehicles (associated with the infrastructure development) on public roads further poses increased accident risks. The anticipated impact would thus not materialise where the infrastructure is proposed, but as a result of all the mining related activities on the public roads such as the R544.

Occupational health and safety risks associated with mining operations are always a source of concern. The proposed infrastructure could create additional safety and security risks to residents, if not properly managed. Occupational safety risks related to the functioning of the proposed infrastructure would have to be dealt with under the Occupational Health and Safety Act (1993). The EMPr should also be strictly implemented, especially with regards to the proposed development that would be in close proximity to Lindokuhle.

The socio-economic conditions of residents of the informal settlements in the area indicate that those living in these settlements are mainly unemployed and could easily revert to criminal activities. The crime levels in the area are expected to continue as the proposed project would not alleviate the unemployment levels. Concerns in this regard relate to e.g. the illegal reworking of waste rock piles or selling of these products. Unauthorised entry to the mining area should thus be guarded against (Batho Earth, 2019).

The overall impact on safety and security risks during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW, and LOW during the operational phase.

18.13.1.8. Health risks

Concerns revolve around the possible public health impact of the proposed infrastructure (e.g. topsoil and overburden dumps, dust pollution due to wind erosion from topsoil stockpiles (although limited) and the use of unpaved haul roads) on the health of the surrounding landowners and communities, due to possible air/dust pollution. Dwellings could thus, especially in winter months or during windy periods, be negatively affected. Concerns also relate to the possible dust impact on agricultural practices if these are within the dispersion plume.

Gaseous emissions from construction vehicles and those vehicles on site could further impact on the air quality in the area.

The intensity would be influenced by various factors such as the prevalent wind direction and the location of the nearby settlements, as well as the mine waste management plan to be implemented.

Mining activities is one of the main contributors impacting on the air quality in the area. The proposed project is however not anticipated to increase the health risks as a result of possible increase in the air pollution (dust). Health risks, even though it could be negligible, should still be adequately dealt with and be taken into account in the monitoring processes. Care should also be taken to limit any possible health related impacts by striving towards international best practice (Batho Earth, 2019).

The overall impact on health risks during the construction phase after mitigation measures have been implemented is anticipated to be VERY LOW, and LOW during the operational phase.

18.13.1.9. Noise related impacts

It is not anticipated that the construction activities associated with the development of the infrastructure and the inflow of the workers to the area would significantly change the ambient noise levels in the area. Due to the existing mining activities in the area and the very limited number of workers involved in the process, the noise impacts with regards to the development of the infrastructure are therefore deemed moderate to low. Impacts of a moderate to low rating are anticipated from movement of vehicles and other machinery, based on the findings of the Noise Impact Assessment.

The impacts on the quality of life of nearby residents are thus not anticipated to be negatively impacted by the increase in noise levels as a result of the infrastructure development project.

The overall impact on noise from a socio-economic aspect during the construction and operational phase after mitigation measures have been implemented is anticipated to be VERY LOW.

18.13.2 Decommissioning, closure and post-closure phase

Possible social impacts to be experienced during decommissioning of the infrastructure could include the following:

- Job losses and/or off-set by jobs created as part of decommissioning the infrastructure or supplanting it;
- Negative impact on infrastructure development and maintenance;
- A change in community infrastructure;
- A change in the industrial focus of the area;
- Disruptions and nuisance factors associated with the actual decommissioning such as noise, visual and traffic related impacts;
- Increased safety risks associated with the decommissioning of the infrastructure;
- Remnants of possible environmental impacts; and
- Remaining visual impact as a result of mining.

As decommissioning is likely to only take place in more than 25 years, it is recommended that a detailed Social Impact Assessment be undertaken then to determine the actual impacts on the changing social environment at that stage.

18.14 Blasting

18.14.1 Construction phase

During the construction phase limited mining drilling and blasting operations is expected. No detail impact evaluation was for done the construction phase.

18.14.2 Operational phase

Modelling was conducted by BMC to calculate the possible effects of ground vibration, air blast and fly rock specifically to the points of interest or possible interfaces identified.

Ground vibration and air blast was calculated from the edge of the pit outline and modelled accordingly. Blasting further away from the pit edge will certainly have lesser influence on the surroundings. The modelling and calculation from pit edge therefore represent worst cast.

18.14.2.1. Expected ground vibration

Expected ground vibration levels were calculated for each POI identified surrounding the mining area and evaluated with regards to possible structural concerns and human perception. Ground vibration is calculated and modelled for the pit area at the minimum and maximum charge mass at specific distances from the opencast mining area. Ground vibration predictions were done considering distances ranging from 50 m to 3 500 m around the opencast mining area.

The simulation provided shows ground vibration contours only for a limited number of levels (i.e. 6 mm/s, 12.5 mm/s, 25 mm/s and 50 mm/s). These levels are considered the basic limits that will be applicable for the type of structures observed surrounding the pit area. This enables immediate review of possible concerns that may be applicable to any of the privately-owned structures, social gathering areas or sensitive installations.

The modelled ground vibration influence from the minimum charge per delay and the maximum charge per delay is shown on Figure 18-18 and **Figure 18-19** respectively. Tables with the predicted ground vibration values and evaluation for each POI is provided in the specialist report attached in **Appendix 8.11**.

The minimum charge used indicated 19 POI's of concern and the maximum charge indicated 51 POI's of concern with regard to possible structural damage (included are GY02 and the powerlines inside the larger VDDC pit area). On a human perception scale[10], 40 POI's were identified where vibration levels may be "perceptible" for the minimum charge, and 52 POI's for the maximum charge. "Perceptible" levels of vibration may be experienced up to 3 375 m, "unpleasant" levels up to 1 527 m and "intolerable" levels up to 651 m. Problematic levels of ground vibration (i.e. levels greater than the proposed limit) are expected up to 1 050 m from the pit edge for the maximum charge. Any blast operations further away from the boundary will have lesser influence on these points.

The closest structures observed are buildings/structures, road, powerlines/pylons, railway line and heritage site (railway station). The planned maximum charge evaluated showed that it could be problematic in terms of potential structural damage and human perception. The ground vibration levels predicted ranged between 1.5 mm/s and 8 719.1 mm/s for structures surrounding the open pit area.

The nearest structures are located 249 m from the pit boundary. Ground vibration level predicted at this building is 113.1 mm/s for the maximum charge. In view of this specific mitigations will be required.

A positive aspect identified is that the boxcut areas are furthest away from the infrastructure that could potentially be influenced. This will assist in establishing more

[10] Potential negative human perception indicators used are "perceptible"," unpleasant", "intolerable" which stems from the human perception information given and indicators such as "high" or "low" is given for the possibility of damage to a structure. Levels below 0.76 mm/s could be considered to have negligible possible influence (BMC, 2019).

accurately what the possible influence may be and will allow opportunity to adjust blast parameters for lesser influence.

There are no national roads in close proximity to the pit area. There are a number of provincial roads in the vicinity of the project area to be considered. The R542 and R544 roads are located to the east of the opencast pit area at a distance of 875 m and 772 m, respectively. Expected ground vibration levels at these roads are within the recommended limits.

The overall impact on blasting during the operational phase after mitigation measures have been implemented is anticipated to be LOW.

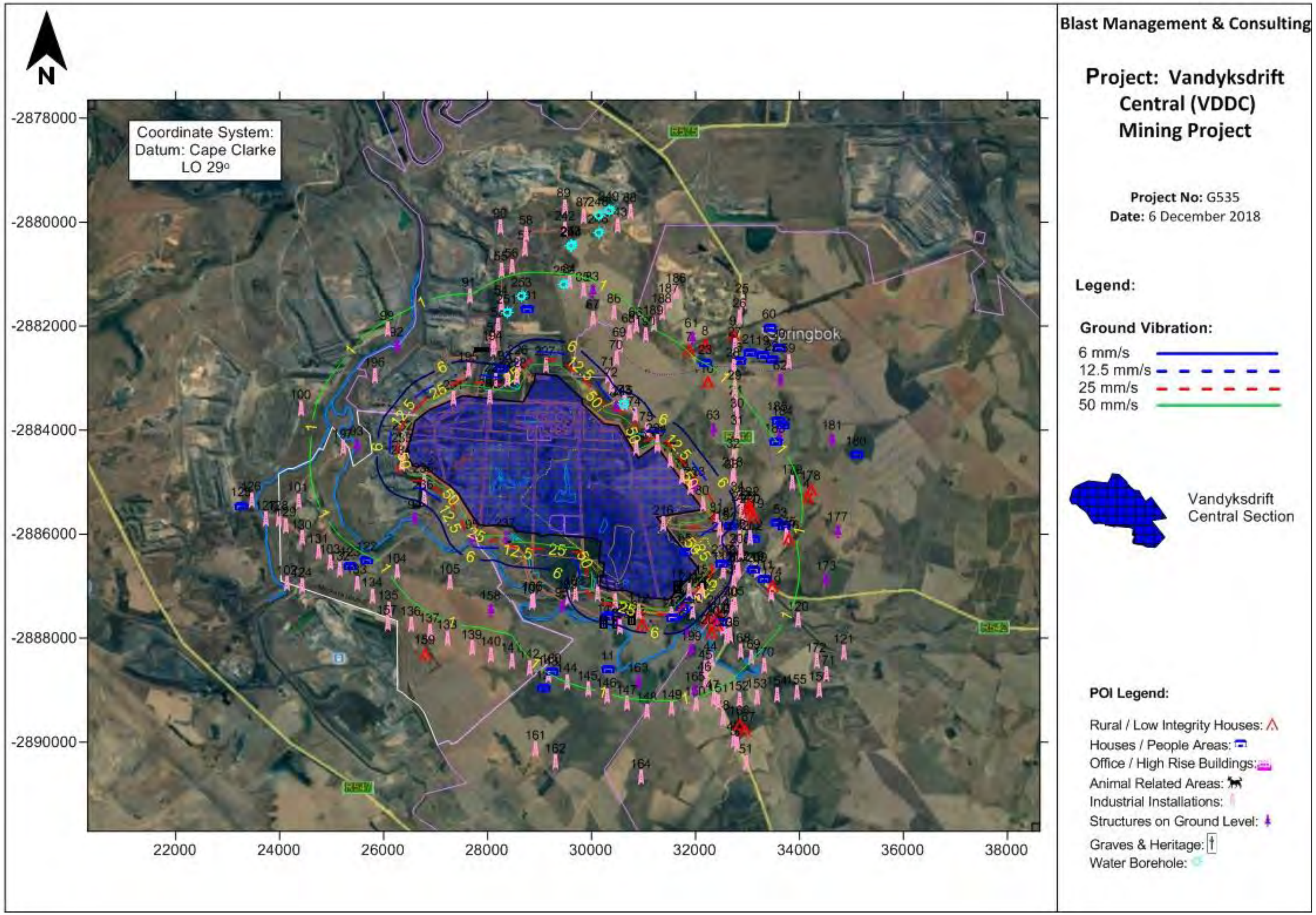


Figure 18-18: Ground vibration influence from minimum charge per delay (751 kg) for pit area (BMC, 2019)

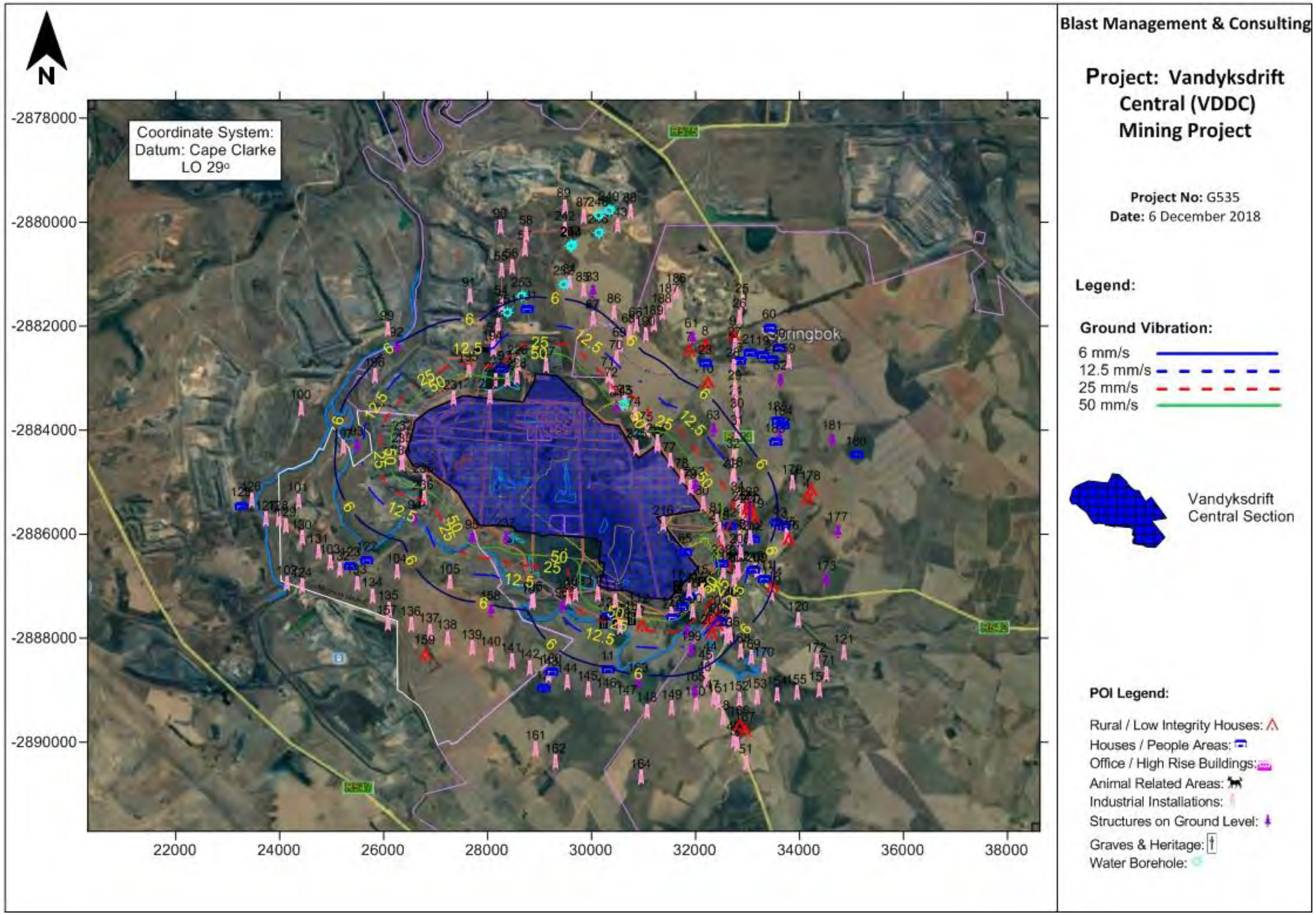


Figure 18-19: **Ground vibration influence from maximum charge per delay (3 756 kg) for pit area (BMC, 2019)**

18.14.2.2. Expected air blast

The expected air blast level contours for the minimum and maximum charge are shown in **Figure 18-18** and **Figure 18-19** respectively.

Indicators used to indicate possible concern for structural damage or human perception are:

- "Problematic": there is real concern for possible damage, at levels greater than 134 dB;
- "Complaint": people will be complaining due to the experienced effect on structures at levels of 120 dB and higher (not necessarily damaging);
- "Acceptable": if levels are less than 120 dB;
- "Low": there is very limited possibility that the levels will give rise to any influence on people or structures. Levels below 115 dB could be considered to have low or negligible possibility of influence.

Review of the air blast levels indicate some concerns since the air blast predicted for the maximum charge ranges between 111.5 dB and 147.6 dB for all the POI's considered. These levels may contribute to effects such as rattling of roofs or door or windows with limited points that are expected to be damaging and others could lead to complaints. The closest structures at 249 m showed concerns of complaints at maximum charge.

Minimum charge predictions identified that six POI's at the pit area could experience levels of air blast that could lead to complaints. Maximum charge predictions indicate that 13 POI's at the pit area could experience air blast that could lead to complaints. Apart from the buildings/structures inside the pit area, none were identified where damage may be induced.

The current accepted limit on air blast is 134 dBL[11]. Damages are only expected to occur at levels greater than 134 dBL. Prediction shows that air blast will be greater than 134 dB at distance of 130 m and closer to pit boundary. The buildings/infrastructure within the pit area will be relocated and will therefore not be of concern. Other infrastructure in the pit area such as roads, heritage sites, powerlines/pylons and boreholes are present, but air blast does not have any influence on these installations.

The possible negative effects from air blast are expected to be the same than that of ground vibration. It is maintained that if stemming control is not exercised this effect could be greater, with greater range of complaints or damage. The pit is located such that "free blasting" (i.e. meaning no controls on blast preparation), will not be possible. The effect of stemming control will therefore need to be considered. In many cases the lack of proper control on stemming material and length contributes mostly to complaints from neighbours (BMC, 2019).

The overall impact on blasting during the operational phase after mitigation measures have been implemented is anticipated to be LOW.

[11] linear decibel

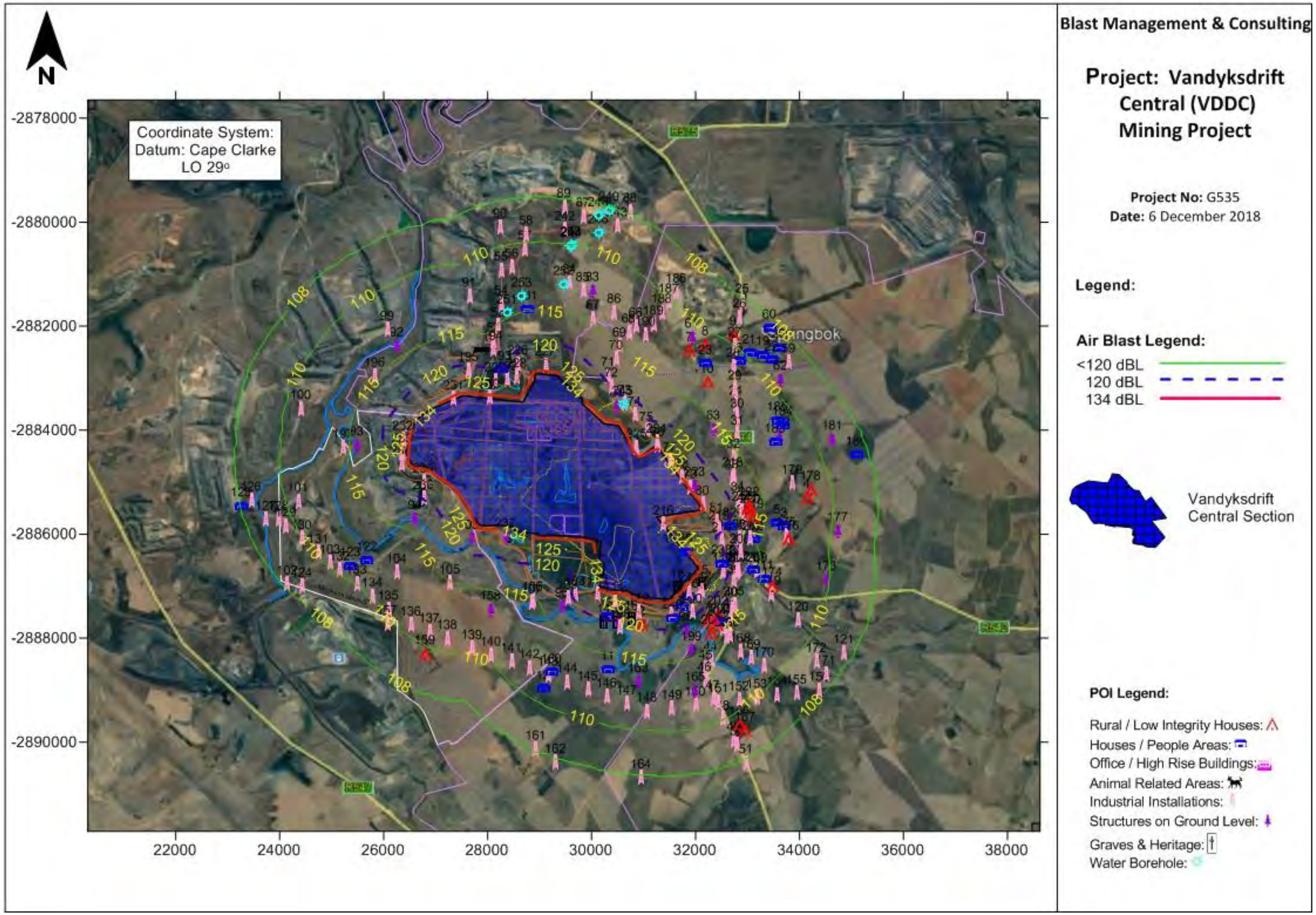


Figure 18-20: Air blast influence from minimum charge (751 kg) for pit area (BMC, 2019)

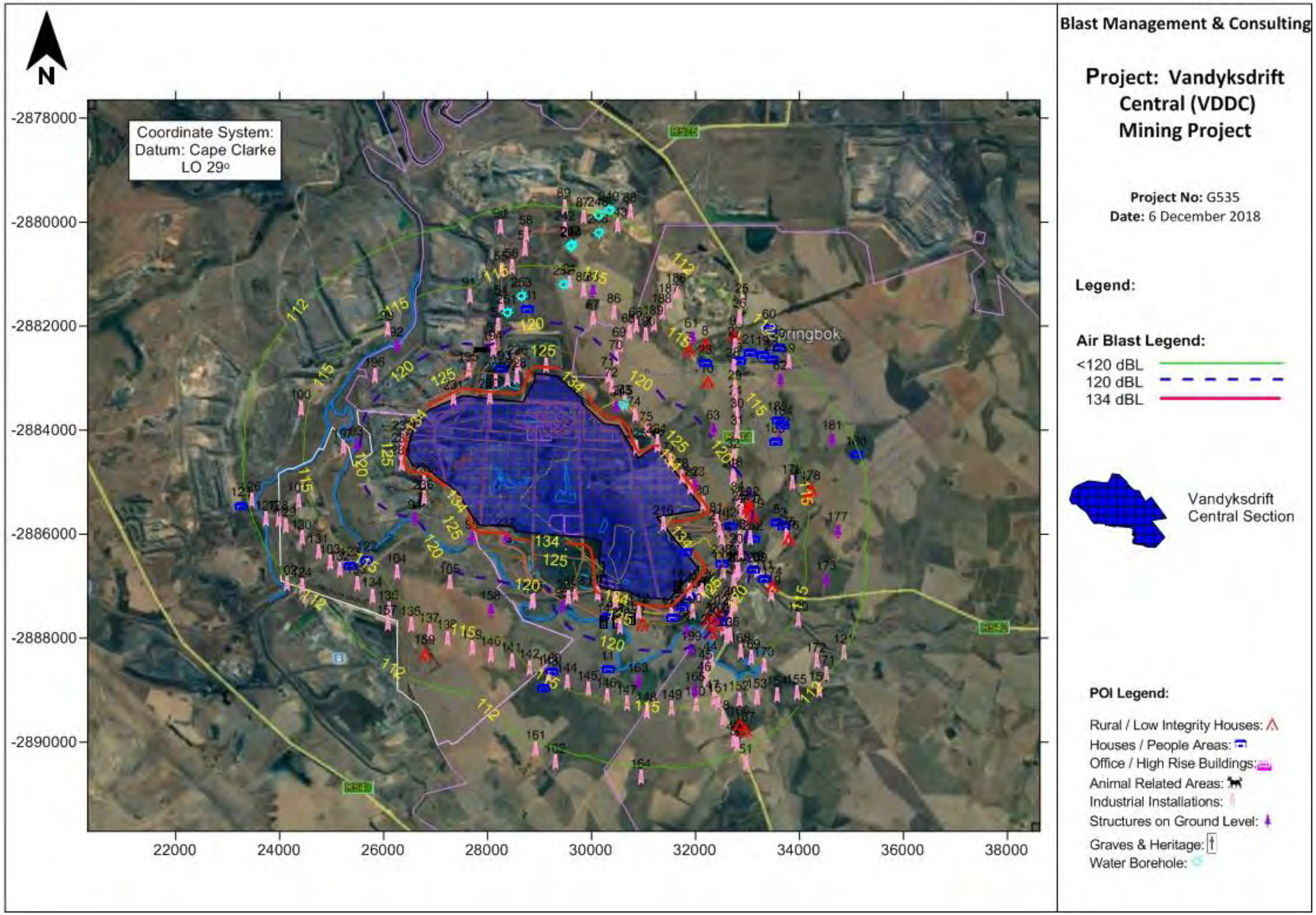


Figure 18-21: Air blast influence from maximum charge (3 756 kg) for pit area (BMC, 2019)

18.14.2.3. Fly rock

The occurrence of fly rock in any form will have a negative impact if found to travel outside the unsafe zone. This unsafe zone may be anything between 10 m or 1 000 m. A general unsafe zone applied by most mines is normally considered to be within a radius of 500 m from the blast; but needs to be qualified and determined as best possible.

A safe distance from blasting was calculated following the rules and guidelines from the International Society of Explosives Engineers Blasters Handbook by BMC. Based on a 251 mm diameter blast hole and 6.5 m stemming length, a possible fly rock range with a safety factor of 2 was calculated to be 365 m. The absolute minimum unsafe zone is therefore 365 m. This calculation is a guideline and any distance cleared should not be less, since the occurrence of fly rock can never be 100% excluded. Best practices should therefore be implemented at all times.

The predicted fly rock exclusion zone for the VDDC pit is shown in **Figure 18-22**. Review of the calculated unsafe zone showed that 42 POI's are within the unsafe zone. This includes six POI's inside the pit area at this stage, and outside the pit area it is mainly the railway lines, powerlines, building/structures, dam and graves (BMC, 2019).

The overall impact on blasting during the operational phase after mitigation measures have been implemented is anticipated to be LOW.

18.14.2.4. Noxious fumes

Explosives used in the mining environment are required to be oxygen balanced. This refers to the stoichiometry of the chemical reaction and the nature of gases produced from the detonation of the explosives. The creation of poisonous fumes such as nitrous oxides (NO_x) and carbon monoxide are undesirable. These fumes present themselves as a red brown cloud after the blast has detonated. It has been reported that 10 ppm to 20 ppm can be mildly irritating. Exposure to 150 ppm or more (no time period given) has been reported to cause death from pulmonary oedema. It has been predicted that 50% lethality would occur following exposure to 174 ppm for 1 hour. Anybody exposed must be taken to hospital for proper treatment.

Factors contributing to undesirable fumes are typically poor-quality control on explosive manufacture, damage to explosives, lack of confinement, insufficient charge diameter, excessive sleep time, water in blast holes, incorrect product used, or product not loaded properly. The specific types of rock/geology can also contribute to fumes.

The occurrence of fumes in the form the NO_x gas is not a given and is very dependent on various factors as discussed above. However, the occurrence of fumes should be closely monitored (BMC, 2019).

18.14.2.5. Impact rating

The impact associated with blasting is rated as LOW to MODERATE before mitigation and can be mitigated to a LOW risk class.

18.14.3 Decommissioning, closure and post-closure phase

No impact from blasting is expected during this phase.

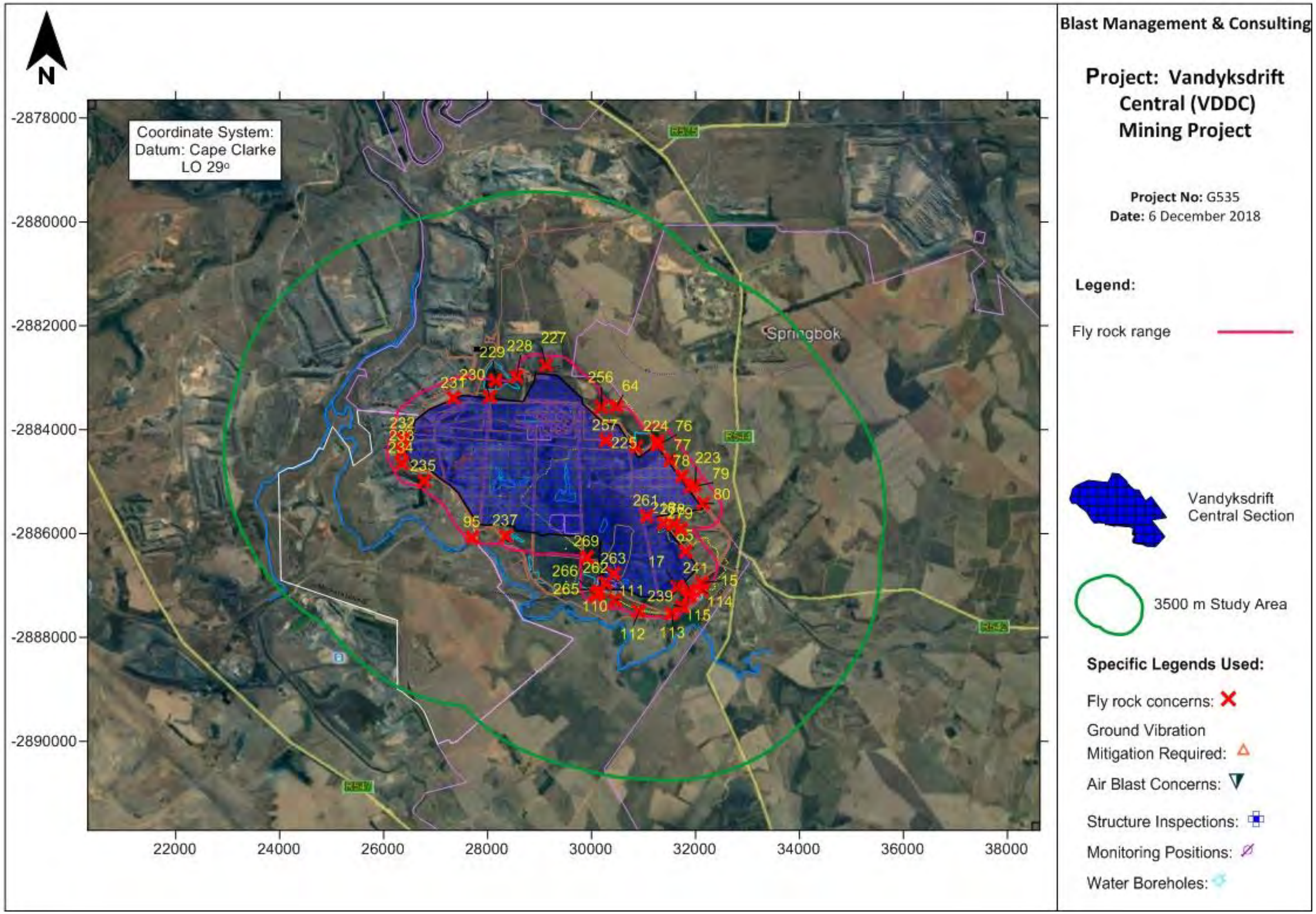


Figure 18-22: Predicted fly rock exclusion zone for VDDC pit (BMC, 2019)

18.15 Impact rating

The impact rating as well as proposed mitigation, is provided in **Table 18-6** (Construction Phase), **Table 18-7** (Operational Phase) and **Table 18-8** (Decommissioning, Closure and Post-closure Phase). The detailed impact rating is attached as **Appendix 9**.

It should be noted that each of the mitigation measures are provided with a reference number to allow for ease of referencing in the EMPr. Where a specific mitigation measure is proposed to address more than one impact, the initial reference number is provided in brackets.

Table 18-6: Summarised impact rating: Construction Phase

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Wetlands							
Site clearing, vegetation removal and stripping of topsoil	Loss of wetland ecosystem services, or degradation of these services. A considerable cumulative impact considering the extent of mining and development in the area, and the already lost wetland areas and associated services.	120 ha of wetlands to be lost	HIGH	1.1	Use of existing access routes where possible. Minimising the disturbance footprint area, and the duration of the construction phase	Control by limiting disturbed area	MODERATE
				1.2	Demarcate footprint areas to be cleared to avoid unnecessary vegetation clearing. Exposed areas must be ripped and vegetated to increase surface roughness		
				1.3	Strip and stockpile topsoil and subsoil separately	Stop by following correct procedures	
				1.4	Implement dust suppression such as wetting of roads	Control by limiting dust generation	
				1.5	Adhere to mine driving rules to limit speed and therefore the generation of dust. Vehicles must be in good working order.	Control by training	
	The exposed soils are susceptible to erosion due to wind and runoff, resulting in sedimentation of downstream wetlands. Stockpiles and dumps are also susceptible to erosion.	Local disturbance	MODERATE	1.6	Separate clean and dirty water. Clean water must be diverted and directed around working areas, and measures implemented to manage the discharge and avoid scouring and erosion. Compile a suitable stormwater management plan, which must be implemented from the onset of the project and continued for the life of the project. Create energy dissipation at discharge areas to prevent scouring.	Stop and control by implementing Stormwater Management Plan	LOW
				1.7	All personnel and contractors must undergo Environmental Awareness Training. A signed register of attendance must be kept as proof	Stop by training	
Flora & Fauna							
Site clearing, vegetation removal and stripping of topsoil	Destruction and fragmentation of the vegetation community (including portions of an Endangered vegetation type (Eastern Highveld Grassland), a Vulnerable ecosystem type, corridors and areas classified as ESAs (wetlands)).	Throughout project area	HIGH	1.8	Demarcate areas to be developed so that only these areas are disturbed and to prevent movement of construction personnel and vehicles into sensitive surrounding environments	Control by limiting disturbed area	MODERATE
				1.9	Demarcate and declare sensitive areas outside of the project area as no-go area and restrict access to this area as far as possible. This should be implemented with the exception of those mining areas in which authorisation for mining has already been granted		
				(1.1)	Where possible, existing access routes and walking paths must be used and the development of new routes limited		
				1.10	All laydown and storage areas should be restricted to within the project area		
				1.11	A qualified ECO must be on site when construction begins to identify species (specifically SCCs) that will be directly disturbed and to relocate flora that is found during construction.	Stop by relocating SCCs	
				1.12	Areas that are denuded during construction and where no future mining will occur, need to be re-vegetated with indigenous vegetation. This will also reduce the likelihood of encroachment by alien invasive plant species;	Remedy by revegetating	
				1.13	Compile and implement an alien vegetation management plan for the entire site. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	
				1.14	Implement appropriate fire breaks to restrict the impact fire might have on the endangered vegetation.	Control with procedures	
	Displacement of faunal community (including threatened or protected species) due to habitat loss, disturbance (noise, dust and vibration), destruction of corridors and/or direct mortalities.	Local disturbance	HIGH	1.15	During vegetation clearance, methods should be employed to minimise potential harm to faunal species. Clearing must take place in a phased manner and to maximise the potential for mobile species to move to adjacent areas.	Control with procedures & training	MODERATE
				1.16	Prior and during site clearance any larger fauna species noted should be given the opportunity to move away from the construction machinery		
				1.17	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	Control and stop through proper waste management	
				1.18	Maintain mine driving rules to restrict speed. Lights must be turned on in all vehicles (day and night)	Stop and control with procedures & training	
				1.19	Drivers must attend driver awareness training to prevent the unnecessary road killing of animals		
				1.20	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals		
				1.21	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site		
				1.22	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered		

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
				1.23	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north of the project areas) must be maintained to facilitate the movement of wildlife within and between any natural areas and wetlands	Control with maintenance	
				(1.34 & 1.35)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas	Control and stop with proper maintenance	
				1.25	Two SCCs were observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*). Implement an ad hoc monitoring programme to record sightings and to track their breeding success and distribution.	Control with monitoring	
Soils, Land Capability and Land Use							
Site clearing, vegetation removal and stripping of topsoil	Clearing of soil will result in loss of land capability. Vehicle movement will result in compaction of soils. Soil contamination by hydrocarbons.	716 ha of soils to be disturbed, of which 542 ha is already impacted	MODERATE	1.26	Excavated soils should be stockpiled	Control and stop with proper maintenance	MODERATE
				1.27	Stockpiles are to be clearly demarcated on site layout plans. Also indicate the material in each stockpile to ensure that topsoil and spoils are not mixed		
				1.28	Soil stockpiles are to be maintained in a fertile, vegetated, and erosion free state. If this can't be achieved due to design of stockpiles, then financial provision must be made to reinstate soil chemistry (fertiliser, lime, organic material) and physical structure (placement of topsoil, no compaction) and the associated specialist studies to inform these measures prior to the start of rehabilitation	Control and remedy with maintenance	
				1.29	Ensure proper storm water management measures are in place at stockpiles.	Stop and control by implementing Stormwater Management Plan	
				1.30	Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles.	Stop and control with restrictions & training	
				1.31	Stockpiled soil to be reserved for rehabilitation purposes only.		
				1.32	If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place	Control with erosion correction measures	
				1.33	Prevent any spills from occurring. If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities as required	Control and remedy with maintenance	
				1.34	All vehicles are to be serviced in designated areas	Control and stop with proper maintenance	
				1.35	Leaking vehicles, equipment and machinery should have drip trays placed under them where the leak is occurring and be repaired as soon as possible or removed from site. A maintenance log must be kept.		
Heritage							
Site clearing, vegetation removal and stripping of topsoil	Damage to the historical structures identified (i.e. Douglas Pump Station, SAR Pump Station, and Vandyksdrift Railway) due to construction activities.	None (Douglas pumps station: 120m^2; SAR pump stations: 30m^2 - will not be directly impacted)	VERY LOW	1.36	Chance-find procedures (refer to Appendix A) must be implemented. If any employee finds any heritage resources during any developmental activity, all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site.	Stop and control with procedures & training	VERY LOW
	Damage to the graves due to construction activities	GY01: 31 graves GY02: 13 graves	HIGH	1.37	GY02 will not be impacted as a result of the infrastructure development but must be exhumed and relocated before opencast mining is done in the area.	Stop by relocating	LOW
				1.38	For GY01: Demarcate the graveyard with a fence or wall and fit with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery	Control with demarcation	
				1.39	For GY01: Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.	Control with procedures	
				1.40	For GY01: Corridors of at least 100m should be maintained between the graveyard's border fences and any developmental components such as roads or other infrastructure that may be developed in the future. This buffer zone must be maintained at all times.	Control and stop with proper maintenance	
				1.41	For GY01: The graveyard should be inspected every three months and noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register	Control with maintenance & monitoring	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
				1.42	The graveyards should be kept tidy from any invader weeds and any other refuse		
Palaeontology							
Site clearing, vegetation removal and stripping of topsoil	Loss of fossils and other palaeontological significant artefacts	~1400ha, which includes the total mining extent, including infrastructure development.	VERY LOW	1.43	It is very unlikely that any fossils would be impacted upon by the excavations for the proposed infrastructure since the fossils would occur in the shales associated with the coal seams at greater depth. No mitigation required.		VERY LOW
Groundwater							
Construction laydown areas, construction works, movement of materials and construction equipment	Hydrocarbon spillages may seep into the underlying aquifer systems and result in the contamination of groundwater	Localised, depending on extent of spill	VERY LOW	(1.35)	Avoid soil contamination by hydrocarbons or concrete-containing water. Supply vehicles, machinery and equipment with drip trays when leaking	Control and stop with proper maintenance	VERY LOW
				(1.35)	Equipment, machinery, and vehicles must be repaired immediately or removed from site if it is leaking. A maintenance log must be kept.		
				1.44	Hazardous material to be stored in appropriate waste skips for correct disposal	Stop with proper storage	
				1.45	Contaminated soil must be removed and disposed of at a licenced facility.	Remedy with removal	
Surface water							
Construction laydown areas, construction works, movement of materials and construction equipment	Pollution of rivers/streams due to discharge of contaminated water as a result of erosion of soils during rainfall events, as well as hydrocarbon spillages from machinery, vehicles and equipment.	Local impact, depending on extent of contaminated discharge/spillage	LOW	1.46	Minimise the disturbed footprint area as far as possible.	Control by limiting disturbed area	VERY LOW
				(1.9)	Delineate "No-go" zones where the construction plant and personnel are in close proximity to the Olifants River	Control and stop by demarcation	
				1.47	Spill-sorb or a similar product will be kept on site, and used to clean up hydrocarbon spills in the event that they should occur	Control and remedy with maintenance	
				1.48	The construction area will largely be within the existing dirty water management area of the mine. Manage storm water in terms of the existing storm water management system	Stop and control by implementing Stormwater Management Plan	
				1.49	Construct surface water management infrastructure, such as storm water canals and silt traps first at the Eastern overburden stockpiles and dirty water management infrastructure area, to ensure that contaminated runoff and dirty water spills are contained.		
				(1.34 & 1.35)	Servicing of construction vehicles may take place only in dedicated areas that are equipped with drip trays.	Control and stop with proper vehicle maintenance	
				(1.35)	Repair leaking equipment immediately or remove from site to facilitate repair.		
				(1.44)	Bunded containment and settlement facilities will be provided for hazardous materials, such as fuel and oil.	Stop with proper storage	
				(1.45)	Remove all contaminated soil and place in appropriate containers. Contaminated soil may only be disposed of in a licenced facility;	Remedy with removal	
				(1.32)	Implement appropriate erosion protection measures at steep areas and soil stockpiles.	Control with erosion measures	
				1.50	Develop and implement a waste management plan for the construction phase.	Control with proper waste management	
				1.51	Appropriate sewage management will be implemented during the construction phase that would tie into the existing sewage management strategy at Wolvekrans Colliery, i.e. portable chemical toilets which are regularly serviced.		
				1.52	Continue with existing water quality monitoring up- and downstream of the construction areas, before and during construction where practical, in order to detect any increase in suspended solids or turbidity.	Control with monitoring	
	Spills and leaks from machinery, equipment and vehicles entering wetlands and impact on water quality within these systems. The storage and mixing of substances on site also pose a risk to wetlands.	Local impact, depending on extent of contaminated discharge/spillage	MODERATE	1.53	Divert clean upslope runoff around the development footprint. The clean water diversion is to be constructed first, before establishment of the boxcut.	Stop and control by implementing Stormwater Management Plan	LOW
				1.54	Review water management around the construction areas if erosion is evident, or if the water quality monitoring indicates an increase in suspended solids.	Control with maintenance & monitoring	
				(1.4 & 1.5)	Implement dust suppression measures and adhere to mine driving rules to prevent excessive dust generation;	Control by limiting dust generation & training	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	Reduction in catchment yield as a result of containment of contaminated runoff water emanating from the site, with no release to the catchment. Change in surface flow characteristics.	0.24% reduction in MAR of Wotbank Dam, which is 190x106 m3	LOW	(1.46)	Minimise the aerial extent of disturbed areas and potentially contaminated areas as far as possible.	Control by limiting disturbed area	LOW
				1.55	Minimise areas where dirty construction activities are carried out (e.g. servicing areas and workshops, fuel storage areas, waste storage areas) and ensure appropriate bunding of these areas.		
				1.56	Divert upslope runoff around the construction activities to minimise the volume of dirty water generated and contained.	Stop and control by implementing Stormwater Management Plan	
				1.57	Pump surplus dirty water to existing mechanical evaporators for disposal or re-use on the mine in terms of existing authorisations.	Remedy with treatment	
Removal of material from the boxcut	Discharge of contaminated water into water resources as a result if erosion of spoil stockpiles during rainfall events, deposition of sediments in local watercourses, and an increase in sulphate and TDS from overburden stockpiles.	Local impact, depending on extent of contaminated discharge	MODERATE	1.58	Direct runoff and seepage from the overburden dumps located in between the proposed ramps to Vleishaft PCD	Stop and control by implementing Stormwater Management Plan	VERY LOW
				1.59	Direct runoff and seepage from the overburden dumps located at the SKS pit to the SKS void		
				1.60	Divert runoff and seepage from the Eastern overburden dump via a canal and berm system to silt traps and a set of boreholes which will take all runoff into the underground workings		
	Pollution of surface water resources by deposition of sediments in the local watercourses and discharging mine-impacted water into the environment.		MODERATE	1.61	Contain water on site, at in-pit sumps and pumped from here to either Vleishaft PCD for reuse in the existing mining operations or to existing mechanical evaporators for disposal.	Stop and control by implementing Stormwater Management Plan	VERY LOW
				(1.6)	Implement surface water management measures, such as clean water diversion canals and berms to divert runoff from clean catchment away from mine workings.		
				1.62	Comply with the conditions of the water use licence for the dewatering of the opencast pit.	Stop and control by complying with authorisations	
Noise							
Construction laydown areas, construction works, movement of materials and construction equipment	Increased noise levels	Predicted increase in noise levels are expected to result in 'little' reaction with 'sporadic' complaints from Noise Sensitive Receptors R2, R3 and R8 during the night and 'medium' reaction with 'sporadic' to 'widespread' complaints from R7 during the night	MODERATE	1.63	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of and, if necessary, the replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	LOW
				1.64	Continue selecting equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment	
				1.65	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.	Control and stop with procedures, training, and maintenance	
				1.66	Where possible, other non-routine noisy activities such as construction should be limited to day-time hours.		
				1.67	A complaints register must be kept.	Control by communicating with I&APs	
Visual							
Clearing of vegetation, stripping of topsoil and development of infrastructure	Visual disturbance due to dust generated from construction activities, as well as views of the activities themselves	At completion of structures, visual impact will reach some 8-9km from the structures	LOW	(1.2)	Only clear vegetation when and where necessary;	Control by limiting disturbed area	LOW
				1.68	Only remove topsoil when and where necessary.		
				(1.28)	Topsoil stockpiles should be vegetated where possible to lessen the visual intrusion.	Control and remedy by maintenance	
				1.69	Ensure that stockpiles are placed away from surface water and drainage lines, where possible.	Control and stop with planning and demarcation	
				(1.32)	Monitor and fix any erosion in the landscape or on stockpiles.	Control with erosion measures	
				1.70	If possible, rehabilitate dumps concurrently	Remedy with rehabilitation	
				1.71	Ensure that construction and operations are undertaken in line with GNR1147(as amended), or any other applicable legislation at the time of implementation.	Control by complying with closure plan	
Air quality							

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Clearing of vegetation, stripping of topsoil and development of infrastructure	Increased particulate matter (PM10) as a result of construction activities	8.41 tons/month	LOW	1.72	Implement dust suppression (e.g. wetting or chemical suppression) at materials storage, handling and transfer operations, as well as spoils handling areas and earthmoving operations (continuous as required) where feasible	Control with dust suppression	LOW
				(1.4)	Implement dust suppression (e.g. wetting or chemical suppression) on unpaved roads	Control by limiting dust generation	
	Increased particulate matter (PM2.5) as a result of construction activities	16.83 tons/month	VERY LOW	1.73	Restrict haul trucks to specified haul roads using the most direct route	Control with training & restrictions	VERY LOW
				1.74	Reduce unnecessary traffic that can generate dust.		
				(1.5)	Implement strict on-site speed control according to the mine driving rules		
	Increased dust generation as a result of construction activities	43.14 tons/month	VERY LOW	1.75	Reduce the extent of open area to minimise the time between clearing and construction of infrastructure	Control by limiting disturbed area	VERY LOW
				1.76	Implement stabilisation such as chemical, rock cladding or vegetation of disturbed soils	Remedy with stabilisation	
				(1.12)	Re-vegetate areas that will not be mined in future	Remedy by revegetating	
Social environment							
Construction of infrastructure and establishment of opencast mining area	Employment opportunities, procurement and inflow of workers	Local impact	LOW	1.77	Give preference to communities within close proximity to the mining activities if any new employment opportunities are created	Control by communicating with I&APs	LOW
				1.78	Procurement and recruitment of individuals should be undertaken through formalised structures and according to processes that are in line with international best-practice standards	Control with procedures	
				1.79	Procurement of goods, services, material and equipment should be focused on the local area where economically feasible		
				1.80	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration		
	Inflow of jobseekers		MODERATE	1.81	The communication strategy with regards to the recruitment process and use of contractors to the local residents should ensure that unrealistic employment expectations are not created.	Control by communicating with I&APs	LOW
				(1.77)	Maximise the use of local labour if required and where possible		
				1.82	South32 should support efforts of the ELM to limit in-migration to the area and the subsequent development or extension of informal settlements in the area		
				(1.80)	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration	Control with procedures	
	Impact on daily living and movement patterns		LOW	(1.5)	Strict adherence by contractors to mine driving rules should be enforced	Control by training	VERY LOW
	Residential proximity and possible relocation		LOW	1.83	Disciplinary action for reckless driving within the mining area should be implemented	Control with procedures	VERY LOW
				1.84	Adhere to mitigation measures proposed by specialists and relevant regulations to limit noise and dust pollution	Control through implementation of mitigation measures	
				1.85	Heavy vehicles should be in good working order to limit any noise and dust pollution	Control and stop with proper maintenance	
				(1.4)	Dust suppression methods should be strictly implemented	Control by limiting dust generation	
				1.86	Possible negative impacts on the surrounding landowners and nearby residents should be limited to minimise any possible negative impacts on these residents' quality of life.	Control by communicating with I&APs	
				1.87	Also refer to mitigation measures for impact for sense of place, safety and security risks, health risks, and noise related impacts.	Control through implementation of mitigation measures	
	Impact on Agricultural Activities		LOW	1.88	Effective management of the mining activities associated with the infrastructure development would be required to avoid any environmental pollution (e.g. water) and limiting any increase in dust levels.	Control through implementation of mitigation measures	LOW
	Impact on Sense of Place		LOW	1.89	Undertake appropriate site management as stipulated by the specialist to limit the visual impact	Control through implementation of mitigation measures	LOW
				1.90	Risks of accidents should be recognised. Safety training should continue and focus on the designated drivers (employees) of heavy vehicles. The mine driving rules should be adhered to.	Control and stop with procedures & training	
				1.91	Strict codes of conduct should be implemented for personnel operating heavy and light vehicles to minimize traffic hazards within the mining area		

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
				1.92	Construction and upgrade of roads within the mining area should be done in a manner which would facilitate safe and efficient movement of material, employees, as well as other mining vehicles		
	Safety and Security Risks		LOW	1.93	Maintain roads to ensure safety	Control and stop with maintenance	VERY LOW
				1.94	Emergency procedures should be established that provide immediate response should an accident occur within the mining area	Stop with training & procedures	
				1.95	Appropriate firefighting equipment should be on site and construction workers, as well as permanent employees should be appropriately trained for fire fighting		
	Health Risks		LOW	1.96	Gaseous emissions should be minimised through proper operation and maintenance of vehicles	Control with maintenance	VERY LOW
					Vehicles should be in a good working order and adhere to mine driving rules	Control by training	
				(1.4)	Implement dust suppression measures	Control by limiting dust generation	
				1.97	Fugitive dust emissions should be controlled through the implementation of appropriate mitigation measures e.g. ongoing rehabilitation	Control with concurrent rehabilitation	
				1.98	Possible negative impacts on the surrounding landowners and nearby residents should be limited by ensuring that health risks are minimised and mitigation measures are implemented as stipulated by the air quality specialist	Control through implementation of mitigation measures	
	Noise Related Impacts	As per noise	LOW	(1.84)	Mitigation measures to limit any increase in noise as recommended by the noise specialist should be adhered to.	Control through implementation of mitigation measures	VERY LOW
				(1.67)	A noise monitoring program should be implemented to ensure noise from activities and equipment meet or fall below noise guidelines Keep a complaint register.	Control by communicating with I&APs	

Table 18-7: Summarised impact rating: Operational Phase

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Wetlands							
Operation of surface infrastructure associated with opencast mining	Further loss of wetland ecosystem services, or degradation of these services.	Local, depending on size of disturbance	HIGH	2.1	Separate clean and dirty water. Clean water must be diverted and directed around working areas and overburden dumps, and measures or structures created to manage the discharge to avoid scouring and erosion	Stop and control by implementing Stormwater Management Plan	HIGH
				2.2	Ablution facilities must be provided for all staff and maintained for proper and correct use	Control with proper waste management	
				2.3	Waste must be collected in appropriate containers to accommodate volumes, these bins must be serviced. Recycling of waste must be encouraged, and in the event that waste cannot be recycled, the waste must be disposed of at a licenced facility. It is recommended that all waste be removed from site on a weekly basis to prevent rodents and pests entering the site.		
				2.4	Dust suppression must be implemented, and mine driving rules must be maintained. Vehicles must be in good working order.	Control by limiting dust generation	
				2.5	Spills of hydrocarbons must be prevented as far as possible. Spill kits containing spill-sorb or a similar type product must be available and on hand to clean spills and should be reported to the appropriate authorities as required	Control and stop with procedures and remediation	
				2.6	All personnel and contractors to undergo Environmental Awareness Training, including topics such as wetland, faunal and flora importance and the procedure to follow should fauna be encountered. A signed register of attendance must be kept for proof	Stop by training	
				2.7	Implement an alien vegetation management plan for the site. The use of herbicide needs to be monitored and only used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	
				2.8	Implement and maintain a suitable stormwater management plan, including stormwater measures at stockpiles	Control by stormwater management	
				2.9	Dirty water must be contained in suitable containment facilities and re-used or treated before it is discharged into the water resource.		
	Spills and leaks from machinery, equipment and vehicles as well as the storage and mixing of substances on site, pose a risk to wetlands if contaminated runoff or material with pollution potential enters wetlands.	Local, depending on size of disturbance	MODERATE	2.10	Where applicable, hazardous materials, chemicals and additives must be stored in appropriate waste skips. Materials must also be stored in bunded areas which can accommodate the required volumes	Stop with proper storage and waste management	LOW
				2.11	Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when leaking or when being serviced. A maintenance log must be kept.	Control and stop with proper maintenance	
				2.12	No servicing of equipment on natural or rehabilitated areas		
				2.13	Leaking equipment shall be repaired immediately or be removed from site to facilitate repair		
				2.14	All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages. All re-fuelling and servicing of equipment is to take place in demarcated areas.		
				2.15	All contaminated soil shall be removed and be placed in appropriate containers. Contaminated soil may only be disposed of in a licenced facility	Remedy with removal and remediation	
				2.16	A specialist Contractor shall be used for the bio-remediation of contaminated soil where the required remediation material and expertise is not available on site.		
Aquatic ecosystem							
Discharge of treated water from the modular WTP via wetland system into the Olifants River	Habitat inundation as a result of additional water volumes	Local, depending on size of disturbance	VERY LOW	2.17	Maintain erosion protection and energy dissipating measures at the discharge point.	Control with erosion protection measures	VERY LOW
				2.18	The quality of the water discharged will be closely monitored to ensure that it complies with the specified RQO at all times.	Control by monitoring	
Flora & Fauna							
Operation of surface infrastructure associated with opencast mining	Continued fragmentation of an Endangered vegetation community (Eastern Highveld Grassland) including portions of wetlands and areas classified as ESA due to the activities, as well as encroachment by alien invasive plant species.	Throughout project area	HIGH	2.19	Highly sensitive areas outside of the project area should be declared a no-go area and access to this area must be prevented as far as possible. This should be implemented with the exception of those mining areas for which authorisation for mining has already been granted	Control and stop by demarcation	MODERATE
				(2.7)	Implement an alien vegetation management plan for the site. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Opencast mining not previously authorised	Continued removal and fragmentation of an Endangered vegetation community (including portions of wetlands and areas classified as ESA) due to the activities and potential encroachment by alien invasive plant species.		VERY HIGH	2.20	Appropriate fire breaks should be implemented to restrict the impact fire might have on the endangered vegetation	Control with procedures	MODERATE
Operation of surface infrastructure associated with opencast mining	Continued displacement and fragmentation of the faunal community due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Local disturbance	HIGH	2.21	Implement an ad hoc monitoring programme to record sightings and to track the breeding success and distribution of the two SCCs observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*)	Control with monitoring	MODERATE
				(2.3)	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.	Control with proper waste management	
				2.22	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals	Stop and control with procedures & training	
Opencast mining not previously authorised	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing anthropogenic disturbances (noise, dust and vibrations) and habitat degradation/loss (litter, road mortalities and/or poaching).	Local disturbance	HIGH	2.23	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site		MODERATE
				(2.6)	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered.		
				2.24	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north) must be maintained to facilitate the movement of wildlife within and between any natural areas	Control and stop with proper maintenance	
				(2.14)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas		
Soils, Land Capability and Land Use							
Operations of stockpiles, storing of wastes on *in situ* soils Opencast mining of areas not previously authorised	Stockpiling on top of soil will continue in loss of soil resource land capability. Vehicle movement will result in compaction of soils. Soil contamination by hydrocarbons, waste stockpiles and evaporators	Local, depending on size of disturbance	HIGH	2.25	Excavated soils should be stockpiled.	Control and stop with proper maintenance	HIGH
				2.26	Stockpiles are to be clearly demarcated on site layout plans. Also indicate the material in each stockpile to ensure that topsoil and spoils are not mixed.		
				2.27	Soil stockpiles are to be maintained in a fertile, vegetated, and erosion free state. If this can't be achieved due to design of stockpiles, then financial provision must be made to reinstate soil chemistry (fertiliser, lime, organic material) and physical structure (placement of topsoil, no compaction) and the associated specialist studies to inform these measures prior to the start of rehabilitation	Control and remedy with maintenance	
				(2.8)	Ensure proper storm water management measures are in place at stockpiles.	Control by stormwater management	
				2.28	Compaction of the removed topsoil should be avoided by prohibiting traffic on stockpiles.	Stop and control with restrictions & training	
				2.29	Stockpiled soil to be reserved for rehabilitation purposes only.		
				2.30	Monitor and fix any erosion in the landscape or on stockpiles. If erosion occurs, corrective actions must be taken to minimise any further erosion from taking place.	Control with monitoring & erosion correction measures	
				(2.5)	Prevent any spills from occurring. If a spill occurs, it is to be cleaned up immediately and reported to the appropriate authorities as required	Control and stop with procedures and remediation	
				(2.14)	All vehicles are to be serviced in designated areas	Control and stop with proper maintenance	
				(2.11 & 2.13)	Leaking vehicles, equipment and machinery should have drip trays placed under them where the leak is occurring and be repaired as soon as possible or removed from site. A maintenance log must be kept.		
Heritage							
Opencast mining not previously authorised	Damage to the historical structures identified (i.e. Douglas Pump Station, SAR Pump Station, and Vandyksdrift Railway) due to construction activities.	None (Douglas pumps station: 120m²; SAR pump stations: 30m² - will not be directly impacted)	VERY LOW	2.31	Implement a chance-find procedure. If any employees find any heritage resources during any developmental activity all work at the site must be stopped and kept on hold. Chance finds must be reported to supervisors and through supervisors to the senior manager on site.	Stop and control with procedures & training	VERY LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	Damage to the graves due to construction activities	GY01: 31 graves GY02: 13 graves	HIGH	2.32	GY02 must be exhumed and relocated before opencast mining is done in the area.	Stop by relocating	LOW
				2.33	For GY01: Demarcate the graveyard with a fence or wall and fit with an access gate. Relatives of the deceased must be located by means of social consultation and to obtain permission for fencing or walling the cemetery.	Control with demarcation	
				2.34	Regulated visitor hours must be implemented that is compatible with safety rules. This will not be necessary if the graveyard is located next to a public or national road which can provide direct access to the graveyard.	Control with procedures	
				2.35	A corridor of at least 100m should be maintained between the graveyard's border fences and any infrastructure that may be developed in the future. This buffer zone must be maintained at all times.	Control and stop with proper maintenance	
				2.36	The graveyard should be inspected every three months. Inspections should be noted in an inspection register. The register should outline the state of the graveyard during each inspection. Reports on damages to any of the graves or to the graveyards (fences, walls, gates) should be followed with the necessary maintenance work. Maintenance work should be recorded in the inspection register.	Control with maintenance & monitoring	
				2.37	The graveyards should be kept tidy from any invader weeds and any other refuse		
Palaeontology							
Opencast mining not previously authorised	Loss of fossils and other palaeontological significant artefacts	196ha (opencast mining not yet authorised)	VERY LOW	2.38	Implement Chance Find Protocol as included in the EMPr	Stop and control with procedures & training	VERY LOW
				2.39	If recognisable fossils are found by the responsible person monitoring the excavated sediments, then a palaeontologist should be approached to do an assessment.		
Groundwater							
Waste management and storage associated with opencast mining	Potential deterioration in quality of baseflow to rivers and water abstracted from boreholes as a result of seepage from the following facilities: - Overburden dumps and Dragline Spoils - Mixed ROM and slurry stockpile areas - Mechanical evaporators - Final Rejects Dump - No. 5 Seam and No. 4 Seam Stockpiles - Vleishaft PCD	Localised, depending on extent of spill	MODERATE	2.40	The Eastern overburden dump and Mixed ROM coal and slurry areas must be lined with at least compacted clay to prevent contamination from entering the aquifer system	Stop with planning and design	VERY LOW
				2.41	Groundwater monitoring must be instituted upgradient and downgradient of these facilities to monitor and intercept any potential contamination timeously	Control with monitoring	
				2.42	Groundwater monitoring boreholes must continue at designated positions based on infrastructure layout, as recommended		
				2.43	Evaporation sprayers are likely to cause significant contaminant build-up over time at the selected discharge points. However, this contamination is likely to be similar to the geochemical nature of backfill material where the sprayers will be constructed. Modelling indicates no impact to sensitive receptors and it is likely that mobilised contamination will move into the VDDC opencast. No actions are therefore required in the vicinity of the sprayers during mining except occasional removal of salt build-up and disposal at an appropriate facility.	Remedy with removal and disposal	
Opencast mining not previously authorised	Dewatering of the surrounding aquifer as a result of pumping from the pit as opencast mining proceeds. Surrounding water users may experience a decrease in available volumes such as baseflow to rivers, borehole abstraction availability and dewatering of wetland areas.	Regional, depending on volume of water that is removed from surrounding aquifers	MODERATE	(2.1)	Separate clean and dirty water to limit the dirty water make.	Stop and control by implementing Stormwater Management Plan	VERY LOW
				2.44	Monitor static groundwater levels on a quarterly basis in all boreholes within a zone of one kilometre surrounding the mine to ensure that any deviation of the groundwater flow from the idealised predictions is detected in time and can be reacted on appropriately.	Control with monitoring	
				2.45	Should surface water monitoring show that watercourses are affected by mine dewatering, discharge of clean water from the mine or possibly water treatment plant into the watercourses should be considered. Timing and volumes should be determined by a surface water specialist.	Control with clean water discharge	
				2.46	The monitoring results must be interpreted annually by a qualified hydrogeologist and the monitoring network should be audited every 5 years.	Control with interpretation and auditing	
				2.47	Update the numerical model using measured inflows, water levels and any potential future drilling and pump test information, to re-calibrate and refine the impact prediction. This should be done every 5 years during operation of the opencast	Control with updating of model	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
				2.48	Dewatering and groundwater abstraction for mining purposes should be monitored so as to prevent negative impacts on the underlying aquifer	Control with monitoring	
				2.49	Areas in the opencast where the defunct underground is intersected could be sealed with blasted overburden with engineered designs to limit groundwater ingress	Control with planning and designs	
Surface water							
Dust suppression on haul roads	Pollution of surface water resources by spillage of dust suppression water into the watercourses, and contaminated runoff from these areas entering watercourses, with resultant deterioration of water quality in terms of elevated salinity and sulphate	Local, depending on extent of dust suppressant used	MODERATE	2.50	Develop and implement a formal procedure for dust suppression to ensure that dust suppression application rates are carefully controlled to prevent the excessive application of water, ponding and excessive runoff of dust suppression water into the watercourses	Control with procedures	VERY LOW
				2.51	No dust suppression should be carried out on surfaces that are already moist.	Control with restrictions	
				2.52	Dust suppression with contaminated water should be confined to isolated dirty water management areas.		
Opencast pit and related infrastructure	Pollution of surface water resources by contaminated stormwater runoff entering watercourses, contaminated seepage from overburden dumps, leakage of contaminated water from pipelines, erosion at clean canal discharge points, and clean water runoff entering the dirty water management area.	Local impact, depending on extent of contaminated discharge/spillage	HIGH	2.53	All infrastructure areas with the potential to generate dirty storm water runoff, including washdown water will be located within the designated dirty water areas.	Control with restrictions	LOW
				2.54	Divert clean runoff around the designated dirty areas by means of cut-off canals, sized to accommodate at least the 1:50 year peak flow event	Control with water management infrastructure	
				(2.17)	Install and maintain adequate erosion protection at the clean canal discharge locations	Control with erosion protection measures	
				2.55	Manage general and hazardous wastes according to the existing waste management plan for Wolvekrans Colliery.	Control with waste management	
				2.56	Inspect all pipeline routes regularly to enable early detection of leaks.	Control with inspections	
				2.57	Collect all contaminated storm water and dirty water generated at the proposed activities and pump to Vleishaft PCD, Re-use water, or evaporate at mechanical evaporators and treat surplus water at mobile WTP if required.	Control with water management infrastructure	
				(2.1)	Divert runoff from clean catchments draining towards the eastern overburden dump, around the dump	Stop and control by implementing Stormwater Management Plan	
				2.58	Implement an inspection and maintenance plan on the storm water system to ensure that all silt traps are maintained, and that storm water canals and pipelines remain unblocked and free flowing (monthly inspections will be carried out)	Control with inspections	
				(2.5)	Spill-sorb or a similar type product must be kept on site and used to clean up hydrocarbon spills in the event that they should occur.	Control and stop with procedures and remediation	
				2.59	Use the overburden material in the concurrent rehabilitation of the opencast pit.	Remedy by rehabilitation	
Transport of coal via haul roads for processing	Spillage of contaminated water and coal particulates resulting in pollution of surface water resources	Local impact, depending on extent of contaminated discharge/spillage	LOW	(2.57)	The majority of haul roads is located within the dedicated dirty water management area, and haulage of coal will therefore take place within the dirty water management area. Runoff will drain either to the opencast pit or to Vleishaft PCD, where it will be contained.	Control with water management infrastructure	VERY LOW
				2.60	All dirty water containment facilities should be designed, operated and maintained to have a risk of spill of 2% or less (1:50 year recurrence interval) in any one year.		
				2.61	As far as is practical, ROM coal should be allowed to drain within the pit before being loaded onto the haul trucks, to prevent spillage of water from the haul truck load boxes onto the haul roads.	Control with procedures	
				2.62	Loading of trucks will be carefully controlled to ensure that overloading will not take place.		
Forced evaporation at mechanical evaporation on SKS pit	Wind-blown contamination results in the release of contaminated water into the catchment, with resultant deterioration in water quality. Salinisation of water to be evaporated over time due to combined evaporation of brine from WTP.	Localised, depending on extent of forced evaporation	MODERATE	2.63	Consideration to be given to temporarily halt mechanical evaporation during high wind conditions.	Control with restrictions	LOW
				2.64	Where forced evaporation occurs over seeded areas, it is recommended that monitoring of soils by a soil specialist be undertaken.	Control with monitoring	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
				2.65	Limit forced evaporation to spray only over pits. Where evaporators are in close proximity to watercourses (i.e. evaporators at SKS void) monitoring should be implemented and corrective action taken if monitoring show an impact on water quality		
				2.66	Monitor salination of water managed through the evaporation system due to the combined evaporation with brine from the WTP and take corrective action if needed.		
Operation of the modular WTP	Pollution of surface water resources by spillage of chemical additives, water treatment waste products, and discharge of water that does not meet the discharge standards.	Local impact, depending on extent of contaminated discharge/spillage	HIGH	2.67	The modular WTP will be isolated within a designated dirty water management area and containerised.	Control with water management infrastructure	VERY LOW
				2.68	All spills from the WTP will be collected in a sump, from where water will be directed to the Vleishaft PCD or SKS Pit.		
				(2.10)	All chemicals and additives will be stored in dedicated bunded areas, where any spills will be contained.	Stop with proper storage and waste management	
				2.69	An inspection and maintenance plan will be implemented to ensure that the water treatment plant and brine storage tanks always operate within specification.	Control with inspection	
				(2.18)	Discharge water quality will be continuously monitored for early detection of water quality non-compliant with the discharge standard.	Control by monitoring	
				2.70	Should upset conditions occur, or poor discharge water quality be detected, the WTP discharge will be directed to the Vleishaft PCD or SKS Pit.	Control with water management infrastructure	
Handling and storage of waste from the WTP	Pollution of surface water resources by: - Spillage of brine onto the ground or into water resources - Inadequate containment where brine is stored - Leakage from containment facilities for brine	Local impact, depending on extent of contaminated discharge/spillage	HIGH	2.71	Brine will be stored in existing closed tanks at the SKS pit and are located within the designated dirty water management area.	Control with stormwater management	VERY LOW
				2.72	Spills will enter the SKS pit or will be pumped to the Vleishaft PCD.		
				(2.69)	An inspection and maintenance plan will be implemented to ensure that the water treatment plant and brine storage tanks always operate within specification.	Control with inspection	
Discharge of treated water from the modular WTP via wetland system into the Olifants River	Release of surplus treated water into the catchment will influence the water quality of the receiving resource. Due to the current impacted state of the Olifants River, the quality of water due is expected to improve due to the dilution effects. Some erosion may occur at the discharge point.	Downstream of treated water discharge point	HGIH POSITIVE	(2.17)	Install and maintain dissipating structure at the discharge point as required. Install and maintain erosion protection measures at the discharge point.	Control with erosion protection measures	HIGH POSTIVE
	Release of surplus treated water into the catchment will increase in yield, which is regarded as positive. The change in the water quantity of the receiving resource and may impact on the aquatic ecology by changing the seasonal flow patterns in the river system and also result in altered hydrology of the wetland into which the discharge form the Northern Canal takes place.	Catchment level impact	MODERATE POSITIVE	(2.18)	The quality of the water discharged will be closely monitored to ensure that it complies with the specified RQO at all times.	Control by monitoring	MODERATE POSITIVE
Isolation of dirty catchment as a result of containment of runoff from dirty water management areas	Containment of runoff from dirty water management area alters the infiltration of the catchment, reduces the availability of water and changes surface flow characteristics of wetlands.	Local, depending on treated water discharged into the Olifants River	MODERATE	2.73	The site layout has been designed to minimise the dirty footprint, and therefore to minimise the impact on the catchment yield. The site layout may not be changed without obtaining the necessary approvals.	Control with restrictions	LOW
				2.74	Rehabilitate areas no longer in use, or that will not be mined in future, to increase the footprint of the clean water management area from which clean runoff is discharged into the environment.	Remedy with rehabilitation	
	Change in flow resulting in change in aquatic ecosystem	Local, depending on size of disturbance	MODERATE	(2.1)	Divert clean runoff around the working areas	Stop and control by implementing Stormwater Management Plan	LOW
	Local reduction in catchment yield (i.e. immediately downstream at the Witbank Dam)	0.24% reduction in MAR of Witbank Dam, which is $190x10^6$ m^3	LOW	2.75	Concurrent rehabilitation of the opencast mining area and dumps will take place once steady state is reached, and the rehabilitation will be shaped to be free draining.	Remedy with rehabilitation	LOW
				2.76	Where rehabilitated areas are sloped towards the active opencast pit, berms and canals will be constructed to maximise the area that is free draining.		
	Regional reduction in catchment yield (i.e. Loskop Dam)	0.11% reduction in MAR of Witbank Dam, which is $190x10^6$ m^3	VERY LOW	2.77	Discharge treated water from the modular WTP to compensate for loss	Remedy with treated water discharge	VERY LOW
Mining and infrastructure development within floodlines	Flooding of mine or mine infrastructure during extreme flood events with an impact on mining operations	Localised, associated with the mining	LOW	2.78	No mining will take place within the 1:100 year floodline areas without the relevant authorisations, in terms of GN R704 exemptions and Section 21(c) and (i) water use licenses (in terms of the NWA).	Control with restrictions	VERY LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
		infrastructure (~1 400 ha)		2.79	Conduct an investigation into the status of Attenuation Dam 1 dam wall, to determine any required upgrading or stabilisation to reduce the potential risk to mining in this area before mining commences.	Control with investigation	
Opencast mining not previously authorised	Pollution of surface water resources by runoff entering mining areas and coming into contact with carbonaceous material, and dirty runoff and mine water make discharging into the environment.	Localised, depending on stormwater management on site	HIGH	(2.57)	Pumping of all dirty water generated at the VDDC workings and proposed infrastructure areas to Vleishaft PCD	Control with water management infrastructure	LOW
				2.80	Reuse of dirty water in the operations at VDDC	Control with reuse	
				2.81	Treatment of excess dirty water (water pumped from Vleishaft PCD to the mobile water treatment plant or evaporators).	Control with treatment	
				2.82	Provide water management facilities with a risk of spill that is lower than 2% in any one year as per the Golder water balance.	Control with planning and design	
				2.83	Continue with the surface water quality monitoring programme and expand the existing network as per the specialist recommendation	Control with monitoring	
				2.84	Implement a water balance monitoring programme will be implemented to enable calibration of the water balance.		
Noise							
Construction laydown areas, construction works, movement of materials and construction equipment	Increased noise levels	Predicted increase in noise levels are expected to result in 'little' reaction with 'sporadic' complaints from Noise Sensitive Receptors R2, R3 and R8 during the night and 'medium' reaction with 'sporadic' to 'widespread' complaints from R7 during the night	MODERATE	2.85	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of, and if necessary, the replacement of, intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	LOW
				2.86	Continue selecting equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment	
				2.87	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.	Control and stop with procedures, training, and maintenance	
				2.88	Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.		
				2.89	A complaints register must be kept on site.	Control by communicating with I&APs	
Visual							
Clearing of vegetation, stripping of topsoil and development of infrastructure	Visual disturbance due to dust generated from construction activities, as well as views of the activities themselves	At completion of structures, visual impact will reach some 8-9km from the structures	HIGH	(2.27)	Topsoil stockpiles should be vegetated where possible to lessen the visual intrusion	Control and remedy with maintenance	HIGH
				2.90	Ensure all stockpiles are placed away from surface water and drainage lines where possible	Control and stop with planning and demarcation	
				(2.30)	Monitor and fix any erosion in the landscape or on stockpiles	Control with monitoring & erosion correction measures	
				2.91	Ensure that operations are undertaken in line with the GNR1147 Annual Rehabilitation Plan and adhere to applicable amendments of this regulation.	Control by complying with closure plan	
Air quality							
Operation of surface infrastructure associated with opencast mining	Increased particulate matter (PM10) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	At 2041: Emission rate of 63 tpa. Daily non-compliance of PM10 within 6 km of the mining operations Annual non-compliance of PM10 within 5 km of the mining operations.	MODERATE	2.92	Regular wetting of exposed areas and haul ramps	Control by limiting dust generation	MODERATE
				2.93	Water sprays and/or chemical stabilisation of on- and offsite haul roads		
	Increased particulate matter (PM2.5) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	At 2041: Emission rate of 165 tpa. Simulated PM2.5 complied with daily limit.	LOW	2.94	Water sprays on drilling operations		LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	Increased dust generation as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	At 2041: Calculated emission rate of 452 tpa	LOW	2.95	Regular wetting of exposed areas and haul ramps. Water sprays and/or chemical stabilisation of haul roads. Enclosure or covering of haul trucks.		LOW
Opencast mining not previously authorised	Increased particulate matter (PM10) generated from operational activities associated with opencast mining.	At 2041: Calculated emission rate of 30 tpa.	MODERATE	2.96	Reduce the drop height of the dragline		LOW
	Increased particulate matter (PM2.5) generated from operational activities associated with opencast mining.	At 2041: Emission rate of 165 tpa. Simulated PM2.5 complied with daily limit.	MODERATE				LOW
	Increased dust generation from operational activities associated with opencast mining	At 2041: Calculated emission rate of 426 tpa	LOW	2.97	Rehabilitation and revegetation of the mined areas as soon as practical, with the option of using watering to suppress dust emissions during dry and windy conditions	Stop and control with rehabilitation	VERY LOW
Social environment							
Construction of infrastructure and establishment of opencast mining area	Employment opportunities, procurement and inflow of workers	Local	LOW	2.98	Give preference to communities within close proximity to the mining activities if any new employment opportunities are created	Control by communicating with I&APs	LOW
				2.99	Procurement and recruitment of individuals should be undertaken through formalised structures and according to processes that are in line with international best-practice standards.	Control with procedures	
				2.100	Procurement of goods, services, material and equipment should be focused on the local area where economically feasible		
				2.101	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration		
	Inflow of jobseekers	Local	LOW	2.102	The communication strategy with regards to the recruitment process and use of contractors to the local residents should ensure that unrealistic employment expectations are not created	Control by communicating with I&APs	VERY LOW
				(2.98)	Maximise the use of local labour if required and where possible		
				2.103	South32 should support efforts of the ELM to limit in-migration to the area and the subsequent development or extension of informal settlements in the area		
				(2.101)	Sub-contractors should adopt a recruitment policy to enhance employment positive impacts, limit in-migration of outside jobseekers and mitigate the potential impact of residual in-migration	Control with procedures	
	Impact on daily living and movement patterns	Local	LOW	(2.4)	Strict adherence by contractors to mine driving rules should be enforced	Control by limiting dust generation	VERY LOW
				2.104	Disciplinary action for reckless driving within the mining area should be implemented	Control with procedures	
	Residential proximity and possible relocation	Local	MODERATE	2.105	Adhere to mitigation measures proposed by specialist and relevant regulations to limit noise and dust pollution	Control through implementation of mitigation measures	LOW
				2.106	Heavy vehicles should be in good working order to limit any noise and dust pollution	Control and stop with proper maintenance	
				(2.4)	Dust suppression methods should be strictly implemented	Control by limiting dust generation	
				2.107	Possible negative impacts on the surrounding landowners and nearby residents should be limited to minimise any possible negative impacts on these residents' quality of life.	Control by communicating with I&APs	
				2.108	Also refer to mitigation measures for impact for sense of place, safety and security risks, health risks, and noise related impacts	Control through implementation of mitigation measures	
	Impact on Agricultural Activities	Local	MODERATE	2.109	Effective management of the mining activities associated with the infrastructure development would be required to avoid any environmental pollution (e.g. water) and limiting any increase in dust levels.	Control through implementation of mitigation measures	LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	Impact on Sense of Place	Local	MODERATE	2.110	Undertake appropriate site management as stipulated in the EMPr to limit the visual impact	Control through implementation of mitigation measures	LOW
	Safety and Security Risks	Local	LOW	2.111	Risks of accidents should be recognised. Safety training should again be implemented focused on the designated drivers (employees) of heavy vehicles. The mine driving rules should be adhered to.	Control and stop with procedures & training	LOW
				2.112	Strict codes of conduct should be implemented for personnel operating heavy and light vehicles to minimize traffic hazards within the mining area		
				2.113	Construction and upgrade of roads within the mining area should be done in a manner which would facilitate safe and efficient movement of material, employees, as well as other mining vehicles		
				2.114	Maintain roads to ensure safety	Control and stop with maintenance	
				2.115	Emergency procedures should be established that provide immediate response should an accident occur within the mining and construction area	Stop with training & procedures	
				2.116	Appropriate firefighting equipment should be on site and construction workers, as well as permanent employees should be appropriately trained for firefighting.		
	Health Risks	Local	LOW	2.117	Gaseous emissions should be minimised through proper operation and maintenance of vehicles	Control with maintenance	LOW
				(2.4)	Implement dust suppressant measures on roads within the mining area.	Control by limiting dust generation	
				(2.4)	Vehicles should be in a good working order and adhere to mine driving rules.		
				2.118	Fugitive dust emissions should be controlled through the implementation of appropriate mitigation measures e.g. ongoing rehabilitation	Control with concurrent rehabilitation	
				2.119	Possible negative impacts on the surrounding landowners and nearby residents should be limited by ensuring that health risks are minimised and mitigation measures are implemented as stipulated by the air quality specialist and in the EMPr	Control through implementation of mitigation measures	
				2.120	The upgrading of an on-site clinic for mine employees could be considered	Remedy by upgrading infrastructure	
	Noise Related Impacts	Local	LOW	2.121	Mitigation measures to limit any increase in noise as recommended by the noise specialist should be adhered to.	Control through implementation of mitigation measures	VERY LOW
				(2.89)	Keep a complaint register	Control by communicating with I&APs	
Blasting							
Blasting activities associated with opencast mining	Ground vibration	Perceptible levels of vibration that may be experienced up to 3375 m, unpleasant up to 1527 m and intolerable up to 651 m.	MODERATE	2.122	Do blast design that considers the actual blasting and the ground vibration levels to be adhered to.	Control through planning and design	LOW
				2.123	Consider where practical to apply electronic initiation systems to facilitate single hole firing.	Control with restrictions	
				2.124	Consider where practical to design for smaller diameter blast holes that will use fewer explosives per blast hole.	Control through planning and design	
				2.125	Relocate the POI / acquire the POI of concern – mined owned.	Stop by relocating	
	Air blast	Levels predicted for the maximum charge ranges between 111.5 and 147.6 dB for all the POI's considered	LOW	2.126	Use proper charging methodology irrespective of the blast hole diameter and patterns used	Control with procedures	LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	Fly rock	Minimum unsafe zone is 365 m	MODERATE				LOW

Table 18-8: Summarised impact rating: Decommissioning, closure and post-closure phase

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Wetlands							
Use and maintenance of machines, vehicles and equipment.	Sedimentation from rehabilitated areas. Spills and leaks from machinery, equipment and vehicles will also impact on water quality of wetlands.	To be determined at decommissioning	MODERATE	3.1	Make use of existing access routes where possible.	Control by limiting disturbed area	LOW
				3.2	Any possible spills of hydrocarbons, concrete or concrete water must be avoided. Spill kits containing spill-sorb or a similar type product must be available and on hand to clean these spills before infrastructure is demolished.	Control and stop with procedures and remediation	
				3.3	Where applicable, hazardous materials must be stored in leak-proof, sealable containers or packaging. Materials must also be stored in bunded areas which can accommodate the required volumes.	Stop with proper storage and waste management	
				3.4	Drip trays or any form of oil absorbent material must be placed underneath vehicles/machinery and equipment when leaking or when being serviced.	Control and stop with proper maintenance	
				3.5	No servicing of equipment on natural or rehabilitated areas.		
				3.6	Leaking equipment shall be repaired immediately or be removed from site to facilitate repair.		
				3.7	All vehicles and equipment must be well maintained to ensure that there are no oil or fuel leakages.		
				3.8	All contaminated soil shall be removed and be placed in containers. Contaminated soil may only be disposed of in a licenced facility placed on the discard facilities prior to their rehabilitation.	Remedy with removal and remediation	
Shaping and contouring of the area to achieve final land use	Altered and lost hydrodynamics and flow regime for the catchment area	To be determined at decommissioning	MODERATE	3.9	Decommission cut-off berms,drains and other stormwater management structures last to restore surface flow dynamics	Control with stormwater management	LOW
General decommissioning and rehabilitation including decommissioning of water management infrastructure	Exposed soils during decommissioning of infrastructure are susceptible to wind and runoff erosion, resulting in sedimentation of wetlands.	To be determined at decommissioning	LOW	3.10	Separate clean and dirty water. Develop and implement a storm water management plan for the decommissioning phase.	Stop and control by implementing Stormwater Management Plan	LOW
				3.11	Implement dust suppression measures.	Control by limiting dust generation	
				(3.9)	Decommission cut-off berms and drains last to restore surface flow dynamics.	Control with stormwater management	
Aquatic ecosystem							
Decommissioning of surface infrastructure associated with opencast mining	Change in water quality resulting in deterioration of aquatic ecosystem	Local, depending on extent of spills/ potential erosion	HIGH	3.12	Heavy vehicles must not be allowed to indiscriminately drive within riparian habitats.	Control with restrictions	VERY LOW
				3.13	Any watercourse crossings of roads must be outside of the riparian and instream areas unless authorised		
				3.14	Rehabilitate diversion berms and/or trenches where they are no longer required	Remedy with rehabilitation	
				3.15	Rip and re-vegetate the disturbed areas as soon as possible.		
				3.16	Implement appropriate water treatment measures after decommissioning, which could include passive measures	Control with planning and design	

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
Flora & Fauna							
Decommissioning and rehabilitation activities	Continued encroachment by alien invasive plant species, as well as erosion due to disturbed soils.	To be determined at decommissioning	MODERATE	3.17	Highly sensitive areas outside of the project area, including the Olifants River, should be declared a no-go area and access to this area must be prevented as far as possible.	Control and stop by demarcation	LOW
				(3.1)	Where possible, existing access routes and walking paths must be made use of, and the development of new routes limited;	Control by limiting disturbed area	
				3.18	All laydown, storage areas etc should be restricted to within the disturbed mining area		
				3.19	Compile and implement an alien vegetation management plan. The use of herbicide needs to be monitored and only be used by a qualified person as several species that are protected by the Mpumalanga Schedule 11 was recorded	Control by alien invasive vegetation management	
				3.20	Appropriate fire breaks should be implemented to restrict the impact fire might have on the endangered vegetation	Control with procedures	
Decommissioning and rehabilitation activities	Continued displacement and fragmentation of the faunal community (including threatened or protected species) due to ongoing disturbances (noise, dust and vibrations).	To be determined at decommissioning	MODERATE	3.21	Two SCCs were observed on the project area: Serval (*Leptailurus serval*) and Cape Clawless Otter (*Aonyx capensis*), an ad hoc monitoring programme should be implemented with sightings recorded for these two species to specifically monitor their breeding success and distribution.	Control with monitoring	LOW
				3.22	An appropriate waste management plan must be developed for the decommissioning phase	Control with proper waste management	
				3.23	No trapping, killing or poisoning of any wildlife is to be allowed on site, including snakes, birds, lizards, frogs, insects or mammals;	Stop and control with procedures & training	
				3.24	Noise and vibrations must be kept to a minimum to reduce the impact of the development on the fauna residing on the site		
				3.25	Staff should be educated about the sensitivity of faunal species and measures should be put in place to deal with any species that are encountered;		
				3.26	Wherever possible, corridor areas (which links the CBA, ONA and ESAs to the north) must be established to facilitate the movement of wildlife within and between any natural areas;	Control and stop with proper maintenance	
				(3.7)	All vehicles and equipment must be maintained, and all re-fuelling and servicing of equipment is to take place in demarcated areas.		
Soils, Land Capability and Land Use							
Rehabilitation of VDDC infrastructure project sites and opencast area	Positive impact: Rehabilitation of soil, land capability and land use by replacing stockpiled soils over disturbed areas and bringing back a form of land capability that can support an alternative end use	To be determined at decommissioning	LOW POSITIVE	3.27	Ensure that the rehabilitation changes the land use from mining back to grazing.	Remedy with rehabilitation	LOW POSITIVE
				3.28	The spoil should be shaped taking the pre-mining landscape into consideration		
				3.29	The designed post mining landforms should be modelled to establish the post mining landscape stability by using a combination of GIS and erosion modelling techniques by a suitably qualified expert using site specific soil quality data		
				3.30	Soil compacted under stockpiles to be ripped at least 300mm deep and rehabilitated as per the end land use requirements		
				3.31	The soil quality should be investigated once stockpiled material will be used as part of rehabilitation, but prior to establishing vegetation through representative sampling and laboratory analysis		
				3.32	The analytical data should be evaluated by a suitably qualified expert and vegetation fertility and or soil acidity problems should be corrected		
				3.33	Clear targets incorporating medium to long term post mining land capability influencing land use, should be part of a potentially successful closure plan.		
Groundwater							
Opencast Mining	Contaminated water may impact surrounding watercourses	Surface decant elevation is approximately 1 530 mamsl, with a	MODERATE	3.34	Following mine closure and rehabilitation of the pit, the backfill will form an artificial aquifer which is likely to discharge. A decant management plan should be developed and should include measures such as the containment of seepage or decant water in appropriate facilities.	Control with planning and design	VERY LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
		discharge volume of approximately 0.5 ℓ/s.		3.35	All sulphate-containing waste material should be stored at the bottom of the opencast pit and should be left to be flooded as soon as possible to exclude oxygen.	Control with procedures	
				3.36	Backfill material should be compacted and surface water flow should be routed around the backfillled opencast to reduce recharge to a maximal extent.		
				3.37	Groundwater monitoring boreholes should be sited at designated positions based on infrastructure layout, to comply with the design requirements of a groundwater monitoring system, as recommended.	Control with monitoring	
				3.38	The monitoring results must be interpreted annually by a qualified hydrogeologist and the monitoring network should be audited every 5 years.	Control with interpretation and auditing	
				3.39	The water level in the backfilled opencast should be controlled by implementing effective water management strategies or pumping to not exceed 1530mamsl to prevent decant. The water level in the pit should be maintained approximately 5m below the sub-surface discharge elevation as a safe management level. Alternatively, an interception trench must be constructed to capture contaminated subsurface seepage.	Control with pumping	
Waste management and storage during decommissioning	Potential deterioration in quality of baseflow to rivers and water abstracted from boreholes as a result of seepage from the following facilities: - Mechanical evaporators - Final Rejects Dump - Vleishaft PCD	To be determined at decommissioning	MODERATE	3.40	Vleishaft PCD, mechanical evaporators (and associated salt build-up), to be removed and the area remediated as per the rehabilitation plan.	Remedy with rehabilitation	VERY LOW
				3.41	Capping of the final rejects dump must be implemented as per approved rehabilitation designs		
				3.42	Maintain monitoring and contaminated seepage management at the final rejects dump to minimise contamination of groundwater.	Control with monitoring and seepage management	
Surface water							
General decommissioning and rehabilitation including decommissioning of water management infrastructure	Pollution of surface water resources as a result of: - Erosion of soils during rainfall events resulting in elevated suspended solids in watercourses - Hydrocarbon spillages from machinery, vehicles, and equipment.	To be determined at decommissioning	LOW	(3.1)	Minimise the disturbed footprint area as far as possible.	Control by limiting disturbed area	VERY LOW
				(3.17)	Delineate "no-go" zones where the decommissioning activities are near the Olifants River	Control and stop by demarcation	
				(3.9)	Decommission the storm water management measures last, if at all, to ensure adequate storm water management during the rehabilitation phase.	Control with stormwater management	
				(3.4)	Equipment, machinery, and vehicles will only be serviced in dedicated areas that are bunded and equipped with drip trays	Control and stop with proper maintenance	
				(3.3)	Hazardous material to be stored in sealable containers within bunded areas	Stop with proper storage and waste management	
				(3.2)	Spill-sorb or a similar product will be kept on site, and used to clean up hydrocarbon spills in the event that they should occur.	Control and stop with procedures and remediation	
				3.43	Erosion protection measures will be implemented at steep areas as determined by a surface water specialist.	Control with erosion protection measures	
				(3.22)	A waste management plan will be developed for the decommissioning phase, which will include the handling of contaminated materials / soils found on site.	Control with waste management	
				(3.2)	All traces of hydrocarbons and residual waste will be removed before infrastructure is demolished.	Control and stop with procedures and remediation	
				(3.8)	Contaminated soils will be excavated and placed on the discard facilities prior to their rehabilitation, or removed from site by an appropriately licensed waste contractor.	Remedy with removal and remediation	
				3.44	An appropriate sewage management strategy will be implemented during the decommissioning phase.	Control with waste management	
				3.45	Water quality monitoring will be undertaken downstream of the decommissioning areas, before and during decommissioning where practical, in order to detect any increase in suspended solids or turbidity.	Control with monitoring	
				3.46	If erosion is evident, or the water quality monitoring indicates an increase in suspended solids, water management around the decommissioning areas will be reviewed.	Control with monitoring & erosion correction measures	
Decant of mine water make	Pollution of surface water resources by decanting acid mine drainage (rebound of water levels is expected within 5 years after cessation of mining). The water balance indicates that an average water make in the	To be determined at decommissioning	HIGH	3.47	The pit will be backfilled without a final void, rehabilitated and made free draining in order to minimise the post closure water make.	Remedy with rehabilitation	LOW

Activity	Potential impact	Size & Scale	Significance If Not Mitigated	Ref	Mitigation Measures	Mitigation Type (Modify, Remedy, Control, Stop)	Significance If Mitigated
	order of 5 800 m³/day can be expected. Based on a sulphate concentration of around 3 000 mg/ℓ, this equates to around 17.4 tons SO_4 per day, or around 6 351 tons SO_4 per year.			3.48	Monitoring of water levels in the mine and the associated water quality is committed to. This will allow both calibration of the post mining water quality and water volumes.	Control with monitoring	
				(3.34)	A water management strategy, including a decant management plan will be developed five (5) years prior to mine closure which will consider passive treatment.	Control with planning and design	
Noise							
Decommissioning and rehabilitation activities	Increased noise levels	To be determined at decommissioning	MODERATE	3.49	Keep all diesel-powered equipment and plant vehicles at a high level of maintenance. This should particularly include the regular inspection of and, if necessary, the replacement of intake and exhaust silencers. Any change in the noise emission characteristics of equipment should serve as trigger for withdrawing it for maintenance.	Control and stop with proper maintenance	LOW
				3.50	Select equipment with lower sound power levels. Vendors should be required to guarantee optimised equipment design noise levels.	Stop with effective equipment	
				3.51	In managing noise specifically related to truck and vehicle traffic, efforts should be directed at (i) Minimising individual vehicle engine, transmission, and body noise/vibration. This is achieved through the implementation of an equipment maintenance program; (ii) Maintain road surface regularly to avoid corrugations, potholes etc; (iii) Avoid unnecessary idling times.	Control and stop with procedures, training, and maintenance	
				3.52	Where possible, other non-routine noisy activities such as construction, decommissioning, start-up and maintenance, should be limited to day-time hours.		
				3.53	A complaints register must be kept.	Control by communicating with I&APs	
Visual							
Rehabilitation of VDDC infrastructure project sites and opencast area	Positive impact: Decommissioning/dismantling of infrastructure and replacing stockpiled soils over disturbed areas and returning to a natural mimicking topography that can support an alternative end use	To be determined at decommissioning	LOW POSITIVE	3.54	Ensure that rehabilitation takes place in line with the Land and Rehabilitation Management Plan (Old_Wvk_Prod_Sop_035) for Wolvekrans, or the rehabilitation plan developed in terms of GNR1147.	Remedy with rehabilitation	LOW POSITIVE
				3.55	Ensure that all unnecessary infrastructure/dumps or stockpiles are demolished/removed.	Remedy with removal	
				3.56	Rehabilitate all areas where infrastructure/stockpiles/dumps have been removed.	Remedy with rehabilitation	
Air quality							
Operation of surface infrastructure associated with opencast mining	Increased particulate matter (PM10) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	To be determined at decommissioning	LOW	3.57	Regular wetting of exposed areas, temporary stockpiles and haul ramps.	Control by limiting dust generation	LOW
	Increased particulate matter (PM2.5) as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	To be determined at decommissioning	VERY LOW	3.58	Chemical stabilisation of on- and offsite haul roads.		VERY LOW
	Increased dust generation as a result of operational activities associated with infrastructure management, including stockpiles and overburden dumps.	To be determined at decommissioning	VERY LOW	3.59	Rehabilitation and revegetation of the cleared areas as soon as practical, with the option of using watering to suppress dust emissions during dry and windy conditions.	Stop and control with rehabilitation	VERY LOW

19. SUMMARY OF SPECIALIST REPORTS

(This summary must be completed if any specialist reports informed the impact assessment and final site layout process and must be in the following tabular form):-

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Soil, land capability and land use (Appendix 8.1)	• If the mechanical evaporator is placed on rehabilitated (top-soiled and vegetated) backfill spoils, at least two monitoring points should be placed within 50 m of the front of the proposed evaporators, with an additional two points at 100 m and a further two at 150 m. • Once a soil resource has been identified for use in rehabilitation, the soil analyses and results mentioned above will be interpreted by a qualified (Pr. Sci Nat) soil scientist for recommendations in terms of fertilisers and soil ameliorants to be utilised as part of rehabilitation. • Mitigation measures proposed from a soil aspect in Table 18-6 and Table 18-7 must be seen as the minimum conditions for approval. • The Final Rehabilitation, Decommissioning and Mine Closure Report compiled as part of the Financial Provisioning Regulation requirements should use information from the soil impact assessment when considering the end land use options, stipulate measurable objectives for achieving the end land use, and stipulate the requirements in terms of land capability to support the end land use. • The development should proceed, but with the principles of sustainable development and the polluter pays in the forefront.	X	EMPr
Blasting assessment (Appendix 8.11)	• Apply for the necessary authorisations in terms of non-mining structures and installations to be placed within 500 m from the mining operations (specifically regulation 4.16 of the Mine Health and Safety Act, 1996 (Act 29 of 1996), • Review blast designs prior to first blast planned and done. Consideration can be given to the possible use of electronic initiation rather than conventional timing systems. This will allow for single blast hole firing instead of multiple blast holes. Single blast hole firing will provide single hole firing – thus less charge mass per delay and less influence. • Conduct a first test blast to confirm levels and ground vibration and air blast. Perform detailed monitoring to help define blasting operations going forward. • Consider increasing the stemming length for better control on fly rock. The recommended stemming length should be between 30 and 34 times the blast holes diameter.	X	EMPr

<table>
<tr><th>LIST OF STUDIES UNDERTAKEN</th><th>RECOMMENDATIONS OF SPECIALIST REPORTS</th><th>SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT
(Mark with an X where applicable)</th><th>REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.</th></tr>
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Determine the safe blasting distance after the final code of practice of the mine has been confirmed. The calculated minimum safe distance is 365 m but may be greater.
Roads and railway lines will require management when blasting operations are done within 500 m or as per mine's code of practice, which may include temporary closure of roads and liaison with rail authorities.
It is recommended to conduct a photographic survey of structures surrounding the mine, where a 1 500 m range is considered a good and reliable distance, to allow for negotiations with regards to complaints from neighbours on structural issues due to blasting. During blasting care must be taken to ensure all people and animals are cleared to outside the unsafe area as determined by the blaster.
Develop and implement a process of evaluating ground vibration levels observed in nearby communities and schedule inspections. Consider photographic survey of structures surrounding the mine as mining progresses closer to privately owned structures.
Recommended ground vibration and air blast limits are as follows.

<table>
<tr><th>Structure description</th><th>Ground vibration limit (mm/s)</th><th>Air blast limit (dBL)</th></tr>
<tr><td>National Roads/Tar Roads:</td><td>150</td><td>N/A</td></tr>
<tr><td>Electrical Lines:</td><td>75</td><td>N/A</td></tr>
<tr><td>Railway:</td><td>150</td><td>N/A</td></tr>
<tr><td>Transformers</td><td>25</td><td>N/A</td></tr>
<tr><td>Water Wells</td><td>50</td><td>N/A</td></tr>
<tr><td>Telecoms Tower</td><td>50</td><td>134</td></tr>
<tr><td>General Houses of proper construction</td><td>USBM Criteria or 25 mm/s</td><td rowspan="3">Shall not exceed 134 dB at point of concern
Preferred level is 120 dB</td></tr>
<tr><td>Houses of lesser proper construction (preferred)</td><td>12.5</td></tr>
<tr><td>Rural building – Mud houses</td><td>6</td></tr>
</table>

It is recommended not to blast too early in the morning when it is still cool or when there is a possibility of atmospheric inversion or too late in the afternoon in winter. Do not blast in fog. Do not blast in the dark. Refrain as far as possible from blasting when wind is blowing strongly in the direction of an outside receptor. Do not blast with low overcast clouds. The energy of the air blast is difficult to mitigate in these weather conditions; and

</td><td></td><td></td></tr>
</table>

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Third party consultation and monitoring should be considered for all ground vibration and air blast monitoring work to bring about unbiased evaluation of levels and influence.		
Visual impact assessment (Appendix 8.3)	• Mitigation measures proposed from a visual aspect in Table 18-6 to Table 18-8 must be seen as the minimum conditions for approval. • Rehabilitation and closure requirements must be enforced with the final end land use as the objective.	X	Section 18 EMPr
Wetlands (Appendix 8.7)	• Mitigation measures proposed from a wetland aspect in Table 18-6 to Table 18-8 must be seen as the minimum conditions for approval; • A 100m buffer width is recommended for all remaining wetland and riparian areas and all non-essential structures and activities may not be permitted within these areas; • It is recommended that the wetland offset strategy compiled for the approval of the DMO project be implemented; and • It is recommended that environmental authorisation for the project only be considered on the acceptance of a rehabilitation plan.	X	EMPr
Terrestrial biodiversity (Appendix 8.7)	• It is recommended that an extensive alien plant management plan be compiled to remove all alien vegetation from within the project area, should the project receive authorisation. • An erosion control plan must be compiled and implemented for the opencast area. • Passive or active water treatment of AMD is recommended, should it be required. • Mitigation measures proposed from a terrestrial biodiversity- and aquatic ecology aspect in Table 18-6 must be seen as the minimum conditions for approval.	X	Section 18 EMPr
Aquatic ecology (Appendix 8.7)		X	Section 18 EMPr
Surface water (Appendix 8.8)	• Where forced evaporation occurs over seeded areas, it is recommended that monitoring of soils by a soil specialist be undertaken. • The proposed additional surface water quality monitoring locations, sampling and analysis should be included in the mine's surface water monitoring protocol. Refer to the monitoring programme in the EMPr. • Mitigation measures proposed from a surface water aspect in Table 18-6 to Table 18-8 should be implemented.	X	Section 18 EMPr

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
Groundwater (Appendix 8.9)	*Management of identified impacts during mining* • Groundwater monitoring boreholes should be sited at designated positions based on infrastructure layout, to comply with the design requirements of a groundwater monitoring system. • Clean and dirty water systems should be separated as planned. • If surface water monitoring shows that the Olifants River or its tributaries are affected by mine dewatering, discharge of clean water into the tributaries should be considered. • The numerical model should be updated during operation of the opencast mine by using the measured inflows, water levels and any potential future drilling and pump test information to re-calibrate and refine the impact prediction. • Dewatering and groundwater abstraction for mining purposes should be monitored so as to prevent negative impacts on the underlying aquifer. • Areas in the opencast where the defunct underground is intersected could be sealed with blasted overburden with engineered designs to limit groundwater ingress. • Since the contamination from the mechanical evaporators is likely to be similar to the geochemical nature of backfill material where the sprayers will be constructed, no impact to sensitive receptors is expected. It is likely that mobilised contamination will move into the VDDC opencast. • The Mixed ROM coal and Slurry Stockpiles, proposed waste rock dumps and dragline spoils and Vleishaft PCD must be lined to prevent any contamination from entering the aquifer system. Groundwater monitoring must be instituted upstream and downstream of these facilities to monitor and intercept any potential contamination timeously. Waste rock dumps and the dragline spoils must be lined with, at least, a compacted clay to prevent contamination from entering the aquifer system. *Management of identified impacts after mining* • Following mine closure and rehabilitation of the pit, the backfill will form an artificial aquifer which is likely to discharge. The water level in the backfilled opencast should be controlled by pumping to not exceed 1530mamsl to prevent decant. The water level in the pit should be maintained approximately 5m below the sub-surface discharge elevation as a safe management level. Alternatively, an interception trench must be constructed to capture contaminated subsurface seepage.	X	EMPr

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• All sulphate containing waste material should be stored at the bottom of the opencast and flooded as soon as possible to exclude oxygen. • A water management strategy (including a decant management plan) must be developed which may include passive or active treatment options. • Backfill material should be compacted, and surface water flow should be routed around the backfilled opencast to reduce recharge to a maximal extent. • It is assumed that the dragline spoils and overburden dumps will be deposited in the VDDC opencast as part of backfill material and that the Mixed ROM coal and slurry stockpile areas will all be removed either during or after mining thereby removing these potential pollution sources. It is considered likely that Vleishaft PCD will be removed after mining has ceased, thereby also removing this source. Groundwater monitoring at the final rejects dump must be maintained and contaminated seepage management implemented. Capping of this facility will also be mandatory.		
Air quality (Appendix 8.4)	• For compliance with the NDCR, an additional three dust buckets and relocation of two existing dust buckets should be placed at locations near the downwind boundary of the VDDC section. • A PM_{10} sampler should be placed at any of the recommended dust bucket locations, if security considerations allow for it. • Additional support infrastructure can reduce the climate change impact on the staff and project, for example ensuring adequate water supply for staff and reducing on-site water usage as much as possible. • Ensure vehicles and equipment is maintained through an effective inspection and maintenance program. • Limit the removal of vegetation and ensure adequate re-vegetation or addition of vegetation surrounding the project. • The east-west orientation of the evaporators is recommended since it will have less impact on the nearby haul road to the east of the void. • Stakeholder engagement regarding air pollution resulting from the project should be held and a complaints register kept at all times. • Monitor local weather forecasts for windy and/or dry conditions – for example, during late winter, spring and early summer. Contingency systems should be in place to respond with additional dust suppression during these periods. • Reduce the drop height of the dragline and from loaders into haul trucks during dry and windy conditions	X	EMPr

LIST OF STUDIES UNDERTAKEN	RECOMMENDATIONS OF SPECIALIST REPORTS	SPECIALIST RECOMMENDATIONS THAT HAVE BEEN INCLUDED IN THE EIA REPORT (Mark with an X where applicable)	REFERENCE TO APPLICABLE SECTION OF REPORT WHERE SPECIALIST RECOMMENDATIONS HAVE BEEN INCLUDED.
	• Regularly check the dust suppression equipment, for example the bowser trucks on ramps, road surface on the haul road where chemical suppressants are used. • Regularly conduct visual inspections of rehabilitates/revegetated areas for complete vegetation cover. • A Pollution Prevention Plan is required for the proposed VDDC operations, but not for construction.		
Noise (Appendix 8.2)	• A monitoring programme as per the requirements of the International Finance Corporation (IFC) and SANS 10103: (a) Once during the construction phase at R5, R7, R10 and R11; (b) Annually during the operational phase at R5, R7, R10 and R11; and (c) In response to complaints received. • Mitigation measures from a noise aspect contained in Table 18-6 should be implemented to ensure minimal impacts on the surrounding environment.	X	Section 18 EMPr
Social impact (Appendix 8.10)	• A detailed Social Impact Assessment should be undertaken during decommissioning and closure to determine the actual impacts on the changing social environment at that stage. • The mitigation measures from a social aspect contained in section 18.5 should be integrated within the EMPr.	X	Section 18 EMPr
Heritage (Appendix 8.6)	• The graveyard identified as GY02 must be exhumed and relocated in accordance with the NHRA. • Mitigation measures from a heritage aspect contained in section 18.5 should be implemented. • A Chance Find Protocol should be implemented throughout all project phases	X	Section 18 EMPr
Palaeontology (Appendix 8.5)	• A monitoring programme and Chance Find Protocol should be included in the EMPr that should come into effect once mining for the project commence.	X	Section 18 EMPr

Attach copies of Specialist Reports as appendices

20. ENVIRONMENTAL IMPACT STATEMENT

20.1 Summary of the key findings of the environmental impact assessment

The key findings of the environmental impact assessment are as follows:

- The VDDC mining project will utilise available mineral resources and is regarded as life extension project at the Wolvekrans Colliery;
- These mineral resources have been mined by underground and opencast methods previously and several impacts have already occurred. Furthermore, the mining area is surrounded by other opencast operations, resulting in a landscape dominated by mining and its associated impacts;
- The VDDC project area is therefore largely a brownfields area where the natural topography has been dramatically disturbed by mining related activities. The main surface water feature is the Olifants River, which drains the study area in the south from east to west, and from south to north in the west, until it flows into the Witbank Dam;
- Although the overall area was prescribed a low sensitivity due to the extent of previous and current mining activities, some high sensitivity areas were identified within the project area. These areas are wetlands and/or are areas considered to have a high biodiversity value or where meaningful numbers of SCC where recorded. The most significant high sensitivity area occurs across the central part of the project area, namely the Vleishaft Tributary (HGM 2). Authorisation to mine this area was however granted in 2007;
- The proposed VDDC mining and infrastructure project is mostly located on existing impacted land, or the area previously authorised to be opencast mined. However, the areas that are not previously impacted, will be highly impacted by the project;
- The viewshed from the proposed infrastructures extends some 10 – 12 km to the north and south. The elevated views from the Ogies dyke in the north is offset by the flat terrain around the Olifants River floodplain, where the site is located. Views to the east and west are somewhat blocked due to topography, with a few isolated exceptions;
- The VDDC section is located in the HPA, an area that is characterised by poor air quality. As a result of the high background particulate values, the residual impact ratings for opencast mining and infrastructure operations (after mitigation) remains moderate to high;
- From previous studies, it was found that most of the fallout of water droplets and dissolved solids occur in the nearby vicinity of the evaporators, within 50 m to 70 m of the evaporator. Nearly all of the fallout (99%) occurs within 125 m to 150 m from the evaporators. Both measurement and model results show that unless removed by rain or other means, monthly deposition of total solids of about 100g/m² (3g/m²-day) is possible at downwind distances of about 300 m from the evaporators. The proposed position of the evaporators is on the unrehabilitated SKS pit and will therefore be located within the dirty water management area;
- A GHG inventory was compiled for the proposed project, taking into consideration the diesel fuel and electricity requirements. The total CO_2-e emissions for construction operations is approximately 175 398 tpa of which 39% is due to vehicle exhaust emissions (Scope 1) and 61% is due to electricity consumption

(Scope 2). The total CO_2-e emissions for mining and infrastructure operations is approximately 435 438 tpa, of which 168 062 tpa is due to vehicle exhaust emissions (Scope 1). GHGs were declared priority pollutants in March 2014 and pollution prevention plans must be developed if the operation contributes more than 100 000 tons CO2-e emissions. The Project's Scope 1 GHG contribution is above this limit and therefore a Pollution Prevention Plan is required for the proposed VDDC operations, but not for the construction phase;

- The GHG emissions from the project are considered low and not likely to result in a noteworthy contribution to climate change on its own;
- The project and the community are considered likely to be negatively impacted by climate change, the project less so than the community, firstly due to the short time over which operations are planned to occur, and secondly because the project is likely to have measures in place to cope with the possibility of water shortage;
- The noise levels from the project operations did not exceed the selected noise criteria at noise sensitive receptors. Construction and closure phase impacts are expected to be similar or slightly lower than simulated noise impacts of the operational phase;
- The surrounding and downstream surface water resources, namely the Olifants River, are considered stressed water resources in terms of both the quantity of water in the system and the quality of the water. The impact of the proposed project on catchment yield is low. Surface water quality impacts from the proposed project can be effectively mitigated by applying best practice water management principles;
- The discharge of treated water from the modular WTP is expected to have a positive impact on the Olifants River downstream;
- The dewatering of the VDDC opencast mining area is expected to result in a maximum drawdown of 20 – 60 m, with a cone of depression of 200 – 250 m from the edge of the pit. The tributary of the Olifants River to the south-east of the mining area is likely to be impacted as a result of the drawdown caused by the mining activities and related dewatering. Surface water users that make use of this tributary may therefore be affected due to reduced baseflow;
- The estimated time for groundwater rebound time after cessation of opencast mining and associated pumping is approximately five (5) years. After rebound has reached equilibrium, decant has the potential to occur. The calculated sub-surface decant elevation is approximately 1 530 mamsl with a discharge volume of approximately 0.5 ℓ/s. The water level in the backfilled pit should therefore be maintained approximately 5 m below the sub-surface discharge elevation as a safe management level. This predicated decant rate and elevation is based on a model that incorporates an intact geological barrier between the VDDC opencast and the SKS and Glencore backfilled pits to the west. Should this not be the case, the decant location, rate and elevation is expected to be different;
- The whole mining property falls in palaeontologically sensitive sediments (shales, mudstones and coal) of the early Permian Vryheid Formation in the Witbank coalfield. Coal seams are between 15 – 110 m below the land surface that is covered by soils. It is very unlikely that any fossils would be impacted upon by the excavations for the proposed infrastructure because the fossils would occur in the shales associated with the coal seams. Opencast mining in the areas not

previously authorised may impact on fossils. The fossils are rare and sporadic and a Chance Find Protocol has been included in the EMPr;

- The historical structures consisting of pump stations and a railway siding will not be affected by the proposed project. Graveyard GY02 will be affected by the section of the opencast pit that has not been authorised in 2007 and therefore exhumation of human remains, and the relocation of graveyards have been recommended;
- Perceptible levels of ground vibration as a result of blasting may be experienced up to 3 375 m, unpleasant levels up to 1 527 m and intolerable levels up to 651 m. The effects of air blast are expected to be less than ground vibration. Levels predicted for the maximum charge ranges between 111.5 dB and 147.6 dB for all the POI's considered. These levels may contribute to effects such as rattling of roofs or door or windows with limited points that are expected to be damaging and others could lead to complaints. The absolute minimum unsafe zone with regard to fly rock is 365 m;
- The proposed mining and infrastructure development would result in limited additional employment opportunities with a temporary increase in the concentration of workers at the VDDC during the construction phase;
- The Lindokuhle settlement is in close proximity to the existing mining activities, and approximately 800 m from the VDDC opencast pit. Although it is not anticipated that the proposed development would directly impact on the community, apart from limited noise and dust pollution, mitigation measures should be strictly implemented to avoid any possible short- and long-term negative impacts on the quality of life of the residents. Ongoing monitoring of possible negative impacts on the residents should be undertaken to determine whether any specific mitigation measures would be required in future.

No fatal flaws were identified during the impact assessment and all specialists agreed that the development should proceed provided that the mitigation measures stipulated in the EMPr are implemented. Monitoring of the impacts should be conducted to determine if any corrective actions are required.

20.2 Final site map

Provide a map at an appropriate scale which superimposes the proposed overall activity and its associated structures and infrastructure on the environmental sensitivities of the preferred site indicating any areas that should be avoided, including buffers. Attach as Appendix

Refer to **Figure 5-4** and **Appendix 5**.

20.3 Summary of the positive and negative implications and risks of the proposed activity and identified alternatives

A summary of the positive and negative impacts associated with the alternatives is provided in **Table 13-1**. A summary of the anticipated impacts of the proposed project after the proposed mitigation measures have been implemented for the operational phase is outlined in **Table 20-1**.

Table 20-1: Positive and negative implications of the VDDC project

Aspect	Main impact	Risk rating
Soil, Land Use and Land Capability	Stockpiling on top of soil will cause a loss of the soil resource land capability. Vehicle movement will result in compaction of soils. Soil will be contaminated by hydrocarbons, waste stockpiles and evaporators.	High
Visual	Stockpiling will increase in size and increase in visibility over time. Ongoing vehicle movement and evaporators will also be visible.	High
Blasting	Ground vibrations, air blasts, and fly rock will be evident due to blasting operations.	Low
Heritage	Damage to historical structures as a result of mining and associated infrastructure activities.	Very low
	Damage to graves as a result of mining and associated infrastructure activities.	Low
Palaeontology	Loss of fossils and other palaeontological significant artefacts due to mining operations and associated infrastructure.	Very low
Social	Dust and noise activities may impact on the quality of life of local residents in the Lindokuhle community	Low
Noise	Vehicles, machinery and equipment will cause an increase in noise levels during construction, operations and decommissioning.	Low
Air	PM_{10}, $PM_{2.5}$ and dust will be generated on site due to mining activities and associated infrastructure.	Low
Flora & Fauna	Destruction and fragmentation of vegetation community, including endangered vegetation, wetlands, corridors and areas classified as ESAs.	Moderate
Aquatic	Increased dissolved solids, increased dissolved metals, alteration of pH, and increased suspended solids of water quality may impact on aquatic organisms. An alternation of the drainage may result in erosion and sedimentation of the habitat quality.	Low
Wetland	Loss and/or degradation of wetland systems and associated ecosystem services	High
Surface water	The release of surplus treated water into the catchment will influence the water quality and quantity of the receiving resource and may negatively impact on the aquatic ecology by changing the seasonal flow patterns in the river system.	Moderate positive
	Pollution of surface water resources by clean runoff entering mine affected areas and coming into contact with carbonaceous material, and dirty runoff and mine water make discharging into the environment.	Low
	Pollution of surface water resources by contaminated stormwater runoff entering watercourses, contaminated seepage from overburden dumps, leakage of contaminated water from pipelines, erosion at clean canal discharge points, and clean water runoff entering the pits.	Low

Aspect	Main impact	Risk rating
Hydrogeology	Surrounding water users may experience a decrease in available volumes such as baseflow to rivers and borehole abstraction availability.	Very low
	Surrounding water users may experience a decline in quality of baseflow to rivers and water abstracted from boreholes.	Very low

21. PROPOSED IMPACT MANAGEMENT OBJECTIVES AND THE IMPACT MANAGEMENT OUTCOMES FOR INCLUSION IN THE EMPr

Based on the assessment and where applicable the recommendations from specialist reports, the recording of proposed impact management objectives, and the impact management outcomes for the development for inclusion in the EMPr as well as for inclusion as conditions of authorisation.

The impact management objectives are based on the following:

- Impacts are to be avoided, where possible;
- Where impacts cannot be avoided, it should be reduced and/or controlled to acceptable levels (i.e. national/international acceptable standards);
- If an impact occurs, it should be remedied;
- If an impact cannot be avoided, investigation into offset initiatives will be required.

The EMPr provides details on the implementation of the management measures (timeframes, as well as roles and responsibilities) required to meet the objectives.

The monitoring and auditing programme provide an assessment of the success of mitigation measures implementation as well as compliance and allows for continual improvement and remedy.

22. FINAL PROPOSED ALTERNATIVES

(Provide an explanation for the final layout of the infrastructure and activities on the overall site as shown on the final site map together with the reasons why they are the final proposed alternatives which respond to the impact management measures, avoidance, and mitigation measures identified through the assessment)

The alternatives were described in detail in **Section 8.1**. The final preferred alternatives are summarised as follows:

- The dirty water make from the mine will be collected and contained in the existing Vleishaft PCD. From here, water will be evaporated at mechanical evaporators to be located on the SKS pit. If required, a modular WTP will be commissioned to manage the surplus dirty water make on site.

  The proposed PCD included in the initial site layout was removed from the infrastructure plans. The management of mine water make through the mechanical evaporators and the modular WTP is preferred, due to concerns regarding the proximity of the proposed PCD to the Olifants River. It is noted that apart from the site located next to the Olifants River, there is no space available for the development of a surface PCD. By constructing the WTP, potential negative impacts associated with the proposed PCD will be avoided. Furthermore, the WTP will have a positive impact associated with the release of treated water into the Olifants River.

- The existing topsoil dump will be extended as opposed to establishing a new topsoil dump to the south of the existing LAC discard dump as originally planned. The following advantages are anticipated:
    - All topsoil stockpiles will be located within the same area, in the vicinity of the existing topsoil stockpile;
    - Lesser transport cost associated with hauling of topsoil to the stockpile, compared to a stockpile located in the far south. This will also result in lesser emissions associated with hauling;
    - The proposed topsoil stockpile area is not located within the vicinity of a natural watercourse, compared to the alternative in the south, which is in the vicinity of the Olifants River. The impact of emissions from vehicle movement, potential dust and erosion from the stockpile on the water quality of a watercourse is therefore expected to be less than the alternative option located next to the Olifants River.
- Slurry stored in the underground workings will be mined with ROM coal and temporarily stockpiled on the Mixed ROM and slurry stockpile areas, as opposed to the re-sale of dewatered slurry. The latter option is not feasible since the slurry cannot be pumped from the underground workings but will be mined with the ROM coal as a mixed material. The mixed material will be allowed to dewater before it is transported to the existing SKS tip and processing at the existing South Plant.

23. ASPECTS FOR INCLUSION AS CONDITIONS OF AUTHORISATION

Any aspects which have not formed part of the EMPr that must be made conditions of the Environmental Authorisation

All relevant recommendations from the specialist assessments have been incorporated into the EMPr and should form part of the conditions of authorisation. Of specific importance is the following:

- The groundwater model should be calibrated and updated every five (5) years as mining proceeds to confirm and improve the assumptions in the model, specifically regarding the integrity of the barrier pillar with adjacent mining operations. A water management strategy, which includes a decant management plan, should be developed to ensure that the water levels in the VDDC pit are maintained to below decant level;
- The operational water balance should be continuously monitored and reviewed on an annual basis. The predictive mine water balance and salt balance should be reviewed every five (5) years commensurate with the update of the groundwater model. The updated models should be used to review the adequacy of the water management measures, i.e. mechanical evaporation and treatment at the modular WTP for discharge, as well as dirty water storage requirements.

24. DESCRIPTION OF ANY ASSUMPTIONS, UNCERTAINTIES AND GAPS IN KNOWLEDGE

(Which relate to the assessment and mitigation measures proposed)

The assumptions and limitations as considered by the various specialists and by the EAP is proved in **Table 24-1**.

Table 24-1: Assumptions and limitations of the VDDC Project

Aspect	Assumptions and limitations
General	• The LoM plans and scheduling as received from South32 was accurate and relevant at the time of the specialists' assessments. • The layout plan as received from South32 was accurate and relevant at the time of the specialists' assessments.
Soil, Land Use and Land Capability	• The information collected in the previous soil reports for VDDC are correct and do not require verification. Thus, the information was used as published previously. • No field verifications were undertaken as part of this assessment.
Visual	• The information collected in the previous reports for VDDC are correct and do not require verification. Thus, the information was used as published previously. • The assessments are based on contours supplied by the mine and supplemented with surveyor general 20 m contours. The specialist is not responsible for the accuracy of the surveys supplied. • At the time of the visual assessment, the estimated heights for these stockpiles were not available and therefore the visual modelling assumed 40 m for stockpiles and 10 m for workshops, explosive magazines and other structures. • No survey verifications were undertaken as part of this assessment.
Blasting	• The project area is not currently part of the active mining operation. There are drilling and blasting operations currently active on other areas of the mine. No drilling or blasting is done for the area considered in this project. • The anticipated levels of influence estimated in this report are calculated using standard accepted methodology according to international and local regulations. • The assumption is made that the predictions are a good estimate with significant safety factors to ensure that expected levels are based on worst case scenarios. These will have to be confirmed with actual measurements once the operation is active. • The limitation is that limited data was available from this operation for a confirmation of the predicted values from the existing operations. • Blast Management & Consulting was not involved in the blast design. The information on blast design applied was provided by the client. • The type of blasting conducted on the existing operations varies significantly with designs provided that shows different designs and results. A best estimate was applied for this project regarding blasting design and expected outcomes. • The work done is based on the author's knowledge and information provided by the project applicant.
Heritage	• The findings, observations, conclusions and recommendations reached in this report are based on the author's best scientific and professional knowledge, available information and his ability to keep up with the physical and other comprehensive challenges that the project commanded. The author has a good understanding of the types and ranges of heritage resources that occur on the Eastern Highveld as he was involved in several heritage impact assessment studies in the area during the last fifteen years.

Aspect	Assumptions and limitations
	• The report's findings are based on accepted archaeological survey and assessment techniques and methodologies. • Areas that were not covered on foot comprise current and older abandoned mining areas as well as unaltered pieces of land which seem to have been utilized for agricultural activities in the past. The project area was also surveyed on at least two known occasions in the past when HIAs were done by heritage specialists. • The author reserves the right to modify aspects of the report including the recommendations if and when new information becomes available particularly if this information may have an influence on the reports final results and recommendations. • The heritage survey may have missed heritage resources as heritage sites may occur in tall grass or thick clumps of vegetation whilst others may be located below the surface of the earth and may only be exposed once development commences. • It is also possible that heritage resources may simply have been missed as a result of human failure either to observe or to recognise them as such.
Palaeontology	Based on the geology of the area and the palaeontological record as we know it, it can be assumed that the formation and layout of the shales, mudrocks and coal seams could contain impressions of leaves of the *Glossopteris* flora in the associated shales but these would not be preserved in the surface soils or coarse sandstones. Vertebrate fossils are extremely rare at this time and seldom occur with fossil plants. Although no fossils have been recorded from this region, there is a small chance that they could, so a Chance Find Protocol should be included.
Social impact	• An SIA aims to identify possible social impacts that could occur in future. These impacts are based on existing baseline information. There is thus always an uncertainty with regards to the anticipated impact actually occurring, as well as the intensity thereof. Impact predictions have been made as accurately as possible based on the information available at the time of the study. • Sources consulted are not exhaustive and additional information can still come to the fore to influence the contents, findings, ratings and conclusions made. • Additional information may become known or available during a later stage, which could not have been allowed for at the time of the study. • Technical and other information provided by the client is assumed to be correct. • Individuals view possible social impacts differently due to their association with the anticipated impact. Impacts could therefore be perceived and rated differently than those contained in the SIA Report. • Attempts were made to contact private property owners and the local councillor. Although interviews could only be conducted with some property owners, it is not anticipated that it would influence the findings of the report.
Noise	• Estimates of road traffic were made with the provided mobile equipment specifications and the mining throughput. Trucks were assumed to travel at 40 km/h. • The quantification of sources of noise was limited to the operational phase of the project. Construction and closure phase activities are expected to be similar or less significant and its impacts only assessed qualitatively. Noise impacts will cease post-closure.

Aspect	Assumptions and limitations
	• All activities were assumed to be 24 hours per day, 7 days per week. • Although other existing sources of noise within the area were identified, such sources were not quantified but were taken into account during the baseline survey.
Air Quality	• The air quality assessment was based on the site layout, mining schedule, on-site vehicle capacities, annual fuel use and operating hours. Assumptions had to be made on the moisture content of coal, topsoil and overburden materials, drilling and blasting information (e.g. no of drill holes per day, no of blasts per week, blast area for coal and overburden respectively). These assumptions were made based on similar investigations for coal mines in the area. • The impact of the operational phase was determined quantitatively through emissions calculation and dispersion simulation. Although the application is limited to infrastructure development and opencast mining areas not previously authorised, the impact due to the operational phase represents the cumulative impact due to mining operations and infrastructure development. • Due to their temporary nature, and because a detailed breakdown of construction activities was not available at the time of the study, the assessment of impacts from the construction and closure phases is mainly of a qualitative nature. • Meteorology: o Use was made of data provided by Eskom for Komati Power Station's meteorological station approximately 13 km from the VDDC site. It was assumed that the data is representative of the project area. Alternatively, the South African Weather Services operate a weather station at eMalahleni and since it is further from the site (27 km), the more appropriate data was considered to be that from Komati Power Station. o The National Code of Practice for Air Dispersion Modelling prescribes the use of a minimum of one year on-site data or at least three years of appropriate off-site data for use in Level 2 assessments. It also states that the meteorological data must be for a period no older than five years to the year of assessment. The data set applied in this study was for the period 2013 to 2015 and complies with the requirements of the code of practice. • Emissions: o The impact assessment was limited to airborne particulates (including TSP, PM_{10} and $PM_{2.5}$). These pollutants are either regulated under NAAQS or considered a key pollutant released by this operation. o The quantification of sources of emission was restricted to the proposed Project. Although other existing sources of emission within the area were identified, such sources were not quantified as part of the emissions inventory and simulations. Their impact would be considered by ambient air quality monitoring in the region. o Accurate dust-fall simulations rely on accurate site-specific particle size distributions. Particle size distributions used in calculations were based on analyses of South African collieries. A particle size distribution was selected from these that would result in the highest fallout rates and was assumed to represent the most conservative estimate.

Aspect	Assumptions and limitations
	• Modelling: o The dispersion model cannot compute real-time mining and production processes. Mining areas to be used in dispersion modelling were chosen based on the mining rate, shape and location. o In-pit sources were assumed to be located at a depth of 30 m - after the removal of an initial overburden layer. Surface mining operations will have a larger impact than those at maximum pit depth; however, they are expected to be of shorter duration than those at depths of 30 m or more. o The range of uncertainty of the model predictions could be -50% to 200%. There will always be some error in any geophysical model, but it is desirable to structure the model in such a way to minimise the total error. A model represents the most likely outcome of an ensemble of experimental results. The total uncertainty can be thought of as the sum of three components: the uncertainty due to errors in the model physics; the uncertainty due to data errors; and the uncertainty due to stochastic processes (turbulence) in the atmosphere. o The selection of a modelling domain takes account of the expected impacts and it is possible that the impacts, when modelled, extend beyond the modelling domain. This occurred for the simulated PM10 concentrations exceeding the permissible frequency of exceedance in the unmitigated scenario; however, exceedance of the guideline outside of the modelling domain is not expected to cover a substantial area. • Greenhouse gases (GHGs): o Scope 1 carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O) emissions were calculated for the operational phase (using the annual fuel usage for the year 2028, which is the maximum amount of fuel (diesel) used per annum). This includes diesel used for mining and infrastructure operations; o Scope 1 CO_2, CH_4 and N_2O emissions were calculated for the construction phase (using the average annual fuel usage over the construction period 2020 to 2022); o Scope 1 emissions were converted to CO_2 equivalent (CO_2-e) emissions for the operational and construction phases; and o Modelling was not included in the scope of work.
Flora & Fauna	• In the event of shapefiles being unavailable, previous study findings have been georeferenced for this project. This is likely to result in a degree of inaccuracy, and should be taken into account. • Delineations have only been assigned to wetlands within the vicinity of the proposed VDDC mining infrastructure. These delineations end abruptly once the infrastructure area is outside of the wetland's reach.

<table>
<tr><th>Aspect</th><th>Assumptions and limitations</th></tr>
<tr><td>Aquatic</td><td rowspan="2">

Limitations did exist regarding access to some of the areas. Therefore, some of the delineations have been completed at a desktop level only, with extrapolations from field surveys.
The selection of aquatic sampling points was completed in accordance to accessibility. Areas where accessibility were limited included areas associated with the iMpunzi opencast mining operations.
The chemical quality of the proposed treated water discharge is unknown. For the purposes of this study, it is assumed that the treated water discharge will have low salinity, no dissolved nutrients or metals and a neutral pH.
The GPS used for water resource delineations is accurate to within five meters. Therefore, the wetland delineation plotted digitally may be offset by at least five meters to either side.
The planned activities will have known impacts and these have been considered, but no unplanned activities or events have been considered for the risk assessment.
Despite these limitations, a comprehensive desktop study was conducted, in conjunction with the detailed results from the surveys, and as such there is a high confidence in the information provided.

</td></tr>
<tr><td>Wetland</td></tr>
<tr><td>Hydrology</td><td>
Assumptions for the water balance modelling –

The mining areas used for the modelling are based on the LOM plans (File name: “StripAdvancepitFloor.dwg”) provided to J&W by South32;
The surface runoff areas are based on the Block Plan provided by Worley (File name: C0082005AADAL0001001Rev1.dwg/pdf);
As per email correspondence with South32 the following was confirmed and incorporated into the model:

A slope of 37° for all dumps/stockpiles were used to compute runoff from side slopes;
Pit ramps may vary in length from 500 m to 1 000 m as the pit advances with an average of approximately 700 m over life of ramp, before being re-habilitated. Therefore, it was assumed that there will be 4 ramps, each 700 m long;
There will be a pre-mining dewatering of old underground workings;
Assumed that all water make will collect in the pit during mining of the pit, as well as the old underground recharge;
In terms of pre-strip, spoils and levelled spoils and rehab areas, the total length behind the active face will be 522 m, sub-divided as follows:


For the potable water use, as per email correspondence with South32 on 11 June 2019, the potable water use at VDDC is as follows

</td></tr>
</table>

Aspect	Assumptions and limitations
	o Existing water treatment plant will supply 5 000 m^3/month for potable use; o Of the 5 000 m^3/month, 2 682 m^3/month will be for domestic use, of which 70% will report to Sewage Treatment Plant and 30% will be consumed; o The remaining 2 318 m^3/month will be used for vehicle washing and the HDV truck, which will report to Pit 4A. • Stochastically generated rainfall data (spanning 2019 to 2069) was supplied by Golder Associates. *Limitations* By their nature, models are theoretical estimates of natural phenomena that are too complex to be derived exactly. It is inevitable that there will be variations in the actual flows when compared to the predicted flows. This can only be addressed by the recalibration of modelled data with measured data, from which more reliable estimates of extreme and average water make and runoff volumes can be developed.
Hydrogeology	Specific assumptions related to the available field data include: • The top of the aquifer is represented by the generated groundwater heads; • The available geological / hydrogeological information (as discussed in the baseline section of this report) was used to describe the different aquifers. The available information on the geology and field tests is considered as correct; • Certain aquifer parameters have not been determined in the field and therefore had to be estimated. • It is important to note that a numerical groundwater model is a representation of the real system. It is therefore at most an approximation, and the level of accuracy depends on the quality of the data that is available. This implies that there are always errors associated with groundwater models due to uncertainty in the data and the capability of numerical methods to describe natural physical processes. • Although the most relevant aquifer parameters are optimised by the calibration of the model, many parameters are calculated and/or judged by conventional means. The fixed assumptions and input parameters listed in Table 7.6 of the specialist report (attached in Appendix 8.9) were used for the numerical model. • The model incorporates an intact geological barrier between the VDDC opencast and the SKS and Glencore backfilled pits to the west. This was communicated by South32 to J&W during a meeting held on 14 November 2018. The barrier between the SKS pit and the Glencore pit is believed to be compromised.

25. REASONED OPINION AS TO WHETHER THE PROPOSED ACTIVITY SHOULD OR SHOULD NOT BE AUTHORISED

25.1 Reasons why the activity should be authorised or not

Opencast mining at VDDC was approved in 2007 through the amendment of the EMPR. The 2007 approved EMPR, however, contained limited infrastructure in support of the opencast mining as it was assumed that existing infrastructure will largely be used. Following a pre-feasibility investigation, the need for additional infrastructure was identified in conjunction with using existing infrastructure on the brownfield development.

In addition to changes in the infrastructure lay-out, the proposed VDDC opencast pit boundary as determined through the pre-feasibility investigation differs from the mine lay-out in the 2007 approved EMPR amendment. An area of approximately 196 hectares in the latest mine lay-out was not included in the previous mine lay-out and is therefore not approved to be opencast mined. This was added to optimise the mine lay-out access to available mineral resources.

As a result of existing and previous mining activities, several impacts have already occurred. Furthermore, the mining area is surrounded by other opencast operations, resulting in a landscape dominated by mining and its associated impacts;

The VDDC project area is therefore largely a brownfields area where the natural topography has been disturbed by mining related activities. Although the overall area was prescribed as a low sensitivity area due to the extent of previous and current mining activities, some high sensitivity areas were identified within the project area. These areas are wetlands and/or are areas considered to have a high biodiversity value or where meaningful numbers of SCC were recorded. The most significant high sensitivity area occurs across the central part of the project area, namely the Vleishaft Tributary (HGM 2). Authorisation to mine this area was however granted in 2007;

An impact assessment was undertaken, supported by relevant specialist studies to determine the impact of the proposed infrastructure and mining development on the environment. These studies have not identified any fatal flaws associated with the proposed project. Neither has any critical factors been identified which would warrant the proposed activities not to proceed.

The proposed VDDC Project will have impact on the environment and therefore, mitigation, management and monitoring measures are required.

All significant impacts have been identified and sufficient mitigation, management and monitoring measures have been prescribed, as follows:

- Impacts rated as HIGH or MODERATE during the construction phase can be mitigated to MODERATE or LOW if the prescribed mitigation measures are implemented. The highest rated impacts are associated with soils and habitat quality. Impacts relating to soils are limited to the area of infrastructure construction and vehicle movement decreasing land capability;
- Impacts rated as HIGH or MODERATE during the operational phase can be mitigated to MODERATE or LOW if the prescribed mitigation measures are implemented. The loss of wetland ecosystem services, as well as the impact on the visual environment and soils will remain HIGH impacts during operation. A wetland offset strategy has been developed as part of the 2007 EMPR and WUL approval to compensate for the loss of wetland areas. The impacts associated with soils and visual aesthetics will be localised and temporary and will have a

LOW impact during the decommissioning and closure phase if the prescribed rehabilitation measures are implemented.

It is recommended that the proposed VDDC Project be allowed to proceed on the premise that:

- The project details in Part A of this report remain unchanged; and
- The commitments in this EIR/EMPr are implemented, adhered to and audited.

25.2 Conditions that must be included in the authorisation

The following conditions are recommended for inclusion in the authorisation:

- The groundwater model should be calibrated and updated every five (5) years as mining proceeds to confirm and improve the assumptions in the model, specifically regarding the integrity of the barrier pillar with adjacent mining operations. A water management plan, which includes a decant management plan, should be developed to ensure that the water levels in the VDDC pit are maintained to below decant level;
- The operational water balance should be continuously monitored and reviewed on an annual basis. The predictive mine water balance and salt balance should be reviewed every five (5) years commensurate with the update of the groundwater model. The updated models should be used to review the adequacy of the water management measures, i.e. mechanical evaporation and treatment at the modular WTP for discharge, as well as dirty water storage requirements;
- The wetland offset strategy developed as part of the DMO project in support of the approval obtained in 2007, should be implemented.

25.3 Specific conditions to be included into the compilation and approval of EMPr

Mitigation measures and monitoring requirements as recommended by the specialists have been incorporated into the EMPr.

Stakeholder engagement must be maintained during all project phases.

25.4 Rehabilitation requirements

The end land use for the VDDC area has been determined as grazing. The rehabilitation plan compiled by Golder Associates is attached in **Appendix 10**.

The Closure requirements for the VDDC section is outlined in **Appendix 8.12**. All aspects related to the VDDC section, should be addressed in the Rehabilitation, Decommissioning and Mine Closure Plan, Annual Rehabilitation Plan and Environmental Risk Assessment Report compiled for the mining right area as required in terms of GNR 1147.

26. PERIOD FOR WHICH THE ENVIRONMENTAL AUTHORISATION IS REQUIRED

Infrastructure will be required until 2049, when the current LoM is reached. The Environmental Authorisation will therefore be required until such time.

27. FINANCIAL PROVISION

State the amount that is required to both manage and rehabilitate the environment in respect of rehabilitation.

The preliminary closure liability for the proposed infrastructure development component of the VDDC Project was calculated at R 20 151 105 (which includes the removal of the infrastructure, and the rehabilitation and maintenance of the disturbed areas).

The opencast rehabilitation associated with the proposed VDDC infrastructure project was calculated based on the end of LoOP volumes and rehabilitation designs provided by Golder & Associates and is R 296 165 229.

The combined financial provision estimate for the proposed VDDC infrastructure and mining project is therefore R 316 316 334.

These costs exclude VAT, P&Gs and contingencies.

Refer to **Appendix 8.12** for the details of the Financial Provision.

27.1 Explain how the aforesaid amount was derived

The amount was calculated according to the methodology in the *Guideline Documents for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine* as published by the DMR. The demolition and immediate rehabilitation closure costing was calculated for the mining right under which VDDC falls (DMR reference MP30/5/1/2/2/379MR) and was undertaken in March 2019 whereby existing information was reviewed, an itemised register was compiled and categorised, rates for demolition activities were determined, items for demolitions were measured and quantified, and an itemised cost spreadsheet and photo report were compiled.

This will be reviewed as required to include the new infrastructure components and to comply with the Regulations as mentioned here.

27.2 Confirm that this amount can be provided for from operating expenditure

(Confirm that the amount, is anticipated to be an operating cost and is provided for as such in the Mining work programme, Financial and Technical Competence Report or Prospecting Work Programme as the case may be).

The closure liability for the proposed infrastructure development will be funded from operational capital budget.

28. DEVIATIONS FROM THE APPROVED SCOPING REPORT AND PLAN OF STUDY

28.1 Deviations from the methodology used in determining the significance of potential environmental impacts and risks

(Provide a list of activities in respect of which the approved scoping report was deviated from, the reference in this report identifying where the deviation was made, and a brief description of the extent of the deviation).

The methodology used in determining the significance of potential environmental impacts and risks is described in section 12 of the EIR. This methodology was included in the Final Scoping Report which was accepted on 23 October 2019. Hence, there were no deviations from the methodology as detailed in the Scoping Report.

28.2 Motivation for the deviation

There were no deviations from the methodology as detailed in the Scoping Report**.**

29. OTHER INFORMATION REQUIRED BY THE COMPETENT AUTHORITY

29.1 Compliance with the provisions of sections 24(4)(a) and (b) read with section 24 (3) (a) and (7) of the National Environmental Management Act (Act 107 of 1998). the EIA report must include the:-

29.1.1 Impact on the socio-economic conditions of any directly affected person

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any directly affected person including the landowner, lawful occupier, or, where applicable, potential beneficiaries of any land restitution claim, attach the investigation report as Appendix 2.19.1 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

An assessment of the socio-economic impacts associated with the proposed infrastructure development was undertaken as part of the overall impact assessment (refer to **section 18)** and a copy of the Social Specialist report is attached as **Appendix 8.10.**

29.1.2 Impact on any national estate referred to in section 3(2) of the National Heritage Resources Act.

(Provide the results of Investigation, assessment, and evaluation of the impact of the mining, bulk sampling or alluvial diamond prospecting on any national estate referred to in section 3(2) of the National Heritage Resources Act, 1999 (Act No. 25 of 1999) with the exception of the national estate contemplated in section 3(2)(i)(vi) and (vii) of that Act, attach the investigation report as Appendix 2.19.2 and confirm that the applicable mitigation is reflected in 2.5.3; 2.11.6.and 2.12.herein).

An assessment of the heritage impacts associated with the proposed infrastructure development was undertaken as part of the overall impact assessment (refer to **section 18)** and the copy of the Heritage Specialist report attached as **Appendix 8.6**.

29.2 Requirements from the Competent Authority in accepting the Scoping Report

The Scoping Report was accepted with conditions by the DMR on 23 October 2019 in terms of Regulation 22(2) of the EIA Regulations (letter reference number (MP)30/5/1/2/3/2/1 (379) EM). The DMR's requirements of information to be provided as part of the Final EIR and EMPr, as well as the manner in which it has been addressed, is summarised in **Table 29-1**.

Table 29-1: Information requirements as stipulated by the DMR in acceptance of the Scoping Report

Information requirement as outlined in letter of acceptance of Scoping Report dated 23 October 2019	Manner in which addressed in the EIAR/EMPr
The draft EIR and EMPr must be made available to the I&APs for comment as required in terms of regulation 40(1) of the EIA Regulations 2014, as amended	The Consultation EIAR/EMPr was made available for public comment from 2 December 2019 to 23 January 2020. Refer to section 9.1.4.
Please ensure that comments from all relevant stakeholders including the responses are submitted to the Department with the EIR. This include, but is not limited to SAHRA, DAFF, DWS Mpumalanga, MTPA. Proof of correspondence with the various stakeholders must be included in the EIR. Should you be unable to obtain comments, proof of the attempt that were made to obtain comments should be submitted to the Department. Please note that the abovementioned comments and responses form public participation regarding the EIR and not the scoping report.	Refer to section 9.2 as well as Appendix 7.
The adjacent landowners, the lawful occupiers and communities must also be consulted and proof and results of such engagements must be attached in the EIR. The provision of regulation 41(2) of the EIA Regulations, 2014 as amended must be used where necessary.	Refer to section 9.2 as well as Appendix 7.
Public Participation Process must be transparent and all comments received during the process must be incorporated into the comments and response report of the final EIR.	Refer to section 9.2 as well as Appendix 7.
The newspaper advert that was placed in the Witbank News on 5 October 2018 is not visible. Please attach visible newspaper advert.	Refer to Appendix 7.
A copy of a visible site notice must be attached in order for this office ascertain the information given to I&APs.	Refer to Appendix 7.
The EIR must include all studies and information required by DAFF on a letter dated 6 February 2019.	Refer to specialist studies in Appendix 8
The EIR must include a Palaeontological Impact Assessment report as required by SAHRA. The EIR must also include all information required by SAHRA on letter dated 9 April 2019.	Refer to Appendix 8.5
The recommendations from the Heritage Impact Assessment by Dr JCC Pistorius must be included in the EIR as conditions.	Refer to section 18 and Part B
The EIR must include a thorough plan study as required by MTPA on a letter dated 26 October 2018.	Refer to section 10.1.1.9.
The EIA must include a detailed plan on the mitigation of impacts on all sensitive areas and species, and this must be supported by specialist reports.	Please see the detailed mitigation measures outlined in Table 18-6 to Table 18-8, which is based on recommendations by the specialists

Information requirement as outlined in letter of acceptance of Scoping Report dated 23 October 2019	Manner in which addressed in the EIAR/EMPr
Comments received from Emalahleni Municipality must be included in the EIR.	No further comment has been received from the ELM. The Consultation EIR/EMPr has been provide to them for comment.
The agreement or any engagement between South32 Coal Holdings (Pty) Ltd and ESKOM regarding the impact on the Dx infrastructure must be attached to the EIR.	See Appendix 12
The EIR must include the closure objectives in relation to the land use and capabilities identified on page 49 pf the Scoping Report.	Refer to Appendix 8.12
The EIR must also include the rehabilitation plan which will indicate how the set closure objectives will be achieved with more emphasis on how the arable land will be secured for agriculture post mining.	Appendix 10
Specialist studies mentioned on page 126 (18.2) must be conducted by independent specialist and must be attached to the EIR. The specialist studies must be in line with appendix 6 of the EIA Regulations, 2014 as amended.	Refer to specialist studies in Appendix 8
A final site map, in A3 size that superimposes the proposed activities and the sensitive areas must be attached to the EIR. This map must be in line with specialist recommendations of the specialist studies.	Appendix 6
Furthermore, it must be reiterated that, should an application for Environmental Authorisation be subjected to any permit or authorisation in terms of the provisions of any Specific Environmental Management Acts (SEMAs), proof of such application will be required.	Not applicable
Any other matter required in terms of Appendix 3(3) and Appendix 4 of the EIA Regulations, 2014 must be included in the EIR.	Not applicable

30. OTHER MATTERS REQUIRED IN TERMS OF SECTIONS 24(4)(A) AND (B) OF THE ACT

(the EAP managing the application must provide the competent authority with detailed, written proof of an investigation as required by section 24(4)(b)(i) of the Act and motivation if no reasonable or feasible alternatives, as contemplated in sub-regulation 22(2)(h), exist. The EAP must attach such motivation as Appendix 4).

Alternatives were considered as part of the investigation as described in **section 8.1**.

31. UNDERTAKING

The EAP herewith confirms

a) the correctness of the information provided in the reports ☒

b) the inclusion of comments and inputs from stakeholders and I&APs; ☒

c) the inclusion of inputs and recommendations from the specialist reports where relevant; ☒ and

d) the acceptability of the project in relation to the finding of the assessment and level of mitigation proposed; ☒

Signature of the EAP

DATE: 29 November 2019

32. REFERENCES

AGES. (2013). BHP Billiton: EMPR Consolidation Report for Middelburg Mine Complex. Technical Report AS-R-2013-01-30.

Airshed Planning Professionals (Pty) Ltd (August 2019a). Vandyksdrift Central (VDDC) Infrastructure: Baseline Air Quality Report. Report No: 17JAW07AQa.

Airshed Planning Professionals (Pty) Ltd (August 2019b). Vandyksdrift Central (VDDC) Infrastructure: Baseline Noise Survey Report. Report No: 17JAW07.

Batho Earth (2019). Proposed Vandyksdrift Central (VDDC) Section: Mining and Infrastructure Development, Mpumalanga. Social Impact Assessment Draft Report.

Blast Management & Consulting. (2019). Blast Impact Assessment, Proposed Vandyksdrift Central (VDDC) Mining Project (Reference JAWS~Vandyksdrift Central~VDDC Project~EIAReport~181206V03).

Golder Associates (2018). Geochemical Characterisation for Wolvekrans Colliery. (Report number 1660807-317000-1).

Golder Associates (2019). Inclusion of VDDC water management into Wolvekrans site wide water management plan. Vandyksdrift Central Feasibility Study. (Report number 19124625-327233-1_ DRAFT).

Jacana Environmentals (2019). Memo: Vandyksdrift Central (VDDC) Project: Mine Residue Facilities: Waste Classification and Barrier Design.

Jaco – K Consulting cc (2016a). Vandyksdrift Central (VDDC) Dewatering Project: Environmental Impact Assessment Report (Reference A0452; Report # JKC_0534).

Jaco – K Consulting cc. (2016b). Water Use Licence Application for Vandyksdrift Central Dewatering (Reference A0452; Report # JKC_0543).

Jones & Wagener, 2014. Vandyksdrift Central Project: Mineral Residue Assessment Report. (Report number: JW207/14/E432).

Jones & Wagener (2019a). Vandyksdrift Central (VDDC) Mining: Infrastructure Development, Hydrogeological Investigation, Final Report. (Report number: JW120/19/G535-300).

Jones & Wagener (2019b). Vandyksdrift Central (VDDC) Mining: Infrastructure Development, Specialist Surface Water Study. (Report number: JW188/18/G535).

Jones & Wagener (2019c). Wolvekrans Colliery: Vandyksdrift Central Mining Infrastructure Development, Coal Slurry: Waste Classification and Assessment Report (Report number: JW103/19/G535).

Jones & Wagener. (2019d). Vandyksdrift Central Mining: Infrastructure Development Soil, Land Capability and Land Use Assessment Impact Assessment Report. (Report number JW200/18/G535-07).

Jones & Wagener. (2019e). Vandyksdrift Central Mining: Infrastructure Development Visual Impact Assessment Baseline Report. Report No.: JW201/18/G535-06 - Rev 4.

Jones & Wagener. (2019f). Vandyksdrift Central Infrastructure and Mining Development. Integrated Water and Waste Management Plan. (Report number JW240/19/G535-14).

Jones & Wagener. (2019g). Vandyksdrift Central Project. Integrated Water Use Licence Application. Draft Technical Report. (Report number: JW219/19/G535-012).

Pistorius, J.C.C. (2019). A Phase I Heritage Impact Assessment (HIA) Study for the Proposed Vandyksdrift Central (VDDC) Mining Infrastructural Development in the Mpumalanga Province.

Pulles Howard & De Lange Incorporated (2006). Douglas EMP Amendment: New Opencast and Pillar Mining Operations on the farms Kleinkopje 15 IS, Steenkoolspruit 18 IS and Vandyksdrift 19 IS. (Report number DMI-ENV-REP-20041117-001335-Rev02).

The Biodiversity Company (2019). Baseline Environmental & Impact Assessment for the Vandyksdrift Central (VDDC) Mining and Infrastructure Development.

South32. (2017a). Van Dyksdrift (VDDC) Project, Pre-Feasibility Mining Report.

South32 (2017b). Van Dyksdrift (VDDC) Project, Pre-Feasibility Report: Infrastructure, Transport and Logistics.

South32 (2017c). Social and Labour Plan for South32 Wolvekrans Middelburg Complex.

The Biodiversity Company (August 2019). Baseline biodiversity assessment for the Vandyksdrift Central (VDDC) Mining: Infrastructure Development.

Worley. (2019.) Van Dyksdrift Central Feasibility Study; Mine Water Management Report. (Report reference C00820-000-CI-REP-0001, Rev0).

12 November 2019

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APPENDIX 1

QUALIFICATION AND CV OF EAP

APPENDIX 2

LARGER SCALE MAP: PROPERTIES AND PROPERTY OWNERSHIP

APPENDIX 3

LARGER SCALE MAP: LOCALITY MAP

APPENDIX 4

MOTIVATION IF NO REASONABLE FEASIBLE ALTERNATIVE

Not applicable – refer to section 8.1 for discussion on alternatives considered

APPENDIX 5

LARGER SCALE MAP: SITE PLAN

APPENDIX 6

LARGER SCALE MAP: INFRASTRUCTURE AND ENVIRONMENTAL FEATURES

APPENDIX 7

PUBLIC PARTICIPATION DOCUMENTS

APPENDIX 8

SPECIALIST REPORTS

8.1 Soils, Land Use and Land Capability Assessment

8.2 Noise Assessment

8.3 Visual Assessment

8.4 Air quality Assessment

8.5 Paleontological Impact Assessment

8.6 Heritage Impact Assessment

8.7 Biodiversity and Wetland Assessment

8.8 Surface Water Assessment

8.9 Geohydrological Assessment

8.10 Social Impact Assessment

8.11 Blasting Impact Assessment

8.12 Rehabilitation, Decommissioning and Mine Closure Plan, Annual Rehabilitation Plan and Environmental Risk Assessment Report in terms of GNR 1147

8.1 Soils, Land Use and Land Capability Assessment

8.2 Noise Assessment

8.3 Visual Assessment

8.4 Air quality Assessment

8.5 Paleontological Impact Assessment

8.6 Heritage Impact Assessment

8.7 Biodiversity and Wetland Assessment

8.8 Surface Water Assessment

8.9 Geohydrological Assessment

8.10 Social Impact Assessment

8.11 Blasting Impact Assessment

8.12 Rehabilitation, Decommissioning and Mine Closure Plan, Annual Rehabilitation Plan and Environmental Risk Assessment Report

APPENDIX 9

DETAILED IMPACT RATING

APPENDIX 10

REHABILITATION PLAN

APPENDIX 11

WASTE MANAGEMENT ACTIVITY INFORMATION

11.1 Waste facility designs

11.2 Waste classification of slurry in underground workings

11.3 Memorandum from Jacana Environmental on barrier design

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11.2 Waste classification of slurry in underground workings

11.3 Memorandum from Jacana Environmental on barrier design

APPENDIX 12

AGREEMENT BETWEEN SOUTH32 AND ESKOM REGARDING 132 kV POWERLINE